NEWTON'S TELESCOPE AND THE CATALOGUING OF THE ROYAL SOCIETY'S REPOSITORY

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THE Royal Society's Repository or museum played a significant part in the activities of the Society, at least in the early decades of its life. The Repository's extraordinarily varied contents represented a practical response to the Society's public concern for curious and useful invention and for sober Baconian observation of all that was new and remarkable in nature. The rapid growth of the Repository in the second half of the seventeenth century can be traced in the Society's minutes, which record 'artificial' and 'natural' curiosities being presented by Fellows and providing the basis for much of the discussion at meetings.

The Repository formed a natural institutional extension of the private cabinets of curiosities which had by the mid-seventeenth century become necessary attributes of aspiring society intellectuals. If the Royal Society's Museum appeared to develop along similarly miscellaneous lines to these virtuoso cabinets, Theodore Hoppen has seen in this an expression of the eclectic composition of the Society's early membership (1). Michael Hunter has stressed both the interest that such virtuoso cabinets held for practising scientists and the Society's insistence on the Repository's potential for serious and diligent use as opposed to mere diversion (2). By the end of the seventeenth century when the first scholarly catalogue appeared, contributing in the process to the international esteem in which the Repository was held, the collection contained material associated with many substantial figures in the Society as well as a host of lesser lights.

One such item was the small reflecting telescope made by Isaac Newton and sent to the Royal Society in 1671. Apart from being the first comparatively successful reflecting instrument and the direct impetus for the subsequent development of the reflector, it was also the means of introducing Newton to the Society, and for Newton it was to assume a symbolic role in the promotion and acceptance of his doctrine on the nature of light and colour (3).

Unfortunately, like the majority of historically significant items from the early Repository, the 1671 telescope apparently does not survive; and indeed it is clear that conditions in the Repository were not always suited to the safety of

the collection. However, the problem that its disappearance poses is complicated by the Society's acquisition in 1766 of a further reflecting telescope, represented as being made by Newton in 1671 and still preserved in the Royal Society's rooms, and the relationship between this and the earlier telescope is by no means clear (4).

On several occasions the Council of the Society attempted to regularize the affairs of the Repository and to catalogue its contents. Much of the paperwork generated in the process is preserved in the Society's Archives, and while this has not provided proof of the fate of the original telescope it has been an important source of information. The eighteenth- and nineteenth-century inventories, which do not appear to have attracted critical attention, present initially an incomplete, confused and somewhat inconsistent view of parts of the collection. This discussion, although concerned in detail with the reflecting telescope, attempts to provide a more adequate context for their use.

The Royal Society was founded in 1660 for 'the promotion of Physico-Mathematicall Experimental Learning', and was awarded its charters by Charles II in 1662, 1663 and 1669. The active nucleus of founder Fellows had been in the habit of meeting together at Gresham College in the City of London, and it was at Gresham that the Society was principally based for its first fifty years (5). Gresham College had been the home of the Elizabethan merchant Sir Thomas Gresham, who in his will had established it as a public college, with a lecturing staff of salaried professors. Initially the Society met in the rooms of those professors who were Fellows, but by early 1661 it acquired a room of its own for meetings and for conducting experimental work. By 1665 its premises had been expanded to include:

> one *publick Room* to meet in, another for a *repository* to keep their Instruments, Books, Rarities, Papers, and whatever else belongs to them: making use besides, by permission of several of the other Lodgings, as their occasions do require (6).

Over succeeding years as the Society's accommodation needs developed it was able to acquire additional unwanted space from the Gresham trustees and from individual professors, until its offices, library and repository eventually occupied a considerable proportion of the College building (7).

The Society's practical experimentation was placed on a regular footing in 1662 when Robert Hooke, arguably the most dynamic and influential figure in the Society's early years, was appointed as Curator of Experiments and responsible for providing an unflagging stream of original demonstrations for the weekly meetings. Hooke, who from 1664 was resident at Gresham as

professor of geometry, was also made Keeper of the Repository, and was closely involved with the collections over the period of their most rapid expansion (8). Initially the Repository had been dependent on casual gifts and purchases, but in early 1666 the Council purchased one of the most notable London virtuoso cabinets, that of Robert Hubert, to form the basis of its collection (9).

From 1667 to 1673 the Society met at Arundel House because its accommodation at Gresham College was required for use as a temporary Exchange in the wake of the destruction caused by the Great Fire. The West Gallery at Gresham, in which the Repository had been housed, was however not returned to the Society's use until 1675. Despite this, the collection may have remained at Gresham in a new location, where it must have been effectively in store, since in June 1668 the Council reimbursed Hooke 'for fitting the place in Gresham College for the societys repository' (10). The instruments certainly stayed under Hooke's control at Gresham, and one of the principal reasons given for the Society's eventual return to the College was 'the conveniency of makeing their experiments in the place where their Curator dwells, and the apparatus is at hand' (11).

The reflecting telescope by Newton arrived in London during the Society's sojourn at Arundel House. Although the Repository would have been the normal home for a piece of donated apparatus of this sort, in this instance it was unusually not directed to the Repository in the minutes of the meetings, nor indeed was it at any time in this period associated in the minutes with the Repository or individually with Robert Hooke. The Council members concerned were anxious to restrict information about the invention, in the first few weeks at least, and this argues for it having been kept in more guarded circumstances. Associations with Sir Robert Moray, the Society's Vice-President, suggest that the instrument was kept by him at Whitehall Palace, and it may well have remained there until the time of the Society's return to Gresham (12).

This point might have been established had Hooke's catalogues of this period survived. Hooke had a keen interest in the application to the Repository of classification schemes, notably that of John Wilkins, which was intended to form the basis of a universal language. John Aubrey, who shared Hooke's enthusiasm for Wilkins's 'Philosophical Grammar', assisted in cataloguing the collection in 1674, and in the following year a draft catalogue was reported as complete (13). As part of this effort Hooke had been instructed to produce catalogues of donations and purchases for the Repository, and another of 'all the instruments or other apparatus of the society, paid for out of the public

treasury' (14). At that time also the instruments were to be 'looked out and kept together in the repository for instruments', which was perhaps a separate room (15). When the Society retained full use of its accommodation in Gresham College in early 1675, Hooke was ordered to move the collections and 'perfect' the catalogues (16).

The first demonstrably successful attempt to regularize and systematize the Society's burgeoning collections was made by Nehemiah Grew, the physician and plant anatomist, whose taxonomic work was sponsored by the Society in the 1670s (17). Grew was appointed joint Secretary of the Society with Hooke on Henry Oldenburg's death in 1677, and Michael Hunter has suggested that it was partly to dispel tension between the two that the Council in 1678 asked Grew to prepare a catalogue and description of the contents of the Repository, thereby leaving the secretarial duties largely to Hooke (18). The result of his labours was published in 1681 as the *Museum Regalis Societatis*, a detailed discussion in nearly 500 folio pages of the whole range of the Society's collections, reflecting nonetheless his clear inclination for the natural curiosities. The instruments and models are grouped with coins and antiquities in Part IV under the heading 'Of Artificial Matters' and the description of the telescope is tantalizingly uninformative, the reader being referred for all detail to the account in the *Philosophical Transactions* for 1672 (19).

The impetus for his work may have been a general concern felt by the Council for the security of the various collections following the removal of the Society's library to Gresham from Arundel House before the demolition of the latter in 1678. The catalogue of the library produced at the time for the Council was compiled by Michael Weeks, the Clerk, and Henry Hunt, the Society's 'Operator', and it seems most likely that Hunt was closely involved in the preparation of Grew's catalogue also (20).

Grew was appointed Curator of the Repository in 1682, and when in 1696 the Council decided at last to appoint a full-time servant to look after the collections they turned to Henry Hunt, first making him Keeper of the Library and then both Keeper of the Repository and Housekeeper (21). Hunt had entered the Society's service in 1673 as Hooke's boy assistant, and in 1676 he had succeeded Richard Shortgrave as Operator, responsible for preparing and performing Hooke's demonstration experiments.

Henry Hunt remained as general factotum to the Society until his death in 1713, two years after the Society had moved its being (and all its possessions) from Gresham to Crane Court off Fleet Street. Although his work and loyalty were highly esteemed, and although the Fellows in general, and Hooke in particular, had a warm regard for him, yet there is no doubt that during the

time that he was responsible for the Repository the collections appear to have slipped into disorder. Perhaps the fact that on several occasions he was able to lend the Society money in a period when its finances were in considerable difficulties may have helped the Council to overlook these shortcomings (22).

An early indication of the worsening state of the Respository is contained in the diary of Frans Burman, the Dutch theologian, who visited Gresham College in 1702, commenting that:

> One room was full of rare instruments collected from all parts of the world of which an english description [by Grew] has been published in folio. Here were many magnets, one of prodigious size, at least a foot, but not formed in iron nor suspended, but carelessly thrown against many of different size (23).

Much more forthright criticism was made in 1710 by the German literary connoisseur and traveller Zacharias Conrad von Uffenbach, whose diary paints a picture of woeful neglect at Gresham:

> Both in Germany and elsewhere an exalted idea of this Society has been formed, both of it and of the collections they have in their Museum, especially when one looks at the Transactions of their Society and the fine description of the Museum by Grew. Thus foreigners have just grounds for amazement when they hear how wretchedly all is now ordered. But it is the sight of the Museum that is most astonishing. It consists of what appear to be two long narrow chambers, where lie the finest instruments and other articles (which Grew describes), not only in no sort of order or tidiness but covered with dust, filth and coal-smoke, and many of them broken and utterly ruined. If one enquires after anything, the operator [Henry Hunt] who shows strangers round . . . will usually say: 'A rogue had it stolen away', or he will show you pieces of it, saying: 'It is corrupted or broken'; and such is the care they take of things! Hardly a thing is to be recognised, so wretched do they all look (24).

The Operator was permitted by the Council to charge visitors to let them see the Repository in order to augment his salary, but Uffenbach was in no doubt that exposing such collections to the idle curiosity of the public placed them at risk, a view he expressed more clearly after his visit to the more frequented Ashmolean Museum in Oxford:

> The things in the museum . . . are in better order than those at Gresham. The wonder is, that they are as well preserved as they are, as every one, in

> true english fashion, handles them roughly, and all persons (even women) are admitted on payment of 6d, who run about, lay hold of every thing, and will not be hindered by the sub-custos (25).

The travel guide used by Uffenbach while he was in London was the then recently published *New View of London*, attributed to Edward Hatton. This includes an extended account of the Royal Society's museum, in which Hatton described over 300 of 'the most remarkable Rarities in the Repository at Gresham College, mostly abstracted from the Learned Dr Grews Account, and the rest as I find them in the Repository' (26). The items are listed in the order given by Grew (with the additions placed at the end) and their descriptions are clearly based on Grew's. The particular items selected may be compared with those known to have survived in the Repository twenty years later, from which it seems possible that Hatton examined these items and described those that he saw, however it is not clear that we can deduce the Newton reflecting telescope was necessarily present and recognizable in 1708.

Very soon the collections were to be subject to the upheaval of being packed and moved to new premises. For a number of years the Gresham trustees had been attempting to secure an Act of Parliament to enable them to rebuild the College on a smaller scale in order to relieve themselves of what was becoming an increasingly difficult financial burden, and inevitably this meant the exclusion of the Royal Society (27). The fifty-year-long association between the College and the Society, which had been to the great mutual benefit of both but had become soured by the stance of the Gresham trustees, was brought to an end in late 1710. At Newton's instigation the Council acquired two houses in Crane Court off Fleet Street 'being in the middle of the Town out of noise, and . . . a proper place to be purchased by the Society for their meetings' (28).

It was soon clear that the museum collection could not be accommodated within the house, and so a new Repository building was constructed at the rear of the house, apparently to a design by Sir Christopher Wren (29). The collections were brought from Gresham 'with what convenient Speed' Henry Hunt could muster, but they had to wait at Crane Court for ten months until the new building was at last ready and a committee could be charged 'to take care of the due placing of the Curiosities in the New Repository' (30).

The small reflecting telescope appears to have survived the move to Crane Court and was subsequently mentioned by Newton's antiquarian chronicler William Stukeley in a manner that suggests that he had seen the instrument. Stukeley was first introduced to the Royal Society, and to Newton, in 1718

when he took up medical practice in London. The friendship that developed between them in the closing years of Newton's life led Stukeley to begin collecting reminiscences of Newton in 1726 for a biography, and in a short manuscript account of Newton's life he noted that he had:

> made that famous reflecting telescope now in the Repository of the Royal Society, and likewise [in 1704] that concave *Speculum*, or burning glass . . ., now in the same repository (31).

More problematic is the reference by Count Francesco Algarotti recently cited by A. A. Mills and P. J. Turvey (32), since the telescope that Algarotti describes as being Newton's first must have been seen by him after the Royal Society instrument had substantially deteriorated, as will be discussed later. Algarotti was a Venetian nobleman who visited England in 1736, and again in 1737–8, being sponsored as a Fellow of the Royal Society by Martin Folkes in 1736. He produced a popularizing text on Newtonian philosophy, *Il Newtonianismo per le dame* (Naples, 1737), which took the form of six dialogues principally about the nature of light and colour, and which passed through several editions. Having explained the nature of aberrations affecting refracting objectives, he described Newton's invention of a reflecting telescope, adding (in the English translation of 1739):

> I have myself seen the first telescope of this sort, worked by those hands [Newton's] which had pointed the planets to their road . . . This instrument is preserved in a city of England, where philosophy and politeness hold a mutual empire; with this are treasured up those prisms which the first time differently refracted the rays of light in the hands of our great philosopher . . . (33).

It will be suggested elsewhere that this does not refer to the instrument in the Royal Society, but may describe material at Trinity College, Cambridge, unconnected with Newton (34).

Henry Hunt died very shortly after the Society's move to Crane Court, and he was succeeded as Housekeeper and Keeper of the Repository and Library by Alban Thomas, who was at the same time appointed Clerk (or Assistant Secretary) (35). Although this was a temporary arrangement, the posts were to remain linked.

Thomas departed abruptly ten years later, leaving suspicions of Jacobite involvement and also outstanding debts that the Society may never have recovered. His valuable cataloguing work in the Library was not matched in the Repository: a Council committee charged with inspecting the state of the

Library and Repository after his departure could only report that 'we have been in the Repository, but as the Curiosities there are not numbered, and we find no Catalogue, we are not able to give any particular account of them' (36). By this time also another shortcoming of the Repository was being increasingly felt. The dampness, which had first been discussed by the Council in 1714, had by 1719 caused sufficient damage to specimens for the President to pass on to the Council 'some Complaints made to him about the State of the Repository'; the problem, however, had still to be solved fifteen years later (37).

Alban Thomas's position was filled in 1723 by Francis Hauksbee, nephew of the notable Francis Hauksbee 'the Elder' (38). Hauksbee *senior* had been a leading instrument maker and an experimenter of great skill. Under Newton's presidency the practice of providing regular demonstrations at meetings had been revived, with Hauksbee acting as the Society's Curator of Experiments until his death in 1713, and his work proved an important influence on Newton (39). Hauksbee *junior* was also an instrument maker and popular lecturer, and he operated from premises adjacent to the Royal Society in Crane Court. Although he did perform some experiments before the Society, he did not succeed to his uncle's post: ten years later however, on the recommendation of 'divers Members of the Society', he secured Thomas's positions of Housekeeper, Clerk and Keeper of the collections, retaining these until his death in 1763.

At Hauksbee's election a point in his favour had been that he was already familiar with the museum collections, having 'frequently been in the Society's Repository to look over the Raritys', and that he could offer £400 security for the collections in his care—a new requirement introduced by the Council only four years earlier. The committee set up immediately after Hauksbee's appointment to investigate the state of the Library and Repository presented a critical report indicating that Thomas had been lax not only in cataloguing but also in controlling loans, and the Council promptly raised poor Hauksbee's liability to £600 (40).

The state of the Repository however clearly continued to cause concern, and in 1729 the Council decided to revive the 1723 Committee for inspecting the Society's Library and collections. Apparently this was at the suggestion of John Hadley (41), now Vice-President, but was presumably made with the strong support of the new President, Sir Hans Sloane, himself an inveterate collector, whose museum was on at least one occasion held up as an example to the Society (42). The Committee on the Repository, in its several reports to the Council between 1729 and 1734, provided ample confirmation of Uffenbach's

dispiriting comments on the condition of the collections twenty years earlier. Thus we learn in their initial report that they found the Repository 'in great disorder', and when they began checking the animal specimens they discovered that 'several of them cannot be found very many more are greatly Damaged, Some by time, others for want of Convenient Cases to preserve them in'. Indeed it was clear that 'the greatest part of the Repository will soon perish & become useless' unless the Council was prepared to take effective action (43). In their summary report came the first admission that material might have been stolen:

> . . . it is scarcely to be expressed the confusion and disorder they [the Committee] found everything in: the greater part of what was expected to be there being lost or imbezzled, and most of what remained in such bad condition either thro' want of care or injury of time . . .

Thus, for example,

> the Committee are Surprized to find so many curious Specimens of Oriental & other precious Stones in the Lists of Donations not to be found in the Repository notwithstanding their most diligent Search (44).

It was quickly apparent to the Committee that the Society's instruments and mechanical devices were in a parlous state, and they somewhat tersely commented that 'The Instruments and Models of Engines are generally so broke to pieces that few of them are worth preserving' (45).

Apart from the expected problems of dirt, dampness and decay, the collections now lacked even basic security. The Committee observed that, apart from the specimens having totally inadequate casing to protect them:

> . . . the Repository is always a common passage or thoroughfair to the family dwelling in the Society's House, and which is indeed a very great conveniency to that family, but is they think not quite so proper for the Repository to be thus exposed (46).

The Committee's principal interest was in providing adequate accommodation for the natural history collections, and in stabilizing decayed and damaged specimens. By the time the Committee was dissolved in late 1733 a physical examination of all the surviving specimens had been completed, and the work was continued alone by Dr Cromwell Mortimer, Secretary of the Society from 1730 to 1752, who was a close associate of Sir Hans Sloane and had acted as the Committee's secretary. Mortimer was also entrusted with the more weighty task of compiling a detailed catalogue of the collections along the lines of

Nehemiah Grew's earlier work, and this occupied him until at least 1736 (47). During this time extensive alterations were made to improve the state of affairs in the Repository: the flooring was inspected, the walls lined with deal, and new locking cases were installed. Proposals for creating new windows and a passageway to separate the Society's tenants from the collections may however not have been carried out.

Minutes of the Repository Committee from 1730 to 1733 survive as do three manuscript inventories of this period (48), allowing the Committee's work to be at least partly reconstructed. Since these shed light on the fate of the reflecting telescope presented by Newton they will be examined in some detail. The Committee's cataloguing work appears to fall into three stages. Firstly they made a preliminary examination of all that survived, completing this in September 1731, in the course of which they undertook the more urgent repair work. Then, between March and October 1733 they reviewed the collections and numbered such material as was thought worthy of preservation, or at least of further consideration. Finally Mortimer was to produce a descriptive catalogue along the general lines of Grew's, but this last stage may not have been completed and the catalogue itself is not known to survive.

The Committee began their work in 1729 by comparing the specimens with the only available catalogues, namely a copy of Grew's work in which someone had begun to number the items in the margins, and a manuscript catalogue 'Supposed to be drawn up by a Servant of the Clerk for his private uses', in which rather more of the items were numbered and which included additions to the earlier catalogue (49).

At their regular weekly meetings the Committee worked systematically through the collections, following Grew's classification scheme, and identifying what they could. Minutes for their meetings are only available from January 1730, when they had advanced so far as to be examining the fish. It is clear from a comparison of the items described in the first few minuted meetings with the annotations made in the Royal Society's existing manuscript Catalogue A (MS 413) that it was this catalogue that was the principal inventory being used by the Committee, and it may be dated at about 1720 (50). Although the Committee began by noting which items were missing, they soon turned to listing only those that survived, presumably because the survival rate was found to be increasingly poor in the vegetable and mineral sections and the items more difficult to identify.

By the time they reached the models and instruments in July 1731, the old manuscript catalogue had ceased to be of any practical use The original compiler of this had begun a classification for 'artificial matters and antiquities' that

was a little different from Grew's, but had not persevered beyond inserting a handful of the items noted by Grew.

The 'ruinous' condition of the instruments, models and engines meant that 'most [could] not be distinguished', and it was decided that those that could not be recognized should 'be laid aside & kept for some other ex-amination' (51). In four meetings 118 artificial curiosities (as well as antiquities and coins, which were treated separately) were listed and numbered. Several of these were comparatively insignificant, and those that could not be positively identified were carefully described, suggesting that the Committee had been cautious in what they decided to lay aside. In spite of this, the Newton telescope is conspicuous by its absence, but instead we find that amongst the first instruments examined were 'the 2 Specula of S^{r} Isaac Newtons reflecting Telescope' (52).

By mid-September the Committee were able to announce that they had 'gone thro' the Museum for the first time' (53) but the projected second review of the Repository had to wait for the fitting of further storage cupboards and for the preparation of a reliable list of donations of objects. The labour of compiling this list, which is the existing Royal Society manuscript Catalogue D (MS. 416), was divided between several Fellows who scanned the minute books of the Society's meetings between particular dates, entering donations under 19 different subject headings (54).

The Committee resumed their meetings in March 1733, working this time from a revised catalogue drawn up by Cromwell Mortimer and combining Grew's catalogue and the newly prepared donation list. This is the Royal Society's manuscript Catalogue B (MS. 414), which was called for, section by section, by the Committee, and which is classified by a new scheme of Mortimer's devising similar to that used by Grew (55). This catalogue is thus only a list of the items that the Committee might hope to find in the Society's care, but it has the advantage over MS. 413 of being an exhaustive listing, and of being annotated throughout to indicate which items survived. Meeting twice a week, the Committee sorted and re-numbered the material in each section of the catalogue, identifying each item with the relevant catalogue entry, against which the item's number was written in pencil. Occasionally they paused to examine 'severall articles wch had been overlooked & inserted them in their pro[per] places', and one may detect a sense of relief when in October 1733 they numbered the final artificial curiosity 'with wch they ended their review of all ye curiosities found in ye Repository' (56). Again, the 1671 Newton telescope has no mark against it, indicating that it was not in the Repository, but we find an entry for number 180 'The 2 Specula for S^{r} Is. Newton's reflecting Telescope' (57).

Evidence of this sort however poses problems of interpretation. For example, although we can be reasonably sure that the telescope was not in the Repository, could it have been elsewhere on the Society's premises? In June 1728 James Bradley, Savilian Professor of Astronomy at Oxford, returned a large objective lens, which had been presented to the Society in 1691 by Huygens but had been on loan to various Fellows since 1713 (58). Almost immediately the Council decided that this lens, together with the two other long focus lenses by Huygens and a collection of historic microscopes bequeathed by Leeuwenhoek in 1723, should be 'reposited under a New Lock in the Closet in the Council Room' (59). As a result none of these items is recorded in the inventory as being present in the Repository in 1733 (60). It does not appear that instruments were kept in the Council Room before this time or that any were added subsequently, so that we may tentatively conclude that by 1731 the Newton telescope had either left the Society or was survived only by parts.

Similarly it is not possible to identify firmly the 'two specula' as being from the Newton telescope, although this seems very likely. The Society does not seem to have retained the mirror of the 4 foot instrument begun by Christopher Cock in 1672, and one would in any case expect comment on the large size of such a mirror (61). No other reflectors are mentioned by Grew, and although it is remotely possible that early mirrors by Hooke might have survived, there is no clear reason why Hooke would have kept such items in the Repository. The mirrors cannot have been from the Society's Newtonian telescope by John Hadley, since this was still on loan to James Bradley at Wanstead. They might perhaps be mirrors for a Newtonian produced after Hadley's, although they would then have been comparatively modern. However, this subsequent work appears to have been conducted away from the Royal Society, and it seems a little unlikely that parts would have found their way into the Society's Repository; certainly none are recorded amongst the donations. The term 'Newtonian' for a reflector employing Newton's optical system was apparently in widespread use by 1735 (62), and was probably well enough known to have been used by the 1731 Repository Committee, yet the mirrors are specifically described as being for Sir Isaac Newton's telescope rather than for a Newtonian telescope. It would appear then that the mirrors were appreciated as being of some antiquity, and that they were assumed to have been associated with Newton himself; however a number of other possibilities exist which cannot be definitely excluded.

The Committee's concern not to destroy material unnecessarily is seen in their treatment of badly damaged material from the animal collections, many

items being placed on one side for yet another review, the Committee 'not esteeming themselves duly authorized to deny them a place in the Repository' (63). The Council subsequently ordered that 'the imperfect models of machines, & other works be laid aside in some waste Room or Garret till the review of the Repository be compleated' (64). One may speculate that parts of the Newton telescope went unrecognized with this discarded material, or that the tube and mounting had been damaged and were simply not felt worth retaining: the optical components would be seen as the important parts and these were being preserved. The fate of this material is not known, but it may well ultimately have been thrown away, as were those natural history specimens which had been found to be 'entirely useless and spoil'd'.

By early 1736 a considerable portion of the catalogue had been completed by Mortimer, and John Hadley was able to praise 'the Good State and Condition wherein the Repository is at length brought, by the great care and Application of the Gentlemen of the Committee' (65). In September 1737 Hauksbee was being asked by the Council to call in the instruments which had been borrowed but not returned (66). A year later it was agreed by the Council that Mortimer and some colleagues were to draw up an inventory and identify the items in Hauksbee's presence so that Hauksbee could then 'sign the Inventory, and take upon himself the charge of the things therein contained' (67).

One is left with the clear impression from the minutes of the Society's Council that, through the efforts of Mortimer and others, the Repository had been well ordered and the safety of its contents assured. An indication that this may not have been so was given very shortly after Mortimer's death by William Stukeley in his diary for 1752:

> Further he [E. M. da Costa] represented that foreigners of curiosity, as well as our own peoples, often desired to see our museum, which had formerly a reputation both at home and abroad. He was ashamed to recite what a ruinous forlorn condition it was now in, and prayed it might be amended (68).

Emanuel Mendes da Costa (1717–1791) was one of the more colourful members of the London scientific community at the middle of the century, and his brief but scandalous association with the Royal Society has recently been explored by P. J. P. Whitehead (69). Da Costa apparently made an early mark for himself, for in 1747 he was elected Fellow of the Royal Society, being sponsored by, amongst others, the President of the Society, Martin Folkes. His proposal had cited his particular knowledge of 'the Mineral and Fossil parts of

the Creation', and it is in the fields of mineralogy, palaeontology and conchology that he is principally known, both as a writer and as a collector. He formed a close friendship with William Stukeley, who like Folkes was a leading member of the Society of Antiquaries, and in 1752 he became a Fellow of that society also.

Whitehead has shown that by the early 1760s da Costa was a much respected member of the antiquarian and scientific worlds, well integrated into the intellectual circles of his time (70). He was therefore widely supported in his application to succeed Hauksbee to the responsible position of Clerk to the Royal Society, and on 3 April 1763 he was confirmed as Clerk, Librarian, Keeper of the Repository and Housekeeper (71).

Da Costa's beloved library and natural history collection moved with him to the house provided for his family in the Royal Society's premises, and Whitehead has concluded that it was his reckless buying of books and specimens that led to his serious financial problems. His purchases had already outrun his resources in 1754 when he had been imprisoned for debt and his collections impounded, but his continuing difficulties now prompted embezzlement. As Clerk he assisted in the collection of membership fees and from soon after his appointment he was persuading new Fellows to pay a life fee but was only passing on the annual fee.

The Council did not have long to wait before recognizing the error of their judgement. The affair was uncovered in mid-1767 and by June 1768 da Costa's collections at the Royal Society had been sold to help pay a debt that eventually totalled £1500. Da Costa was sued by the Society for the remainder and imprisoned; and although he continued his scientific publishing from the King's Bench Prison, and even gave successful subscription courses of lectures on fossils and shells, his connexion with the Royal Society was now at an end.

His keen interest in the development of his own collections, and his activities as a dealer and intermediary between other natural history collectors, inevitably raise some doubt about his handling of the Royal Society's collection (72). However, although there are some puzzling discrepancies between the inventories of the early 1730s and those of the 1760s, there is no clear evidence of da Costa removing material from the Repository or acting contrary to the somewhat looser curatorial ethics of the day.

Two items of some historic interest which are relevant to this discussion do however seem to have disappeared about this time. One of these, 'a Speculum given by Mr Newton', was a composite burning glass comprising seven circular mirrors, each of about one foot diameter, with which the Society's President provided some dramatic demonstrations in 1704. The device was well

known from contemporary descriptions (73) and is the mirror mentioned by Stukeley. It seems surprising that such a relic of Newton should not have been preserved, yet it is not in the 1765 inventory (74). The apparent absence of the second item, 'a wooden model of Dr Hook's Reflecting Quadrant', from the later catalogue is all the more surprising because of renewed interest in the 1740s in the precursors of Hadley's reflecting quadrant (75).

The Council had taken the opportunity whilst selecting a successor for Hauksbee to define the duties of the Society's officers more clearly, stressing for example that the Keeper of the Repository was to be diligent in keeping methodical catalogues (76). Henry Baker, James Parsons and William Hudson were appointed Inspectors and on 26 May 1763 they 'Began the Inspection and Regulation of the Repository' (77). The inventory of natural history specimens (MS. 415) was completed in November 1763, and was followed two years later by an inventory of antiquities, models, instruments, curios, etc. (MS. 417) to complete the survey (78). In their report to the Society the Inspectors claimed to have taken:

> an exact account of all the . . . instruments of several kinds . . . which belong to this Royal Society . . . [which] will furnish a Compleat account of the whole Collection in your Repository. By these two inventories you will know what Treasure you are possessed of; you will know (which you have not done for many years) what is under the care of your Repository Keeper, and what he is Accountable for; the want of which your Inspectors Apprehended has occasioned the loss of numberless things of value . . . Your whole Collection is now clean and disposed in such a Manner as to make an handsome Appearance, and every Article required after can be found with ease (79).

At last, it would appear, everything was in good order and there were no 'loose ends', as there had been in 1733, in the form of unidentified and damaged specimens which could therefore not be included in the inventory. Detailed evidence for da Costa's work in the Repository is scant, but surviving accounts for his expenses provide a few clues (80). There was a fairly high expenditure on boxes for specimens in 1764–6, and there was clearly considerable activity in the Repository in 1766 and 1767. If the damaged residue of the collections was indeed disposed of in some form of purge, then this may perhaps have happened in June 1764 when da Costa hired 'a Man to remove the rarities' (81).

The 1765 catalogue (MS. 417) again includes an entry for the two Newtonian telescope specula, now described as:

76 The Metals belonging to S^r^ Isaac Newton's Reflecting Telescope. a Smaller and larger.

There is no evidence to suggest that these are different from the two described in 1731 (82) and so it will again be assumed that these are the surviving optics from the 1671 telescope by Newton.

The inventory was continued by the Keeper of the Repository as a running catalogue for a number of years, the latest entry in this section being dated 1770. The donation in 1766 of the further telescope by Newton was recorded as:

87 The original reflecting Telescope made by Sir Isaac Newton. presented by Mess^rs^ Heith and Wing.

The Council was more fortunate in its choice of a successor to da Costa: John Robertson (F.R.S. 1741) was appointed in January 1768 and gave exemplary service until his death in December 1777. He in turn was succeeded by his eldest son, also John Robertson, who however soon became lax and negligent in his duties, and resigned in January 1785 following frequent complaints and admonitions (83). During his unsatisfactory period of office the Society moved its premises from Crane Court to a suite of rooms in the Government's new Somerset House. The Royal Society had by this time come to be regarded by Government as a national institution, being consulted frequently on scientific topics, and the Council had been pressing for assistance with accommodation to replace Crane Court, which was proving inadequate for the growing number of Fellows. The Government's offer to provide suitable rent-free rooms in Somerset House was not immediately accepted because the accommodation allocated was found to be too small. The Council's principal complaint to the architect was that there was 'no room at all allowed to the Society's Museum', and although an alternative scheme for the use of the rooms was suggested (84), the Council decided in 1779 to accept the original offer, reducing their accommodation requirements by gifting their collection to the Trustees of the British Museum (85). The Council's action was in effect an acknowledgement that their own museum had been eclipsed by that at Bloomsbury, which now included the extensive collection acquired for the Nation from Sir Hans Sloane. The building of Somerset House moved apace and the Royal Society first met in their new rooms at the end of 1780. The houses in Crane Court were sold in 1782.

The scientific instruments were of continuing use to the Society and were not transferred to the British Museum with the other collections, but were taken to Somerset House, being described in a guide of 1806 as 'a variety of

apparatus and instruments' (86). It may be imagined that the upheaval of packing the Society's numerous and diverse possessions, and the division of both the Library and the Repository for dispatch to two separate locations, provided ample opportunity for small items to be lost or to lose their identity, particularly in the less than capable hands of John Robertson *junior* (87).

Thus it appears that in common with many other instruments and models in the Royal Society's Repository, the 1671 reflecting telescope became dilapidated during the first half of the eighteenth century, until eventually only its principal optical components were recorded. Conditions in the Repository were frequently at a low ebb, and the collections were in the care of curators who were overworked or negligent (and in one instance dishonest) in their duties. The instrument collection was finally put in good order only in the early nineteenth century.

The period of peace following the lengthy French wars at the beginning of the nineteenth century was one in which the Government turned increasingly to the Royal Society to resolve scientific problems of various types and to undertake investigations on its behalf. The long overdue reform of the system of weights and measures, and its establishment on a sound scientific basis, was referred to the Society in 1816. The work of Henry Kater that led to the introduction of the Imperial System in 1824 however was intimately connected with the parallel and pressing problem of developing the geodetic framework of the Government's Ordnance Survey, and was ultimately to involve exacting measurements conducted across the globe. The Navy's growing hydrographic role, together with the call of national prestige, led to a series of expeditions, notably those in extreme latitudes aimed at discovering the North-West Passage. The Society was active in encouraging these, and through close collaboration with the Admiralty ensured that programmes of gravitational, magnetic and other observations were carried out.

The Society's collection of instruments, swollen by the apparatus used by Kater and others, now served two purposes. The Society held instruments that could be and were lent for scientific experiments and expeditions, and it also provided a secure repository for apparatus such as length standards, that had to be regarded as reference pieces accessible only under controlled conditions. The collection of course still included an assortment of items (including the Newton telescope) that were now principally of historic interest, but even some of these, such as George Graham's standard yard, were becoming recognized as having important scientific reference value. These instruments were however not all kept in the Society's rooms. Geodetic instruments for a time remained with those of the Ordnance Survey, while further instruments

were associated with the Board of Longitude, with whom the Society shared a warehouse until the Board's dissolution in 1828 (88).

After the Society's principal collections had passed to the British Museum it is not clear whether there was adequate control over the instruments. Certainly this growing collection was not properly documented, as is made clear in a Council resolution of early 1827 that 'As no accurate catalogue exists of the Instruments belonging to the Royal Society' a committee comprising Davies Gilbert as Treasurer, Captains Francis Beaufort and Henry Kater, and James South, the astronomer, was charged with drawing up an inventory (89). In common with many other Fellows, South at the time was highly critical of many aspects of the Society's operation which were felt to be depressing its scientific prestige. A committee set up at his insistence recommended important reforms, but its report was later rejected (90). Both Beaufort and Kater served with South on this committee and would have shared his views about regularizing any shortcomings in the care of the instruments or their scientific availability: Beaufort was shortly to become Hydrographer to the Navy, and Kater had framed the Admiralty instructions for the care of instruments on the Arctic expenditions (91).

The 1827 inventory survives in two manuscript versions in the Royal Society's Archives: a principal copy (92), and a further copy with items listed by location (93). As well as 'Newton's Reflecting Telescope', also recorded at the same location was a 'Concave Mirror apparently by Newton'. It can be deduced that this was an objective mirror of about the same size as that in the telescope, and it is possible that this may be the slightly oversize mirror which is now associated with the telescope (94). The catalogue was presented to the Council in April 1827, when they 'Resolved that a Glass Case be made for Sir Isaac Newton's Telescope', which is the case in which the instrument donated in 1766 is now displayed (95).

In 1830 there was again considerable discontent amongst the scientific Fellows when it was learnt that Davies Gilbert, the interim President, had proposed the King's brother, the Duke of Sussex, to succeed him; but in spite of attempts to get John Herschel elected, Sussex won the contest (96). Although his knowledge of science was slight, Sussex rapidly appreciated the need for a revision of the Society's policy and a thorough overhaul of its administration. During the first few years of his presidency, and with the active assistance of the new Treasurer, the astronomer John Lubbock, he reformed and regularized many of the administrative procedures (97). Amongst the subjects to come under scrutiny was the security of the Society's various possessions. Apart from the apparent disarray of some sections, such as the papers and

documents, there was the problem of exercising adequate control over borrowing by Fellows; comprehensive catalogues would have to be prepared and regulations for loans framed.

The informality of the existing arrangements is perhaps best illustrated by the disappearance in the period 1800–30 of the collection of historically important microscopes bequeathed to the Society in 1723 by Antoni van Leeuwenhoek. The loss was pointed out in 1855 by the Council's most persistent critic of administrative shortcomings, Sir James South. The microscopes had apparently been lent informally to the surgeon and microscopist Sir Everard Home, who had died in 1832, but enquiries by South and the Council failed to locate them (98). This problem was of course not a new one. Another often quoted example is the Tompion astronomical clock presented to the Society on John Flamsteed's death, which was borrowed, probably by Sir James Lowther in the mid-eighteenth century, and its connexion with the Society soon forgotten; fortunately, it was ultimately acquired by the British Museum (99).

The Council called for catalogues of the instruments, and of the Society's portraits, in March 1831 (100). James Hudson, the Assistant Secretary to whom the 1827 list had been entrusted, delivered a list of the instruments to the Council in June, and Henry Kater was asked to 'revise this list, and make in it such corrections as it may require' (101). It appears that this was complete in July 1831, and the Council authorized it to be printed, although this does not seem to have been done (102).

As with the 1827 inventory, the 1831 list survives in more than one form. It is usually identified with the instrument maker William Simms (1793–1860, F.R.S. 1855), who assisted in its preparation (103). The earlier version of this comprises 81 numbered items, the last marked 'Mr Simms to inspect it', and is presumably in the form of Simms's original catalogue (104). A later version has each item identified by two numbers: 'No in Simm's Catalogue' and 'Proposed Number', the first of which refers to the earlier version (105). The list has been annotated and has clearly been used as a working copy in preparing a printed version. The final page, which has been marked 'not to be printed' is headed 'Report by Mr Simms (May 1831)' and describes the physical condition of some items, ending 'In conclusion,—the most important & useful instruments are those that I find are in the best condition'. The majority of historically interesting instruments are included amongst 'Those of apparent utility', although some, including Wilkins's 1663 burning lens, were in a separate section of 'Those apparently useless'.

In November 1831 new regulations were approved enabling the Council to

restrict the borrowing of instruments and place the onus for their safety and their return within a specified period on the borrower (106). It was now agreed that a definitive list of instruments was to be drawn up, and the Treasurer (Lubbock) was 'authorized to dispose of whatever instruments or materials may be found to be useless to the Society'. In order that the items should be readily and permanently identifiable the Council also resolved 'that, as far as circumstances will permit, each instrument be marked with the words "Royal Society" or the letters "R.S.", and each detached part be marked with the number corresponding to that in the catalogue'. It is not clear when this numbering was done, but it is likely to have been in early 1832 (107).

After some delay, the printed catalogue of the instruments appeared in late 1834, with the new numbering (108). Although Kater and Lubbock had retained a few of the items that Simms had recommended as 'useless', the majority had now gone, including the intriguing parcels of 'unimportant sundries' (109). The Newton telescope, which had been given a proposed number of 22 in 1831, was engraved with the number 28 that subsequently appeared in the 1834 list. It is described in the printed list as having '4 parts', but it is not known what these were, or whether they included the additional objective speculum.

Having now regularized the instrument collection, the Council showed increasing reluctance to place historical material at risk. The astronomer W. H. Smyth was told in 1843 that the Council did not wish 'to make a precedent for removing from the Apartments of the Society so valuable an instrument as the telescope made by Sir Isaac Newton'; and in the same year the Royal Institution was told that 'it is the practice of the Council to refuse to allow instruments possessing any value as historical records to be taken out of the Apartments of the Society' (110). An exception was however made for the Government's 1875 Special Loan Collection of scientific apparatus at South Kensington, but the Newton telescope has retained a special significance for the Royal Society and it was not amongst the apparatus subsequently lent to the Science Museum (111).

Notes

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(1) K. T. Hoppen, 'The Nature of the Early Royal Society', *Br. J. Hist. Sci.*, **9**, 1–24, 243–273 (1976), p. 8.

(2) M. Hunter, *Science and Society in Restoration England* (Cambridge, 1981), pp. 66–7.

(3) See Z. Bechler, ''A less agreeable matter': The Disagreeable Case of Newton and Achromatic Refraction', *Br. J. Hist. Sci.*, **8**, 101–126 (1975).

(4) The 1766 gift is recorded in the various editions of the Royal Society *Record* (1897 to 1940) and has been noted by a number of writers. It has most recently been discussed in A. A. Mills & P. J. Turvey, 'Newton's Telescope: An Examination of the Reflecting Telescope attributed to Sir Isaac Newton in the Possession of the Royal Society', *Notes & Records R. Soc. Lond.*, **33**, 133–155 (1978–9). Somewhat different conclusions have been reached by the present author: A. D. C. Simpson, 'Isaac Newton and the Early Reflecting Telescope' (forthcoming).

(5) For the early history of the Society and its Repository see, for example, T. Birch (Ed.), *The History of the Royal Society of London* (London, 1756–7), H. Hartley (Ed.), *The Royal Society. Its Origins and Founders* (London, 1960), H. Lyons, *The Royal Society 1660–1940, A History of its Administration under its Charters* (Cambridge, 1944) and C. R. Weld, *History of the Royal Society* (London, 1848). The Society's occupancy of Gresham College is discussed by I. Adamson, 'The Royal Society and Gresham College 1660–1711', *Notes & Records R. Soc. Lond.*, **33**, 1–21 (1978–9).

(6) T. Sprat, *The History of the Royal Society of London for the Improving of Natural Knowledge* (London, 1667), p. 93.

(7) Adamson, op. cit. (5), p. 5.

(8) See, for example, J. A. Bennett, 'Robert Hooke as Mechanic and Natural Philosopher', *Notes and Records R. Soc. Lond.*, **35**, 33–48 (1980–1), R. T. Gunther, *Early Science in Oxford*, **VI, VII** (Oxford, 1930), and M. 'Espinasse, *Robert Hooke* (London, 1956).

(9) E. S. de Beer (Ed.), *The Diary of John Evelyn* (Oxford, 1955), **III**, p. 433; Hunter, op. cit. (2), p. 66. An inventory by the Society's Treasurer, Abraham Hill, apparently restricted to purchased items in the Repository, was prepared in 1663: Birch, op. cit. (5), **I**, p. 332.

(10) Roy. Soc. MS. Council Minutes, meeting of 22 June 1668. This is not inconsistent with the brief account of the Repository about this time by Lorenzo Magalotti who appears to link it with Arundel House. Magalotti attended a meeting of the Society in Arundel House in 1669, but the only item described in any detail was one actually exhibited at the meeting: Weld, op. cit. (5), **I**, p. 218, quoting L. Magalotti, *Travels of Cosimo III, Grand Duke of Tuscany . . .* (London, 1821); cf. Birch, op. cit. (5). Michael Hunter has since drawn my attention to a comment made by Magalotti in 1668 which confirms this proposal: 'In the house of Mr Hooke remain all the natural rarities gathered together by the Royal Society, as in a storeroom': W. E. K. Middleton (Ed. and trans.), *Lorenzo Magalotti at the Court of Charles II: his "Relazione d'Inghilterra" of 1668* (Waterloo, Ontario, 1980), p. 140.

(11) Weld, op. cit. (5), **I**, p. 242.

(12) To be discussed in my forthcoming article, see note (4).

(13) M. Hunter, *John Aubrey and the Realm of Learning* (London, 1975), pp. 45, 62. For a recent treatment of the taxonomic issues see M. M. Slaughter, *Universal Languages and Scientific Taxonomy in the Seventeenth Century* (Cambridge, 1982).
(14) Birch, op. cit. (5), **III,** p. 158.
(15) Ibid., **III,** p. 159.
(16) Ibid., **III,** p. 191.
(17) M. Hunter, 'Early Problems in Professionalizing Scientific Research: Nehemiah Grew (1641–1712) and the Royal Society . . .', *Notes & Records R. Soc. Lond.*, **36,** 189–209 (1981–2).
(18) Ibid., p. 202.
(19) N. Grew, *Museum Regalis Societatis or a Catalogue and Description of the Natural and Artificial Rarities belonging to the Royal Society and Preserved at Gresham College* (London, 1681), p. 360, referring to *Phil. Trans.*, **7,** 4004–7 (1672). Although Grew provided no new information about the telescope to demonstrate that he had examined it, it must be assumed that it was indeed in the Repository in 1681. The same is not necessarily so in 1686 and 1694 when subsequent editions of the catalogue appeared since these were merely re-issues of the original text.
(20) Lyons, op. cit. (5), p. 90.
(21) Michael Hunter has noted Grew's eventual withdrawal from active work on the Society's behalf because of pressure from his medical practice: Hunter, op. cit. (17), pp. 202–4. For Hunt, see H. W. Robinson, 'The Administrative Staff of the Royal Society', *Notes & Records R. Soc. Lond.*, **4,** 193–205 (1946): this article was written in 1939 and used extensively by Sir Henry Lyons in his 1944 history of the Society.
(22) Robinson, op. cit. (21), p. 197, notes that the Society owed Hunt at his death £650 plus interest.
(23) J. E. B. Mayor (Ed.), *Cambridge under Queen Anne* (Cambridge, 1911), p. 313.
(24) W. H. Quarrell & M. Mare (Eds.), *London in 1710: From the Travels of Zacharias Conrad von Uffenbach* (London, 1934), p. 98.
(25) Mayor, op. cit. (23), p. 379.
(26) [E. Hatton], *A New View of London* (London, 1708), **II,** p. 666. The comparison between Hatton's listing and material known to survive in the 1730s refers to manuscript inventories to be discussed below.
(27) Adamson, op. cit. (5), p. 7.
(28) Roy. Soc. MS. Council Minutes, meeting of 8 September 1710.
(29) J. A. Bennett, 'Wren's Last Building?', *Notes & Records R. Soc. Lond.*, **27,** 107–118 (1972–3), p. 108.
(30) Roy. Soc. MS. Council Minutes, meeting of 8 April 1712.
(31) A. H. White (Ed.), *Memoirs of Sir Issac Newton's Life by William Stukeley, M.D., F.R.S. 1752* (London, 1936), p. 57. Stukeley claimed to have begun his collection in 1726 when he moved to Grantham, and in the following year he sent a long memoir on Newton to Richard Mead, Newton's physician, under whom Stukeley had studied when first in London. This was intended for transmission to John Conduitt for his proposed biography of Newton, but as

it covered only Newton's early years in the Grantham area there is no mention of the telescope: J. Nichols, *Illustrations of the Literary History of the Eighteenth Century* (London, 1817–31), **IV**, p. 23. This, and other material sent by Stukeley to Conduitt, became inaccessible to Stukeley after Conduitt's death in 1737, and it passed by descent into the possession of the Earl of Portsmouth. Access was granted to John Nichols, but of the portions he published only James Rutty's 1722 extracts from the Society's journal books related to the telescope: ibid., **IV**, p. 19. Hence although it can be deduced that Stukeley's 1752 biographic sketch was written largely from recollections, no earlier account by Stukeley of the telescope has been found to indicate when it was seen. However, the reference to the telescope and the burning glass is quite specific and it must be assumed that Stukeley saw both instruments. Although Stukeley's objectivity in the period in which the manuscript was written has been questioned (see S. Piggott, *William Stukeley, an Eighteenth Century Antiquary* (Oxford, 1950)), he is likely to have been correct in such a factual matter. Stukeley was not unfamiliar with astronomical instruments; and he served for example as a member of the Board of Visitors of the Royal Observatory, Greenwich, in 1726: E. G. Forbes, *Greenwich Observatory. Vol. 1: Origins and Early History (1675–1835)* (London, 1975), p. 83. He is also known to have taken an interest in the Royal Society's Repository, chairing the Repository Committee on three occasions during the reorganization of 1731 when geological specimens were being considered: Roy. Soc. MS. 490 (CMB 63). It is unfortunately not possible to narrow down the period in which the telescope was seen since it is known from his diaries that Stukeley was attending Royal Society meetings regularly after his return to London in 1748 and occassionally before then: see W. C. Lukis (Ed.), *The Family Memoirs of the Rev. William Stukeley* (London, 1882–7). However, since it will be demonstrated below that the telescope and burning glass had deteriorated by the 1730s it will be assumed that both were seen by Stukeley before his departure for Grantham in 1726, and most probably shortly after coming under Newton's influence in 1718, thus supporting the survival of the instrument until at least that date.

(32) Mills & Turvey, op. cit. (4), p. 141, following the transcription from the 1739 translation of Algarotti's *Il Newtonianismo per le dame* quoted in *Nature*, **143** (1939), p. 110.

(33) F. Algarotti, *Sir Isaac Newton's Philosophy Explained for the Use of Ladies* (London, 1739), **II**, p. 129.

(34) See above, note (4).

(35) Roy. Soc. MS. Council Minutes: meeting of 7 December 1713.

(36) 'The Report of the Committee Appointed to Inspect the State of the Library's and Repository' bound in ibid., at meeting of 27 June 1723. Thomas had in fact been instructed twice by the Council in April 1719 to prepare a catalogue which was to be in the form of an interleaved copy of Grew's catalogue with the descriptions brought up to date: ibid., meetings of 8, 23 April 1719. It is possible however that some work may have been done in the Repository: the Rev. Moses Williams (F.R.S. 1719), who acted as temporary Housekeeper

until Thomas's successor was chosen and who was later unsuccessful in his application to become Keeper of the Library only, claimed to have 'been conversant in the Society's Repository in Mr Thomas' time': ibid., meeting of 4 April 1723. He was also invited to join the Council's 1723 Repository and Library Committee: ibid., meeting of 9 May 1723. The easy assumption by Williams of Thomas's duties immediately after the latter absconded suggests that Williams may have been the assistant which Thomas was required to employ from 1719: ibid., meeting of 8 April 1719. See below, note (50).

(37) Idem. A bricklayer's bill for work done in the Repository in 1724 may have been for the installation of the chimney that was certainly in place by 1734 – this however was only lit on meeting days and proved inadequate: ibid., meeting of 18 February 1733/4. An apparently equally intractable problem was the offensively strong smell of the cheese stored in the cellar below the Repository – it took five years of agitation to evict the cheesemonger who had leased the cellar.

(38) Ibid., meeting of 9 May 1723.

(39) H. Guerlac, 'Sir Isaac Newton and the Ingenious Mr. Hauksbee' in I. B. Cohen & R. Taton (Eds.), *Mélanges Alexandre Koyré*, **1**, 228–253 (1964).

(40) Roy. Soc. MS. Council Minutes, meeting of 27 June 1723.

(41) Ibid., meeting of 3 July 1729.

(42) Roy. Soc. MS. 490 (CMB 63), meeting of 8 May 1733.

(43) 'The Report of the Committee for inspecting the State of the Repository and Libraries of the Royal Society' dated 9 October 1729, in Roy. Soc. MS. Council Minutes, at meeting of 6 Nov 1729.

(44) 'The Report of the Committee appointed to inspect and Examine into the State of the Repository of the Royal Society', in ibid., at meeting of 18 February 1733/4. The Report apparently dates from just before the Council's 29 October 1733 meeting at which it was first read, but it was not subsequently amended to note the completion of the examination of the artificial curiosities on 30 October.

(45) 'Report of the Committee for Examining the State of the Repository of the Royal Society' in ibid., at meeting of 2 November 1731.

(46) See above, note (44).

(47) Roy. Soc. MS. Council Minutes, meeting of 12 January 1735/6.

(48) Roy. Soc. MS. 490 (CMB 63), MSS. 413, 414 and 416 (known respectively as Catalogues A, B and D).

(49) Roy. Soc. MS. Council Minutes, meeting of 6 November 1729.

(50) The catalogue MS. 413 is divided along lines closely similar to those used by Grew, and lists the items noted by Grew with subsequent donations to about 1719 interspersed in the earlier part. Later donations to about 1725 have been added in a manner that suggests it was used as a running catalogue until about that date. It seems likely that it was the work of Moses Williams, who would presumably have protested its unofficial status to the 1723 Committee. Confirmation that it continued to be used as the principal catalogue in 1731 is provided by the additions made by the Committee in that year. Similarly, of

the later sections, only that on corals has the entries individually numbered, and it was noted in June 1733 that John Martyn, who had served on the 1730 Committee, 'did formerly at ye Desire of ye Committee examin & number ye Corals': Roy. Soc. MS. 490 (CMB 63), meeting of 15 June 1733. The Catalogue has previously been incorrectly dated as 1763/4 on the evidence of watermarks. The early numbered copy of Grew's catalogue mentioned by the Committee cannot be located, but the Committee appears also to have been using the incomplete copy of the first impression now in the Royal Society Library. In this the individual entries are distinguished in pencil, and the first 80 pages of the catalogue section (covering the review period up to the beginning of the minuted meetings) have been cut out.

(51) Roy. Soc. MS. 490 (CMB 63), meeting of 22 July 1731.

(52) Ibid., meeting of 29 July 1731, item 7.

(53) Ibid., meeting of 16 September 1731.

(54) Roy. Soc. MS. 416, 'A Complete Catalogue of the Several Donations of Manuscripts, printed Books, Naturall Curiosities, Machines & Antiquities, which have been presented to the Royal Society, extracted from the Journal Books with the dates when given & the Donors names annexed'. The list was kept up to date until early 1737: it is continued in MS. 419 which runs to 1744.

(55) Roy. Soc. MS. 414, untitled. This bears a date, ascribed on the evidence of watermarks, of c1741, but is certainly of 1732–3.

(56) Roy. Soc. MS. 490 (CMB 63), meeting of 30 October 1733.

(57) Items that did not appear on Mortimer's list (normally because they were incomplete or unidentifiable) were added at the end of the relevant section. At the last meeting of the review about 100 trifling items remained and only a few of these could be adequately identified. The available space for additions to some sections (such as 'optics') had by then been used up. The majority of these last items, including the two Newton specula, are listed on two loose sheets of paper inserted at the end of MS. 414.

(58) Roy. Soc. MS. Journal Book, meeting of 20 June 1728. The lens was borrowed in February 1712/3 by William Derham, and then from 1718 was remounted and used by John Pound assisted by Bradley: see A. D. Atkinson, 'William Derham F.R.S. (1657–1735)', *Ann. Sci.*, **8**, 368–392 (1952), pp. 387, 388.

(59) Roy. Soc. MS. Council Minutes, meeting of 24 June 1728. The other objectives were one of 170ft focus which had been in Newton's possession and another of 210ft focus presented by Gilbert Burnet in 1724. These were described by R. A. Sampson & A. E. Conrady, 'On the Huygens Lenses in the Possession of the Royal Society of London', *Proc. R. Soc. Edin.*, **49**, 289–299 (1928–9), who concluded that all three lenses owned by the Royal Society were the work of Constantyn Huygens rather than his brother Christiaan.

(60) The lenses survive at the Royal Society. The microscopes were later lent to Henry Baker, who returned them in 1741, and they were subsequently kept in the Repository, from which they eventually disappeared: see below, note (98).

(61) To be discussed in my forthcoming article; see above, note (4).

(62) See for example J. T. Desaguliers, 'Appendix . . .' in D. Gregory, *Elements of Catoptrics and Dioptrics* (2nd edition, London, 1735).
(63) See above, note (44).
(64) Roy. Soc. MS. Council Minutes, meeting of 16 September 1734.
(65) Ibid., meeting of 12 January 1735/6.
(66) Ibid., meeting of 13 September 1737.
(67) Ibid., meeting of 31 January 1738/9. It would appear that Mortimer's catalogue was not yet complete. It is not known whether this inventory was drawn up, and no copy signed by Hauksbee survives in the Royal Society.
(68) Lukis, op. cit. (31), **I,** p. 372.
(69) P. J. P. Whitehead, 'Emanuel Mendes da Costa (1717–91) and the *Conchology, or natural history of shells*', *Bull. Br. Museum Nat. Hist. (Hist. Series),* **6,** 1–24 (1977).
(70) Ibid., p. 7.
(71) Roy. Soc. MS. Council Minutes, meeting of 3 April 1763.
(72) Whitehead, op. cit. (69) p. 8; C. H. Brock, 'Dru Drury's *Illustrations of natural history* and the type specimen of *Goliathus goliatus* Drury', *J. Soc. Bibliography Nat. Hist.*, **8,** 259–265 (1977), p. 259.
(73) J. Harris, *Lexicon Technicum* (London, 1704–10), **II,** article 'Burning Glasses'.
(74) Amongst the items listed in their final session by the 1733 Repository Committee was (number 238) 'a set of reflecting concave glasses one broken' which may be the individual components of the burning glass: Roy. Soc. MS. 414.
(75) This item when first listed in 1731 was described as 'Sir Isaac Newton's Apparatus for making observations at Sea by a double reflection' with 'Query' added, but was amended to 'A Wooden Quadrant with Sliding Index': MS. 490 (CMB 63), meeting of 12 August 1731, item 85. It is of interest that the initial attribution was made, since only three months beforehand Mortimer had examined the Journal Books for the 1699 description of Newton's instrument in order to assess whether Newton had priority over John Hadley. The 1731 entry in MS. 414 was a 'a wooden model of Dr Hook's Reflecting Quadrant', and it was numbered 14 in 1733. An entry 'Large wooden Quadrant' in the 1765 catalogue (MS. 417) had added 'Q^{r} if No 14', but it is not known if this was confirmed: the item does not appear subsequently.
(76) Roy. Soc. MS. Council Minutes, meeting of 17 March 1763.
(77) Roy. Soc. MS. 415/1, f1.
(78) Roy. Soc. MS. 417, 'An Inventory of such Antiquities, Machines, Models, Mathematical and Optical and other Instruments, Weapons of War, Apparel, Utensils and curious Works of Art, as are now in the Repository of the Royal Society. Nov.^{r} 21 1765'. The 1763 manuscript catalogue is in 5 parts, the second being the classification scheme used and the final three being fair copies of sections of the earlier catalogue; however, the coverage is restricted to natural history material, and there are no equivalent subsidiary parts to the 1765 catalogue.
(79) Roy. Soc. MS. Journal Book, meeting of 21 November 1765.
(80) Roy. Soc. MS. Treasurer's Papers (Uncatalogued). Four accounts for da Costa's

expenses are for the periods Jan 1764 – Nov 1764, Dec 1764 – Nov 1765, Jan 1766 – Nov 1766, Dec 1766 – Nov 1767.

(81) Ibid., entry for 27 June 1764, presumably referring principally to an internal reorganization of the Repository, and distinct from entries describing general assistance in the Repository.

(82) See above, note (52).

(83) Robinson, op. cit. (21), p. 201.

(84) Plans showing the proposed museum accommodation are preserved as Roy. Soc. MS. MM.13.58.

(85) Weld, op. cit. (5), **II**, p. 120.

(86) *The Picture of London for 1806* (London. 1806), p. 157.

(87) It is possible that the instruments, models, etc, had already been separated from the natural history collections by the time the gift to the British Museum was proposed. Such a separation was proposed in 1737 (Roy. Soc. MS. Council Minutes, meeting of 13 September 1737) but may not have been acted upon. It is not clear how the Repository collections were divided in 1780: the acknowledgement from the British Museum Trustees of June 1781 notes the receipt only of 'the very ample collection of natural productions', whereas Weld was able to trace some specimens of comparative anatomy to the Museum of the Royal College of Surgeons of England: Weld, op. cit. (5), **II**, p. 125. Both the *Picture of London for 1806* and the *Original Picture of London enlarged and improved* of 1826 say the Society had a museum of natural history.

(88) H. D. Howse & B. Hutchinson, 'The Saga of the Shelton Clocks', *Antiquarian Horology*, **6**, 281–298 (1969), p. 282.

(89) Roy. Soc. MS. Council Minutes, meeeting of 8 February 1827.

(90) Lyons, op. cit. (5), pp. 244, 248.

(91) H. Kater *et al., Instructions for the adjustments and use of the instruments intended for the northern expeditions. Printed by order of the Royal Society* (London, 1818).

(92) Roy. Soc. MS. DM.2.124, 'Account of Instruments, Aparatus, and Coins belonging to the Royal Society. March 1827'.

(93) Roy. Soc. MS. DM.2.126, untitled, 1826 dated watermark.

(94) In the principal copy the word 'concave' has been amended in pencil to 'flat' (and this clearly shows that it cannot be a component of Newton's 1704 burning speculum), but then the whole entry has been deleted in pencil and 'with addition obj. mirror' inserted against the entry for the telescope: ibid., f2. These amendments are in a different hand to that of the original entries, and perhaps date from the 1831 cataloguing.

(95) Roy. Soc. MS. Council Minutes, meeting of 26 April 1827.

(96) Lyons, op. cit. (5), p. 250.

(97) Ibid., p. 256.

(98) South's original letter to the President of 5 April 1855 noted that the Society's correspondence was lacking for the entire period 1740–1830, and that one of the Society's officers had stated that the microscopes were lost (Roy. Soc. MS. MC.5.198). In a further letter of 28 July South said that he had been told by a previous Assistant Secretary (at some time before 1826) that the microscopes had been lent to Home; South had recently examined instru-

ments supposed to have been made by Leeuwenhoek, and therefore perhaps the Society's, but he had found that they were not by Leeuwenhoek (MS. MC.5.207).

(99) *Record of the Royal Society of London* (London, 1940), p. 168.

(100) Roy. Soc. MS. Council Minutes, meeting of 3 March 1831.

(101) Ibid., meeting of 9 June 1831.

(102) Ibid., meeting of 7 July 1831.

(103) Howse & Hutchinson, op. cit. (88), p. 288, however mistakenly associate the 1827 list with Simms.

(104) Roy. Soc. MS. DM.2.123, untitled.

(105) Roy. Soc. MS. DM.2.127, 'INSTRUMENTS belonging to the Royal Society 1831'.

(106) Roy. Soc. MS. Council Minutes, meeting of 10 November 1831. Two weeks later the account for preparing the catalogue was approved: 'Resolved that the following bills be paid . . . Troughton & Simms, for making a list of the instruments in possession of the Society, &c. £6. 12. 6': ibid., meeting of 24 November 1831. Although the Council resolved that the regulations for the loan of instruments (as well as books) be printed (ibid., meeting of 22 December 1831), no copy has been found.

(107) The work was to be supervised by the instrument maker George Dollond (1774–1852, F.R.S. 1819) who at the time was constructing Peter Barlow's fluid-filled lens telescope for the Society. No separate account was submitted, but it may have been added to his bill for the telescope which was approved on 14 February 1833: ibid. The inclusion of new and unnumbered items in the list when it was published in 1834 suggests the numbering was done some time before; as does the fact that one item (the Shelton regulator, item 33) is identified with a piece that bears no number (Howse & Hutchinson, op. cit. (88)), but which was apparently away from the Society's rooms in early 1832 under test by Francis Baily. Dollond subsequently explained to Lubbock that he had only been able to mark those instruments in the rooms or which had been borrowed by members of the late Board of Longitude: Roy. Soc. MS. LUB.D.202.

(108) *Instruments and Apparatus belonging to The Royal Society*. The Council ordered the printing of this and of the portrait list on 16 October 1834, and both are dated November 1834.

(109) A single sheet with the Simms inventory lists a number of items including '2 Specula for I. Newton's Telescope': Roy. Soc. MS. DM.2.129. It is clear that this list, on 1830 watermark paper, is of items that were looked for in vain, and that do not appear in the 1827 inventory.

(110) *Royal Society Council Record*, I (1832–46) pp. 410, 413.

(111) Roy. Soc. MS. MM.13.49.