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A PROVINCIAL MAN OF SCIENCE AT WORK: MARTIN LISTER, F.R.S., AND HIS ILLUSTRATORS 1670–1683

by

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INTRODUCTION

Between October 1670, when Martin Lister arrived in York, and September 1683, when he removed to London, he was at the centre of an informal group of virtuosi – naturalists, artists and antiquaries – who either lived in the provincial capital or visited regularly.[1] Part of the medical establishment at York, and keenly interested in physiological phenomena, Lister was to become nationally renowned as a scientist and naturalist.[2] The *Philosophical Transactions* carried 28 non-illustrated scientific communications from Lister between 1669 and 1673. Over the following 10 years his published papers and books were increasingly illustrated.

A study of the association between Martin Lister and the amateur artists William Lodge and Francis Place provides the opportunity to consider: the relationship between the scientist and his illustrators; the visual conventions being developed in scientific publishing; and the value the scientific community placed on the visual representation of their observations, scientific collections and published communications. How far does a study of the association of Lister and his illustrators illumine general issues pertinent to the history of science? What value have later scholars placed on the work of Lister's illustrators?

MARTIN LISTER AND WILLIAM LODGE

Born *ca.* 1638 in Buckinghamshire, Lister was the third son of Sir Martin Lister and nephew of the royal physician Sir Matthew Lister, under whose direction he was educated. From Melton (Mowbray) school, Lister proceeded to St John's College, Cambridge, where he probably became associated with John Ray the botanist.[3] Martin Lister's family connections gave him a strong claim to royal favour and, by royal mandate, he became a fellow of St John's at the Restoration. The association with Ray, who had a considerable influence upon Lister's development as a scientist, continued at Montpellier (1665–66), where Lister studied medicine for a short time but did not graduate. After his marriage to Hannah Parkinson in 1669 Lister was obliged to forfeit his Cambridge fellowship, and

settled at Carleton Hall near Skipton in Craven 'soe remote a corner where I live', which Hannah inherited from her father.[4] Shortly afterwards they moved to York, where he became part of the medical establishment.

Most of Lister's fieldwork was carried out in the years shortly before and after he entered medical practice at York. As a modestly anonymous writer on snail shells and spiders, his first published communication in *Philosophical Transactions* appeared in 1669.[5] By the early 1670s Lister, who was elected F.R.S. on 2 November 1671, was a regular correspondent of Henry Oldenburg and the Royal Society, many of his letters being published *in extenso*. An observant naturalist, Lister soon acquired a detailed knowledge of the flora and fauna of northern England; and produced important work on the cause of gossamer, on the classification of spiders, on snails and petrified shells, on entomology (the life histories of gall wasps, ichneumons, gut worms and horsehair worms), on veins in plants, vegetable excrescences, mushrooms and experiments on the movement of sap in trees. He also provided information about longevity in the north of England and a description of 'a stone cut from under the tongue of a man'.

Like many naturalists of the period (for example Marcello Malpighi) Lister was also a busy professional physician and was conscious that other 'more leisured' virtuosi might enjoy greater opportunities for learned pursuits.[6] Such a virtuoso was William Lodge, some 10 years younger than Lister, and the son of a wealthy Leeds merchant family. Schooled in Leeds and at Jesus College, Cambridge, Lodge seems to have engaged in painting as an amateur pursuit, informing his mother that 'I make painting onely a recreation, an hour after dinner and so no hindrance is it but rather a furtherance to things of greater concernment ...'[7] Although subsequently educated to the legal profession at Lincoln's Inn, he quit his studies and joined the suite of Lord Bellasis (Thomas Belasyse), Viscount Fauconberg (or Falkenberg) on an embassy to Venice (1669–70), where he visited the public and private cabinets of his hosts. In Italy Lodge came across Giacomo Barri's *Viaggio Pittoresco*, which was later to lead to his publication of *The Painter's Voyage of Italy*. On returning to England, he devoted much of his time to sketching, painting and engraving; he lived, variously, in London, Leeds, York and the Craven area.

The first extant letter from Lodge to Lister, dated 30 September 1673, and written from Lodge's home in Arnolds Biggin, a Craven village not far from Lister's own estate, suggests that the two men had met at Carleton Hall in the summer of 1673 and that Lodge had been requested to draw one of Lister's fossils.[8] A significant stage had arrived in Lister's development as a communicator of scientific observations.

Lister's interest in visual representation

Lister's recognition of the value of the visual representation of science was gradual. His first paper in the *Philosophical Transactions* in 1669 had included written observations of a snail with a reversed spiral shell, which John Ray had

deemed worthy of illustration: 'I have never found one such as you describe ... It deserves to be preserved, described and painted ...'[9] Lister supplemented direct and field observation with the critical use of two-dimensional illustrations. In *Philosophical Transactions* (16 December 1672), he referred to 'a kind of biting Mushroom' which he had seen in a book on the *State of Russia*, but noted that 'the reference to the Cuts or Figures is here confused'. Writing to Oldenburg on 21 May 1673 on the subject of 'tape-worms found in a dog', Lister expressed dissatisfaction at some of the illustrations he had to hand, urging Oldenburg to 'view the Cut of *Tulpius* in the last year's Edition of his *Medic. Observat* ...', where a figure had been reprinted from the edition of 1652. Doubting the reliability of the published illustrations, he commented that some of the detailed features of the tape-worm 'seem to be the meer fancies of the painter ...', making any comparison with actual specimens difficult.[10]

Lister who, like other naturalists such as John Ray, was pursuing a new kind of natural history which aimed at exact observation, description and taxonomy, was concerned that the visual representation of science should have high standards. Such is the context of the earliest surviving correspondence between Lodge and Lister. In the summer and autumn of 1673, Lister was engaged in preparing a paper setting out his detailed observations of fossils[11] and, when he invited Lodge to draw a sample from his cabinet, he probably intended to find out the range of the illustrator's skills. Lodge acknowledged the commission with an assurance that he had 'with my best endeavours imitated the Stone you left with mee at Carleton (which as it was curious so was it the more difficult to represent in design)'. He had produced two 'draughts', 'one as it apeares with most advantage plane wise'; and the other 'as it is erected perspective wise'; the latter approach according well to a draughtsman accustomed to the drawing of 'prospects'. Lodge took proper care to ensure the safe return of the fossil to York, noting that 'the stone itself I would not trust with the Carrier but will send it by a safer opportunity'. It seems he was keen to secure further commissions:

> as you approve of this design, send any other of youre curiosities and I will use all care in imitating em, and if you please to Command me to transferr em on to Copper, they shall be much more naturall then tis possible for em to be represented by pen ... [12]

Lister's need of a skilled illustrator, and Lodge's assurance that his 'utmost ambition is do you any service within the performance of' his talents, seemed to provide a basis for collaboration between scientist and illustrator, a fact recognized by the York virtuoso, John Brooke:

> Tis very desirable, that Mr Lodge, should give you his Assistance; that nothing may be omitted to satisfy your own Inclinacons so studious, of what is accurate & choice. [13]

Oldenburg informed Lister that he was 'exceeding glad to hear you have some things for us about Fossils, an excellent subject ...'[14] The paper on fossils involved

detailed description and comparison of a technical kind, and the subtle distinctions could be demonstrated through the use of pictorial similarities and differences.

The fossils to be illustrated, together with the scientist's accompanying instructions and suggestions, were forwarded in boxes by carrier to Lodge's home in Arnolds Biggin. In describing his design, Lodge informed Lister that 'the method which I have placed the stones in, is as you figured in the litle papers in the greate Box'. From his minute observations of the fossils, he made a number of changes to the arrangement of figures as suggested by Lister, noting that 'instead of 4 and 4 and 13 and 13 I have figured 4 and 5 and 13 and 14 for they are of species different enough to require different figures'. In two instances, Lodge drew the fossils 'both plane and prospect-wise' and inserted a number of explanatory letters. He seems to have developed a growing interest in fossils and added one which he had found at Clitheroe to the design, it 'being singangular'. He informed Lister that 'these are all the variations I made from the former method, I hope you may fitt your discourse to this'.[15]

Within days of receiving the drawings, Lister's scientific communication, with detailed cross-referencing between the text and the pictorial representation of the fossils, was despatched to Oldenburg at the Royal Society. In concluding his paper, Lister gave, perhaps, the most convincing justification of the value of illustrating scientific work:

> Words are but ye arbitrary symboles of things, & perhaps I have not used ym to ye best advantage. Good Design (& such is yt I send you, done by yt ingenious young Gentleman & excellent Artist, my very good friend Mr William Lodge), or ye things ymselves, wch I have all by me, would make these particulars much more intelligible and plain to you.[16]

The illustrated paper was presented to the Royal Society on 13 November 1673 and, five days later, Oldenburg enthusiastically described the reception of the work:

> Yr curious papers and elegant figures I produced before the R. Society, where being read and beheld wth applause ... I was commanded to return you the hearty thanks of ye Company for yr constant and unwearied communications, and particularly for this excellent account of Plant-like figur'd Stones; of wch kind Mr Hook told us, he had many in ye Societies Repository ...[17]

'A Description of certain Stones figured like Plants, and by some observing-men esteemed to be Plants to be petrified', the first illustrated paper on fossils to appear in the *Philosophical Transactions* (9 February 1673/4), reveals much about Lister's fieldwork techniques and the co-operative approach towards contemporary science. The Craven region, underlain by fossil-bearing Carboniferous Limestone 340 million years old, had proved the major source for Lister's samples. Through observation and fieldwork, and the diligence of his virtuosi friends, he had obtained a number of fossils from scars in Broughton and Stock, hamlets near Skipton. He had also been sent samples from the Carboniferous Limestone area of Derbyshire;

and from a quarry near Wansford Bridge in Northamptonshire, an area of Middle Jurassic Limestone 150 million years old. Subsequent to submitting the paper, Lister had received fossils from Bugthorpe (or Buckthorpe) in the Yorkshire Wolds, an area underlain by glacial boulder clay containing fossils of many different ages.[18] Probably to compare his findings, Lister urged Oldenburg, on 7 January 1673/4, to send him a copy of an illustrated book on fossils, Friedrich Lachmund's, *Admirondorum fossilium quae in tractu Hildesheimensi reperiuntur, descriptio iconibus illustrata.*[19]

Collaboration under strain

In 1673 Lister sent a draft paper on snails to Oldenburg, advising him that he intended to 'compleat yt subject' and 'if you please to remitt me ye Table & letter of Snailes, I will amend it, & return it you for your further disposal'.[20] On 3 October 1673 Oldenburg replied that he was returning the original draft on snails 'for yr enlargement'.[21]

During the summer and autumn of 1673 Lodge had drawn samples of snails sent from Lister's cabinet in York. On 23 October, he confirmed that he had 'followed the method you sent me in the small boxes beginning of last summer every box containing a severall species'.[22] Finding that 'there was 3 boxes a-wanting', and that Lister had not sent 'all the species', he rearranged the selection and the numbering making use ' ... of some of my former designs in my book', and assuring that 'I have imitated the snailes to the best of my skill'.

Lister was also preparing a further illustrated communication on fossils, notably on astroites or star-stones, colonies of fossil coral composed mainly of calcium carbonate. Publication was delayed because the interests of Lodge prevented speedy completion of the illustrations; and Lister was soon to find that reliance on an amateur draughtsman of independent means, with a penchant for travel, had its drawbacks. On 23 October 1673 Lodge excused his tardiness, 'the reason why I delayed sending you these designs was occasioned by some business which drove me towards Leeds'.[23] During the following months, Lister's frustration grew. On 1 December 1673 he informed Oldenburg that:

> I have some Notes concerning ye *Astroites* wch you had had ere this, but yt I have not yet received ye figures, tho long expected by me from ye same hand.[24]

Eight days later, he further apologized for not sending the revised paper on snails: 'I have nothing from my friend Mr Lodge wch will excuse my not sending ye Papers promised'.[25] Oldenburg urged Lister to submit the communication notwithstanding, 'because I would fain insert it in ye Transactions of this month ...'; and assured him that 'Yr notes concerning ye Astroites, when ever you can send ym, to be added to ye rest of ye figured stones, will be very acceptable.[26] On 19 December Lister set out the difficulties of his reliance on Lodge as illustrator:

> I am sorry I cannot satisfy your desires in sending you ye Paper of Snailes: it is long yt I have expected ym & some other things from Mr Lodge: but I feare it will be yet much longer, he being a person who is otherways employed & one yt I cannot hasten beyond his owne inclination & fancy & lives 40 miles off this place, soe yt I have but a slow correspondence with him ...[27]

Three weeks later he explained: 'Mr Lodge is very unmindfull of me & I have not yet heard from him, as soon as I doe you shall have ye Papers you desire ...'[28]

On 12 January 1674 Lodge acknowledged that neither of the commissions, the fossils or the snails, was finished:

> I am afraid I have tryed youre patience too much in not designing youre Astroites sooner, I have been much from home twas the reason ... I have not yet finished youre paper of snails, but will delay em no longeer ...[29]

Within days, Lodge had completed the drawings of fossils, and Lister was able to send his illustrated paper to Oldenburg, explaining: 'I have, by ye assistance of Mr *Lodge*, illustrated all these particulars wth *Figures* of which this is the Explication'.[30]

'Observations of the Astroites or Star-stones' was printed in *Philosophical Transactions* Number 112 (1674). Unlike the fossils previously described by Lister and illustrated by Lodge, and found principally in the Craven region of the

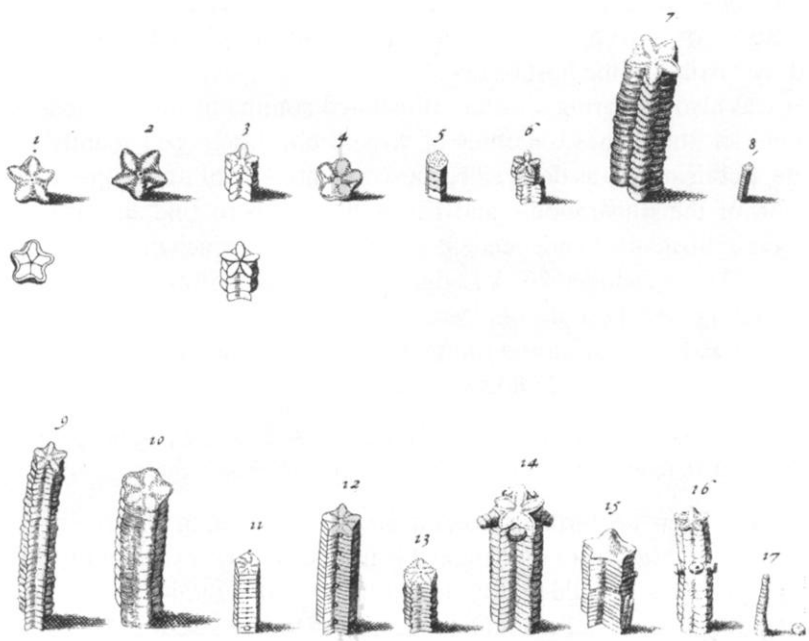

FIGURE 1. Illustration by William Lodge to accompany Martin Lister's communication 'Observations of the Astroites or Star-stones' Royal Society MS. L5, No. 67.

Pennines, the new paper focused on pentacrinoids (*Pentacrinites fossilis*), which were abundant in the Lower Jurassic rock of the Yorkshire Wolds, which is exposed in the clay banks of Bugthorpe Beck. Lister had seen such fossils 'dugg out of a certain *blew clay* on ye bankes of a small Rivulet, betwixt ye Towne & ye foot of ye Wooldes (*sic*).[31] Samples, for example stem ossicles, had been brought to Lister from Bugthorpe and Leppington, two hamlets about 14 miles north east of York. Lodge's illustrations[17] were designed to show the astroites from a number of angles and to bring out the differences in size, for example by placing the largest sample next to the smallest, and these being juxtaposed by 'the longest Peice' (figure 1). Lister's explanatory tables highlighted the observed similarities and differences in the illustrations.

By October 1673 it was clear that Lodge's modifications to the ordering of the snail illustrations did not satisfy Lister:

> I am sorry the snailes differ from youre method, but if you please to give me your method more exactly I shall not be much of my labour to design em over agen ...[32]

Lodge finally completed his commission on the snails, and on 2 February, almost three months after his promise to redesign the illustrations, advised Lister that: 'I have by the bearer ... sent you the paper of Snailes, they may be are not so well as you could have wished em, but my endeavours were never the lesse ...[33]

Six weeks later Lister sent the illustrated figures, together with his revised paper on snails, to the editor of the *Philosophical Transactions*, assuring him that he had corrected the original draft 'wth as much care & exactnesse, as I could'. In the preamble to the paper, Lister noted that:

> You will receive ye first part of our Tables of Snails & some Queries upon ye same subject; also ye lively figure of each shell for illustration, done by Mr Lodge.[34]

Lister's intention to produce a full-scale study and classification of snails, sea shells and shell-stones was delayed by his professional duties. Thus, by March 1674, only the work on land and fresh-water snails was in a sufficiently forward state to warrant publication:

> You had received ye 2 other parts of ye Tables, if this wett summer, & a raging Epidemic distemper in this Cittie (ye small Pox) had not wholly taken up my time & diverted me from my purpos of visiting some noted places of our sea Coasts.[35]

On 31 March 1674 Oldenburg acknowledged:

> yr generous and enriched return of yr Table and Inquiries of Snailes, we are much obliged to you, as we are likewise to Mr Lodge for ye neat figures. And you are afresh to be thanked for all in ye name of ye R. S...[36]

Although Oldenburg favoured speedy publication for the 'knowledge of to ye philosophical and curious world', he was prepared to delay the dissemination of

work which authors considered incomplete: 'I suppose, you will not have yr business of Snailes publick till it be finish't; wch maketh me forbear till you shall please to direct me in it'.[37] However, Lister justified early publication, believing that the opportunity to read even part of his work on snails would provide encouragement for others:

> Thus much of ye designe I know, will incite others, yt injoy more leisure than my selfe, to be doing upon ye like arguments. And, indeed, I cannot say when ye rest will be fit to publish; though I neglect noe oportunity to store my selfe with materials from all parts, but it may be very long before they be fit to see ye light.[38]

On 11 July 1674, after the paper had already gone to press, Oldenburg wrote urgently to Lister:

> Reading over again yr Tables of Snailes in order to print ym this month, I find, yt in the Figures of ym there are wanting No. 14, 15, 16, viz *Limax cinereus maximus, Limax cinereus alter*, and *Limax ater*. I pray let me know wth all possible speed, whether it be an oversight, or not; and if it be, be pleased to supply this defect, if conveniently you can, by ye first post, yt ye Graver, who hath undertaken to grave the rest, may not be stopped too long from finishing ye plate. The defect is most certain, and I doubt not of yr favor of supplying it...[39]

The oversight came too late to be rectified and, although Lister attempted to retrieve the 'missing' drawings from Lodge, the illustrated paper on snails, finally published in *Philosophical Transactions* Number 105 (20 July 1674) included 24 paired samples of snails' shells numbered 1 to 13 and 17 to 27 [40] (figure 2). The numbered figures were described and explained in the tables, a careful integration of text and 'the lively figure of each Shell for illustration, done by Mr Lodge'. The paper also revealed something of Lister's approach to scientific observation, 'I choose this methode, as ye most convincing, viz to give a comparative view'.[41]

The protracted delays in finishing the illustrations, the omission of three figures in the published paper and the errors in numbering were not the only matters of dissent between scientist and illustrator in 1674. Lodge was dissatisfied with the quality of the engraved illustration of the snails in *Philosophical Transactions*, and since the illustrated paper on astroites had not yet been published, he sought to retrieve the situation:

> If I knew how to come to the design of ye Astroites, I had rather transfer em on to copper then Any other; I saw the snayles in the Last P. Transactions they are indifferently done.[42]

Oldenburg seems to have recognized that it might prove beneficial if Lodge carried out the engraving work, observing to Lister (24 October 1674) that he would 'endevour to find out Mr Lodge, and be glad he may grave the Astroites himself'.[43]

Illustrations, possibly by Lodge, accompanied Lister's paper describing 'an odd figured Iris', published in *Philosophical Transactions* Number 110.[44] Doubts in

FIGURE 2. Illustrations by William Lodge, to accompany Martin Lister's communication on snails. Royal Society MS. L5, No. 70.

attribution of the five figures arise partly from the style of numbering (although this can be accounted for by the employment of a different engraver) and the depiction of shadows. In Lister's papers on fossils and astroites (the latter finally appearing in Number 112 of 25 March 1675) the source of light is from the left with shadows shown cast to the right of the samples – suggestive of a right-handed artist.[45] In contrast, the source of light for the paper on the 'Iris' is from the right with shadows cast to the left of the samples. In other respects however the approach accords with that of Lodge, particularly in the 'prospect-wise' method, although such techniques were widely employed in the later seventeenth century.

There must be more doubt in relation to the drawing which accompanied Lister's communication on 'odd worms vomitted by children',[46] a small illustration squeezed on the border of a large fold-out in which the principal illustration related to a communication on a very different subject, a combination of visuals which was not untypical of the *Philosophical Transactions* during the editorship of Henry Oldenburg.

Lister's cabinet

A feature of contemporary science in the seventeenth century was the 'repository' or 'cabinet', and the Royal Society took considerable interest in the location and contents of such collections, Oldenburg recognizing that:

> Many such collections, in all parts of ye world, made by judicious and diligent men, will at length make up such a store-house, as our Society designeth for an Universal History of Nature ...[47]

When the Royal Society's 'Repository', the first institutional museum in England, was catalogued in 1681, it incorporated the natural world of plants and animals, fossils and minerals, and the contemporary 'artificials' of ingenious virtuosi including Wren's beehive, Hooke's cider-press and Newton's first reflecting telescope.[48] Lister contributed several items to the collection, whilst retaining his own cabinet in York.

The observation of similarities and differences was an essential stage in a scientific rationale, and Lister's cabinet provided a basis for his work on molluscs and shells, making it possible 'to find likenesse and unlikenesse of things upon a suddaine'. Lister was interested in the geological formation of Yorkshire – the fossil-bearing scars in Craven, the ironstone quarries at Adderton; the sulphur wells at Knaresborough, the curious 'subterranean trees' in the Isle of Axholme and Hatfield Chace; and the alum mines on the coast north of Scarborough:

> I keep by me certain large pieces of crude alum-mines, such as they were taken out of the rock. I had also in the same cabinet like pieces of the ordinary fire stone or marcasite of the coal-pits...[49]

The virtuosi of the York circle were avid collectors, and presented one another with

samples for their cabinets, sometimes mere 'curiosities' but often of scientific value. Whilst preparing illustrations for Lister's communications, Lodge was also supplying him with samples, including fossils and mineral ores from the Craven area, and from the neighbouring parts of Lancashire: 'tomorrow I am for Cledero (Clitheroe) to make a search for stones as likewise at Rainsbrough-Scarr you shall have your box full of both sorts next week ...'[50] However, a few weeks later he wrote:

> I was misinformed concerning the stones at Rainsbrough, I made a diligent search and found nothing but a sort of Shining Agate like Stone (which I suppose to be rock Crystall).[51]

Lodge forwarded the sample together with other fossils found at Clitheroe including 'one of the longest Entrochi I have seen, about halfe an inch broke accidentally off in my hand'. He informed Lister, 'I will be curious to observe any variety that you have not already, and give you an account without any delay'.

In addition to his interest in molluscs, fossils and mineralogy, Lister was a pioneer in the classification of spiders. It was his paper on the cause of gossamer, and the subsequent controversy that it aroused, that had first brought him to the attention of the Royal Society. During the 1670s Lister was working on descriptions or 'histories' of spiders based *ex moribus et vita*, which included exemplary accounts of the eye arrangements in each group and a wide range of other characteristics. From time to time, Lister's virtuosi friends would send him specimens of spiders encountered on their travels.[52] In the late spring and summer of 1674, Lodge undertook a 'northern journey' – Midlam, Penrith, Carlisle, Newcastle, Durham, Whitby, Scarborough – during the course of which he forwarded samples and specimens for Lister's cabinet in York. Whilst at Midlam he found, in an old stone wall, four varieties of spiders which he labelled A–D and sent to Lister with an accompanying written description of their colours.[53] Lodge had compared the four specimens against Lister's 'catalogue' of spiders; and also described how he had found an 'egg bag' of one of the varieties. Drawings of the 'finds' were forwarded to Lister in York.

Between August 1674 and the Spring of 1675 Lodge was in London where, at Lister's behest, he visited a number of collections professing 'I love Curiosities'. Together with Captain T. Fisher, 'an ingenious and curious Gentleman', he visited the 'closet of curiosities' of Captain Hicks on 5 February 1675.[54] Hicks agreed that Lodge might 'take a draught of anything in his closett', and the artist took the opportunity to illustrate his description of the collection with marginal sketches of fossils, curious stones and even a humming bird (figure 3).[55] The inspection of Hicks's collection commenced with flint stones and petrified shells, two samples of which were given to Lodge, who forwarded them to Lister 'in a white cloth within the Canvas bagg of Ore'. He also forwarded 'Severall Capp stones included like the rest in flint', together with 'a peice of a curious wrought shell'. He observed and sketched 'severall flints of fruit like stones' and 'severall Hart stones included like

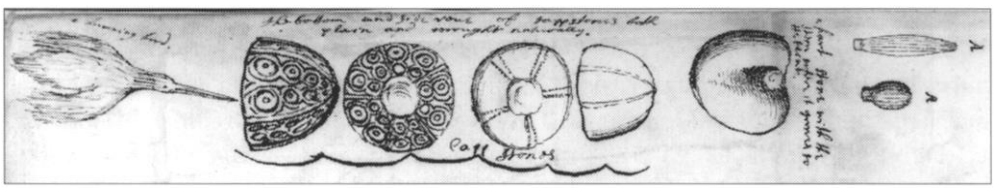

FIGURE 3. Drawing by William Lodge of a humming bird enclosed in his letter to Martin Lister 6 February 1674/5. The Bodleian Library, Oxford MS. Lister 34 fol. 151r.

the rest in flint of which there is no pattern but by design on the margin'. At the end of the visit, Hicks revealed the most exotic parts of his collection:

> divers strang habits, and weapons used in the East and West Indies and other remote parts, sharks, Aligators, Ratle snakes from a ratle in theire tail, which gives the inhabitants notice to stand cleare, strange jaw-bones and skins of creatures, humming birds, they are not so bigg as a wren the colour of Mallards neck they have a long small beak which they thrust into flowers, feeding there like bees.[56]

Lister further instructed Lodge, who made a second visit to Hicks's collection and forwarded further samples to York 'as ye Capt could spare and would come att a moderate price'.[57]

Whilst in London, Lodge also served Lister as an intermediary in arranging for the receipt and despatch to York of samples of mineral ores, advising: 'if any parcells of Tinn Ore &c Com to me I shall take care to convey em to you at York ...'[58] Writing on 3 October, he informed Lister: 'there came lately to my hands some ores out of Sussex. I have according to youre order sent em down, by one William Pell a Carrier'.

Lister was also interested in samples of tin ore from Cornwall. His old associate, John Ray, made contact with Henry Bedford of Falmouth, who sent the samples to Lodge in London.[59] On 6 February 1675 Lodge advised Lister that 'there came last week a parcell of Oares out of Cornwall', and that he would deliver the parcel to the York carrier. Lodge had also sent to the correspondent at Falmouth, 'the catalogue of those things in the tinn mines, which you want'.[60] In February 1675 John Brooke, a member of the York virtuosi circle, advised Lister that Lodge would shortly be despatching from London 'some unpolish'd Loadstones'.[61] Shortly afterwards, Lodge enquired 'whether the Loadstones I sent be to youre desire, the litle diamonds on(e) the outside are so hard they will cutt Glass'.[62]

During the 1670s, using information from a number of correspondents, Lister compiled 'Methode for the Historie of Iron' and part of the treatise was later published in *Philosophical Transactions* (1693). He may have had expectations of 'mineral adventure' on his estate at Carleton near Skipton, having confided to John Ray his 'great hopes of considerable mines in my own lordship'.[63]

ARACHNOLOGY

During the 1670s Lister was engaged on natural history more widely, particularly with spiders and snails. In the summer of 1674, he was negotiating with Lodge over the visual representation of spiders, whose 'history' was to constitute the first tract of a proposed book. Lodge was engaged not only in drawing the spiders, both directly from specimens and from other sources, but also in producing the engravings. Given previous misunderstandings over scientific illustrations, Lodge was anxious that the instructions to which he was to work should be precise:

> I perceive you are resolved of the size and method for ye Generall plate, I desire you will pitch upon the sizes of the particular plates ... I will send you a tryall of a particular plate and have your approbation before we go to farr ...

Confident that if he could complete one of the plates to Lister's satisfaction, he would have little difficulty in completing all of them, Lodge requested information about the size of illustrations for the particular species of spiders: 'I desire you will give me an accompt in youre next of the full bigness that each sort will arrive to ...' He also detailed his own ideas about the most appropriate representation of some of the spiders' features:

> I would have 3 plates larger than the rest to express the manner of the Nests ... or to show them sitting in the midle of the nest as some doe ...

On the reverse side of the letter, Lodge set down sketches of two sizes of diagrams:

> ... this size in my opinion will serve for each particular history and room enough to express the order of the eye, and manner of the Egg Bagg ... This size will serve when there is occasion to represent the rest ...[64] (figure 4).

Six weeks later he reported only limited progress:

> I have done some of the Spiders but I am afraid there are some of the small ones which I can hardly represent so well on the copper as they are drawn with the pen ...[65]

In early January 1675, he again reported slow progress, although he had completed one plate and was able to run offprints. He was also in contact with another northern artist working in London, Francis Place:

> I have been already with Mr Place, I feare not but to doo the spiders on copper, I have done the oak leafe already which comes off well, and in a larger plate then ordinary because of his different sort of nest which I bring in, when I have done a few more I will send em to have youre approbation...[66]

A month later, Lodge sent Lister 'a proofe of the Oake leafe' with an assurance that 'now that the days grow longer I hope I shall dispatch the rest to youre liking'[67]

Despite the frustrations and difficulties, the two men remained on good terms,

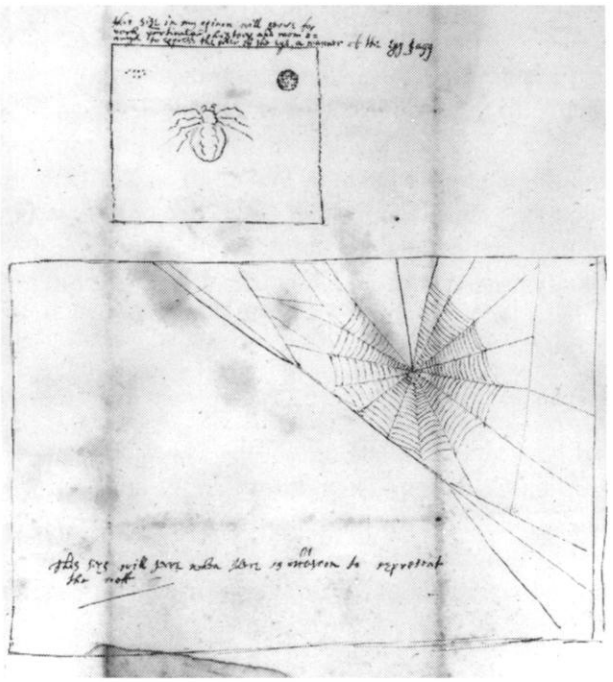

FIGURE 4. Drawing by William Lodge of spiders and webs enclosed in his letter 21 August 1674. The Bodleian Library, Oxford MS. Lister 34 fol. 170r.

Lodge thanking Lister 'for youre kind invitation to York' and apolologizing 'for my remissness in makeing my acknowledgements to so good a freind (*sic*)'. Planning to stay in the northern capital in the summer of 1675 'to finish my plate of York' he insisted: 'I shall take a room or two for etching is to(o) slovenly an employment in a friends house.'[68]

When *Historiae animalium Angliae tres tractatus* was published, Lister addressed prefatory remarks 'To the Reader', which set out the relationship between scientist and illustrator, and also his views on the difference between 'old' and 'new' ways of making a visual record of minute observations:

> ... I have made sure that practically all the drawings of the animals were carried out in my presence. My aim was to see that the excellent artist did not merely (as is often the case) express his own personal conception. To facilitate this I first of all indicated with my finger the characteristics of each species that I most particularly wished to have depicted... Now we ask ourselves not what would make a more pleasant picture as regards the animal's shape or position, but what drawing resembles the living animal most closely and would more readily and accurately be recognized by other people...

The remarks suggest that the two men were in close physical proximity when working on the book, and that this occurred, perhaps, in the summer of 1675 or even 1676:

> some time ago I had a suitable period of leisure at my disposal and betook myself to

> Lincolnshire, where I spent not merely hours, or even days, but whole months exclusively in an examination of these tiny little creatures. During the following winter I reviewed my descriptions of them.[69]

A recent study has suggested that Lister had spent this period at the Burwell home of his late great-uncle, Sir Matthew Lister.[70]

The completion of the manuscript did not end Lister's difficulties with his first book. He was unfamiliar with the practices of the London booksellers and of the Royal Society's printer, from whom he had expected professional expertise to see the work through. In his last letter to Oldenburg, 15 September 1677 (despatched unknowing of Oldenburg's death), he sought advice both on the means of publication and printing, and on the illustrations:

> yt you will take care of ye Edition of 3 Tracts of Natural Historie, wch I have by me, and wch I shall readily put into your hands ... I know not how Mr Martin is to be dealt with in this kind, or what other Booksellers there are yt may be more reasonably treated with ...

Concerned at the trouble and expense occasioned by the engravings, it appears that the association with Lodge had not been entirely to Lister's satisfaction:

> There are 5 plates of Designs wch belong to ym (*the 3 tracts*), and wch have stood me in great cost to perfect ym. Soe yt I should be glad, if I could gett ym well transferred upon copper, without more charges to my selfe...[71]

When Lister's *Historiae animalium Angliae tres tractatus* was published in London in 1678, it was under the imprimatur of the Royal Society and printed by the Society's printer, John Martyn. The first tract or essay was on spiders; the second on land and freshwater snails; and the third on sea-snails or molluscs.[72]

Changing illustrators

At least one authority subsequently attributed the engravings that accompanied *Historiae animalium Angliae tres tractatus* partly to Francis Place.[73] By 1675 Lodge was already in contact with Place, perhaps at Lister's request, as a possible illustrator for Lister's scientific works. Like Lodge, Francis Place (1647–1728) came from a family of some property and was intended for the legal profession (Gray's Inn), but he developed a strong inclination for drawing, painting and etching.[74] In 1669 Place was involved in the commission for a number of the plates on topography and plant life which illustrated the English edition of Jan Nieuhof's *Embassy ... to the ... Emperor of China* (London 1669), a popular travel book on China.[75] In 1675, Place and Lodge drew a series of views or 'prospects' of York; and in the following years were to establish a close working and social relationship. A versatile artist of independent means, Place was to attain national renown in his own right and by the mid-1670s was becoming well known in the circles of the literati and virtuosi. For example, in 1676 he was commissioned to produce a series

of etchings of the recently founded Royal Observatory in Greenwich.[76]

When John White, a London printer, moved to York (*ca.* 1680) Lister was one of his earliest patrons. In 1681 White printed a new edition of *Historiae animalium Angliae tres tractatus* which included a fourth tract on the subject of fossil shells, and which had a separate preface. The additional section had a separate title page, pagination and register and was illustrated with nine plates engraved by Place.[77]

Lister and Place had similar interests and moved in similar circles of society; a later commentator noting that 'one was as enthusiastic in his love of art, as the other in the pursuit of natural science'.[78] In 1681, encouraged by Thomas Kirke (who assisted in the final transcription and draft), Lister was completing an English 'methodized' and annotated edition of *Johannes Godartius of Insects*, and commissioned Place to illustrate the work. The illustrations were shown to the Royal Society when Lister, Place and Kirke passed through London on the way to the continent.[79] The *Godartius*, which Lister had originally begun to translate and draft in the early 1670s, was printed in York by John White. It was illustrated with 14 plates with 144 compartments of figures (as in a 'cabinet') etched upon copper from drawings of insects represented in every stage of transformation (figure 5). The importance of the quality of the illustrations by Place was acknowledged by Lister:

> that Naturall History is much injured, through the little incouragement, which is given to the Artist, whose Noble performances can never be enough rewarded; being not only necessary, but the very beauty, and life of this kind of learning

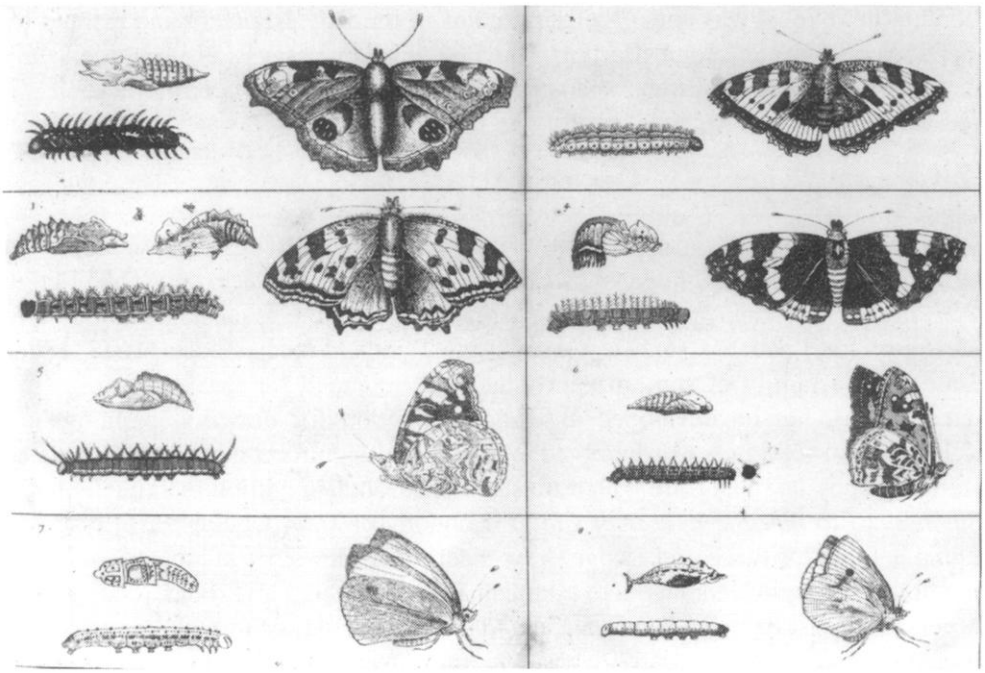

FIGURE 5. Illustration by Francis Place in *Johannes Godartius of Insects* (York, 1682)

Lister had 'taken great care of the Designes, in transferring them upon Copper Plates; which I dare promise are Exquisitely performed, by the best of our English Artists...' He noted the reluctance of the publishing world to bear the costs of the illustrations, the engravings being at 'my expense'; and that 'the Book-sellers were not willing to Reimburse me, so that this Impression consists but of a 150 Coppys, which were intended only for the curious ...'[80]

The advantages of close proximity between illustrator and scientist is demonstrated in the note accompanying the communication which Lister submitted for publication in March 1681/2 in Hooke's *Philosophical Collections* 'An account of a very strange and rare case in Physick, together with the description of a monstrous Animal cast out of the Stomach by Vomit ...':

> I send you (here inclosed) the true and exact shape of a Worm, which a man Vomited up here the last week ... curiously and regularly shaped in all its members, as is fully exprest by the pains of a most excellent Artist, who Limned it by the thing itself, not two hours after I had it under my eye, that nothing might be added, but what was very true and natural.[81]

Some confusion surrounds the attribution of the illustrations which accompanied Lister's communications on antiquities in the Royal Society's journal. Unaware of Oldenburg's death on 5 September 1677, Lister forwarded a paper (15 September 1677) – in the form of a letter – relating to Roman antiquities, and to inscriptions on funerary urns. More than four years later it was published in Number 4 of *Philosophical Collections* (1682) but now in the form of a letter from Lister to Hooke.[82] After the resumption, in 1683, of the publication of the *Philosophical Transactions* the names of the draughtsmen and engravers were often inscribed on the illustrated pages of the journal. For example, Number 149 (10 July 1683) included a communication by the 'judicious' Martin Lister entitled 'Some Observations upon the Ruins of a piece of a Roman Wall and Multangular Tower at York' and an accompanying fold-out illustration engraved by 'J. Savage *sculp.*'. Although there was no acknowledgement to the original graphic artist, it has been attributed to William Lodge. When the Leeds diarist and topographer, Ralph Thoresby, drew up brief biographical notes on William Lodge and listed his principal works he noted 'The Tables of *Entrochi* and *Astroites*, the *Multangular Tower* and *Roman Wall* inserted in the *Phil. Trans.*'[83] Yet it is possible that the multangular tower and Roman wall illustration may have been the work of Francis Place for, in writing to Ralph Thoresby in 1698, Lister referred to the drawing and the written communication:

> ... I cannot tell you the particular number (i.e. of *Philosophical Transactions*) in which that Roman building is, but it was printed about fourteen years ago, and the drawing was done by Mr Francis Place ...[84]

It must be acknowledged, however, that Lister was writing without access to the periodical, and had earlier (1696) acknowledged to Thoresby the failings of his memory, 'I grow into years, and can mind but few things'.[85] Attribution is made more difficult because, in the 1670s, both William Lodge and Francis Place

produced prospects of York; while Lodge's etching 'The Ancient and Loyall Citty of York' is based as much on Place's sketches as on his own.[86]

Whilst the direct association between Lister and his first illustrator may have ceased by the mid 1670s, contemporary and quasi-contemporary accounts suggest that Lodge and Place remained companions between whom there was 'a strict friendship' on a number of protracted sketching and sporting excursions to Scotland (*ca.* 1677) and Wales (*ca.* 1680). In the later 1670s, Lodge might have welcomed 'release' from the demands of producing scientific illustrations for Lister's work, for he was engaged in an illustrated book of his own, an Englished version of Giacomo Barri's *Viaggio Pittoresco*. The translation, published in 1679 under the title of *The Painter's Voyage of Italy*, included etchings by Lodge (*Ins et fecit*) of the most renowned Italian masters, together with miniature 'prospects' of their associated Italian cities.

Lister played an important role in the early history of the Ashmolean Museum: he was, after Ashmole, its most important benefactor. In September 1682 Robert Plot, who was seeking to build up the collection for the Ashmolean Museum in Oxford, wrote to Lister enquiring after an altar stone which Lister had promised to send and requesting whatever else could be spared 'toward the better furniture of my poor cabinet'.[87] Largely because of his donations of Roman altars, coins and other antiquities, Lister received an honorary MD from Oxford in 1684. Shortly afterwards, he moved to London, where he enjoyed a distinguished medical career.

One aspect of Lister's association with Lodge and Place may have been to foster the artistic skills and development of Lister's family. A recent study has suggested that William Lodge may well have encouraged the talents of Lister's wife Hannah and perhaps those of his eldest daughter Susanna.[88] Yet given the family chronology and Lodge's urge to travel, it seems just as likely that instruction also came from Francis Place. What is known is that, after the removal of the family to London, Hannah and Susanna worked together on the illustrations of Lister's scientific works. For example, the meticulous drawings for Lister's systematic *Historiae... Conchyliorum* (1685–92), which comprised about 1000 plates of shells but almost no text, were produced largely by Lister's new amateur illustrators.[89]

Conclusion

Martin Lister is sometimes criticized for being somewhat credulous and conservative, and it has often been pointed out that his views on fossils were reactionary, since he regarded them for the most part as merely curiously-shaped stones or freaks of nature which had 'no parts of a different texture from the rock or quarry whence they are taken' and 'never were any part of an animal'.[90] Sterner critics have suggested that, in adversely commenting on the concepts of Steno, Lister set back their acceptance by almost a century.[91] Yet Lister was not alone in remaining committed to the view that, in general, fossils did not represent real plants or animals that had once lived on the Earth. At the same time he realized that

there might be exceptions, and he is acknowledged as a naturalist who did important work in attempting a rational classification of fossil remains.[92] The ammonite illustration in Lister's *Historiae animalium Angliae* ... is perhaps the earliest published figure of an ammonoid giving sufficient detail for it to be identified.[93]

In other respects, Lister was ahead of his time. Of greatest significance, in the long term, was his advocacy of a new kind of visual representation, a geological map. When his 'Proposal for a new Sort of Maps of Counties, with Tables of Sands and Clays, such chiefly as are found in the North Parts of England' was presented to the Royal Society in March 1684, it was recorded that this was 'drawn up about Ten Years since' and that Yorkshire was cited as a particular example.[94] This was, perhaps, the first proposal for the preparation of a national geological survey, a soil or mineral map of England.[95] Lister's suggestion of a kind of stratigraphic or geological map of England, distinguishing the soils and their boundaries by colours, was published in *Philosophical Transactions*, but was never carried out in his time.[96] Subsequently, in the nineteenth century, Sir Charles Lyell acknowledged that Martin Lister was the first to be aware of the continuity over large districts of the principal groups of strata in the British series.[97]

Despite Lister's many accomplishments in several different scientific fields, there is a strong impression that his scientific interests, though followed enthusiastically at times, were secondary to his medical career. In London between 1683 and 1712, with his busy practice, and later being physician to Queen Anne, Lister had few opportunities for empirical scientific observation, and he came to rely increasingly on written and secondary authorities. On the other hand, his years in York (1670–83) are recognized as significant for his practical fieldwork and his growing recognition of the important contribution which well-designed and accurate two-dimensional draughtsmanship, etching and engraving could make to the observation, recording, understanding and dissemination of science. In recent years a start has been made to rehabilitate Lister, who is now becoming recognized as one of the outstanding zoologists of the later seventeenth century; and the first part of *Historiae animalium Angliae* ... justifies Lister's right to be regarded as the founder of modern arachnology.[98]

In the seventeenth century, when art and science were closely linked, illustrators such as William Lodge, who died unmarried in Leeds in 1689 at the age of 40, and Francis Place, both of whom worked mainly on topographical 'prospects' and engravings of portraits of illustrious personages (living and dead), could make a valuable contribution to the development of science, a factor clearly recognized by the Royal Society. The high quality of the scientific illustrations which accompanied Martin Lister's communications and books was acknowledged by contemporaries; as witnessed in the plaudits recorded at a meeting of the Royal Society; or in the praise of individual Fellows.[99] Later authorities have also commented on the increasing use and sophistication of scientific illustration, for example the improvement in fossil identification through high quality and exact drawings and engravings, seen in Hooke's *Micrographia* (1665) and the illustrated papers of Martin Lister in

Philosophical Transactions in 1674–75.[100] A detailed study of the association between the scientist, Martin Lister, and his illustrators reveals something of the trials and rewards arising from the visual representation of science.

Acknowledgements

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Figures 3 and 4 are photographs of Lister manuscripts (MS. Lister 34, fols 151r and 170r) kindly supplied by the Bodleian Library and reproduced with their permission.

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