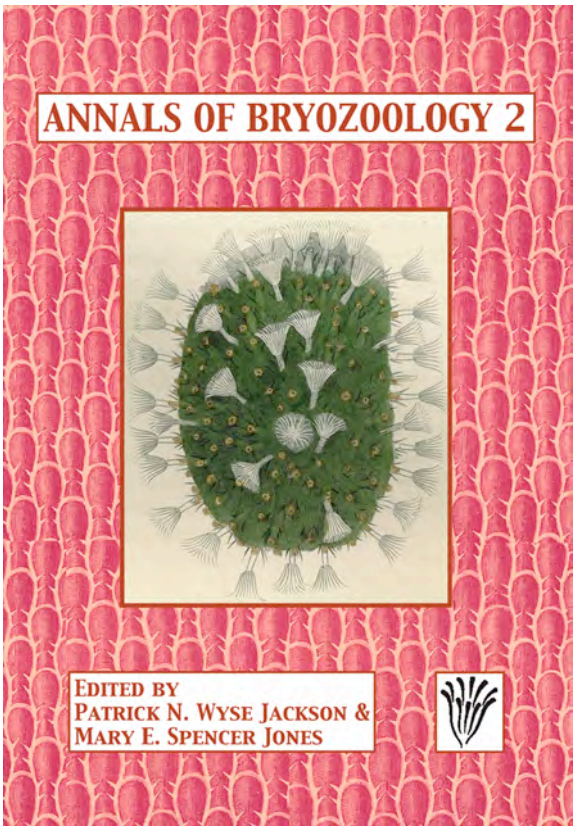

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One name, two species: the history behind the Linnean Zoophyte, *Alcyonium gelatinosum*

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1. Introduction

The Zoophyte binomen *Alcyonium gelatinosum* was introduced by Linnaeus in the 2nd edition of *Fauna Suecica* published in 1761[1] as: "*Alcyonium gelatinosum* informe gelatinosum. Habitat in Oceano, supra Fucos" (i.e. encrusting upon *Fucus*). Later, in the 12th edition of *Systema Naturae*,[2] he incorporated the erect "Sea ragged Staff" of Ellis[3] and earlier British authors[4] into the scope of his Swedish *A. gelatinosum*, adding the critical word '*polymorphum*' to the species diagnosis (i.e. as *A. polymorphum gelatinosum*). While this demonstrates that Linnaeus recognized close internal similarities despite different colony forms (indicative of species)—now regarded as bryozoan congeners and referred to *Alcyonidium* Lamouroux, 1813[5]—his action led to the long-persisting nomenclatural anomaly, that Thorpe and Winston[6] identified and attempted to correct. Their solution, however, proved partially flawed.[7] In this paper we elaborate and extend some aspects of both pairs of authors' accounts, which are relevant to the history and characterization of the two *Alcyonidium* species involved.

2. *Alcyonium gelatinosum* Linnaeus, 1761: 'Habitat ... supra Fucos'

When Linnaeus compiled the 10th edition of *Systema Naturae*,[8] he was able to base his listings of "Zoophytes" almost entirely on the detailed work of Ellis[3] in the *Natural History of the Corallines*.[9-10] Such was the quality of Ellis' plates that there is rarely doubt

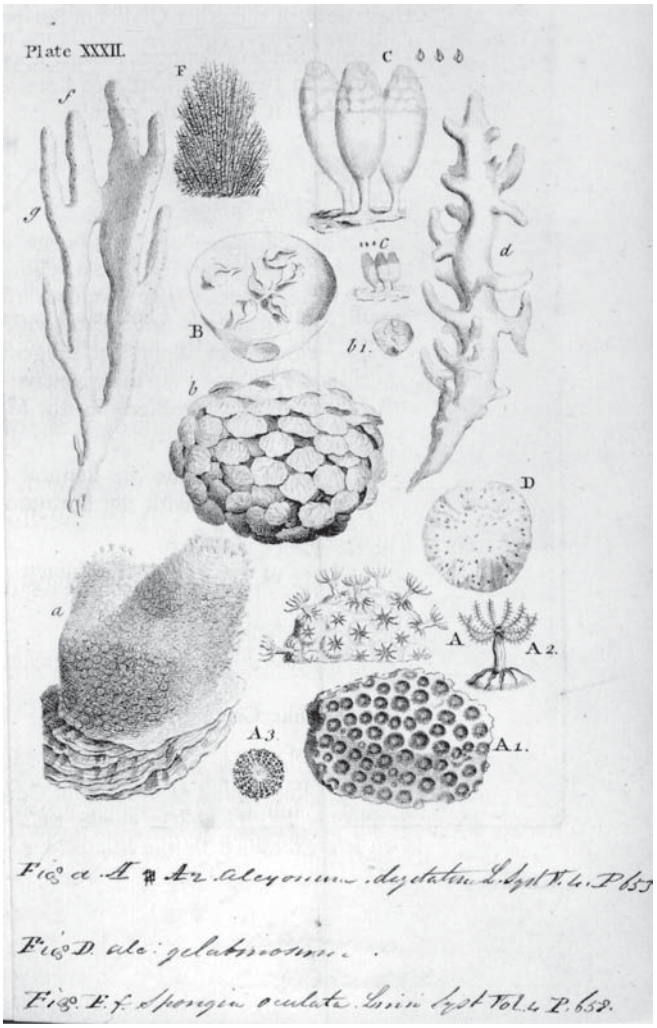


Figure 1. Plate XXXII d, D from Ellis 1755.[3] The drawing is labelled as Fig D Alc. gelatinosum and it can be clearly seen that this is definitely the erect taxon, and not the encrusting taxon also called Alc. gelatinosum by Linnaeus (1761).[1]

about the identity of Linnaeus' species. However, presumably because he knew no English and relied on the plates alone,[10] Linnaeus missed the "Sea ragged Staff"—known today as *Alcyonidium diaphanum*—which Ellis (1755, Pl. XXXII d, D)[3] had confusingly placed among gastropod egg cases (see Figure 1).

Alcyonidium gelatinosum (as *Alcyonium*), clearly not the "Sea ragged Staff" but a quite different species with which Linnaeus had become familiar, was introduced some years later in the 2nd edition of *Fauna Suecica*[1] as: "*Alcyonium gelatinosum* informe gelatinosum. Habitat in Oceano, supra Fucos, frequens" accompanied by a brief description. Later still, as just noted, in the 12th edition of *Systema Naturae*, Linnaeus[2] incorporated Ellis'[3] British

"Sea ragged Staff" into his Swedish *A. gelatinosum*. This was evidently a considered move, uniting two species of similar internal morphology but differing external appearance, as the opening diagnosis: '*A[lcyonium] polymorphum gelatinosum*' makes clear. The first cited reference is to *Fauna Suecica*, confirming the already introduced name; the second is to Ellis' *History of the Corallines* (1755, p. 87, Pl. 32, fig. D)[3] — the 'Sea ragged Staff' of British authors — to which Linnaeus added '*Alcyonium ramosum molle*', making the distinction between the two absolutely clear. We will consider first the Swedish species which Linnaeus in 1761[1] recorded as "supra Fucos".

It is important to note that, in the account of *A. gelatinosum* in *Fauna Suecica*, there are no cited synonyms or references to earlier literature. The species is, therefore, genuinely new and found by Linnaeus on Swedish shores; it is not simply the provision of a binomen for a pre-existing description. The linked questions arising from the introduction of *A. gelatinosum* are (1) the identity, in terms of the nomenclature employed by later writers who attempted to discriminate species of *Alcyonidium*, especially in the century from Hincks in 1880[11] to Hayward in 1985,[12] of the Linnean species; and (2) the origin(s) of Linnaeus' specimens within Sweden. The first question, subject to the verification from collected specimens that we provide here, Ryland and Porter (cum syn.)[7] have already answered. The second, based on Linnaeus' own travels (and bearing in mind that the geographic limits of 18th century Sweden differed from those of today), we address here.

During the 17th and early 18th centuries, associated with the reigns of Gustavus Adolphus and (initially, prior to later disasters) Karl XII (after whom, indeed, Linnaeus was named), Sweden flourished and became a major European power. Besides the land shown on present day maps (and incorporating the present provinces of Bohuslän and Skåne (Figure 2), which were wrested from Denmark–Norway in 1658), Sweden controlled Finland, a small part of Russia boarding the Gulf of Finland, the Baltic States of Estonia and Livonia (northern Latvia), and extensive parts of the Baltic seaboard of the German states. The principal of these was much of Western Pomerania (Vorpommern), from Rostock to Stettin (now Szczecin, in Poland) on the River Oder, but other outliers included the city of Wismar and a sizeable enclave between (but excluding) the cities of Bremen and Hamburg. These territories were confirmed by the Treaty of Westphalia in 1658. Linnaeus was born in 1707. Toward the end of Karl XII's reign Sweden lost important battles and had to surrender territories (treaty 1728), keeping only Finland and part of Western Pomerania, comprising the coastline between Peenemünde (in the Stettiner Haff) and Warnemünde (seawards of Rostock) (Figure 2). With the exception of the part in what is now Germany, these territories border the very brackish Baltic Sea proper. No *Alcyonidium* survives in water of salinities less than ~10. At the surface this line lies roughly at the southern end of the Øresund, and from the eastern tip of Møn to the Darsser Ort (promontory) west of this area (Figure 2). While more saline water may extend eastwards into the Baltic along the sea bed away from the coastlines, these former Swedish territories (even on the Baltic coast of Germany) would seem to have no bearing on the source of Linnean *Alcyonidium*.

Linnaeus spent his first university year at Lund, in Skåne. While at Lund he collected

Figure 2. Linnaeus' Sweden. The map shows the main provinces (capitalized) of southern Sweden, Denmark, and Baltic Germany, including the area ruled by Sweden in Linnaeus' time. Towns and geographic features mentioned in the text, especially those relevant to the Västergötland and Skåne journeys, are indicated. Numbered broken lines in the southwestern Baltic show the approximate average positions of the 8 and 10 surface isohalines. Numbered solid circles (•) mark Danish localities at which verified Alcyonidium gelatinosum *was collected by the authors in December 2002 as follows: 1, Alholm, Isefjord and Kulhuse, Isefjord/Roskildefjord; 2, Kerteminde, Fyne Island, outer Kertinge Fjord; 3, Sprove village, Island of Møn; 4, Rødvig, south of Stevns Klint. Crosses (+) show approximate locations of records of encrusting Alcyonidium (under various specific names) from the literature (sources given by Ryland and Porter,[7] who discuss the specific identities).*

"marine plants" (including algae) at Malmö and Lomma, on the eastern shore of the Øresund[13] but, presumably, if he found any *Alcyonidium* on *Fucus* it went unrecorded. In 1728 he transferred to Uppsala, to the northwest of Stockholm (where shores, as just noted, lack *Alcyonidium*), with which he remained associated.[13-14] In 1735 he travelled to Holland, obtained an "instant" medical degree during a week at Harderwijk, and then moved to Leiden to study the subject! While there, much influenced by the philosophy of Aristotle's *Historia Animalia*[13] he compiled the small first edition of *Systema Naturae*. He spent August 1736 in England, but would not have known the slightly younger John Ellis (b. 1710)[15] at that time.

Returning to Sweden, Linnaeus practised medicine in Stockholm from 1738 until 1741, when he returned to Uppsala as professor with a remit covering medicine and natural history. In his hugely productive years at Uppsala he wrote an astonishing number of books including subsequent and ever larger editions of *Systema Naturae* (though several of the listed 'editions' were, in fact, straight reprints; the critically important 10th edition was actually the fourth revision, and the 12th, the fifth revision[2]), *Fauna Suecia*[1] and, of course, all the famous botanical works.

Linnaeus' various compilations required a continuing supply of specimens to describe. His own students—his 'apostles'[14]—of whom Daniel Solander was one, sent him material from various parts of the world. Solander was sent to England in response to a request from John Ellis, and with a letter of introduction to Ellis. He worked at the British Museum. He met Joseph Banks, whom he accompanied on Captain James Cook's first *Endeavour* voyage (1768–1771). Later, he completed Ellis' second book, the *Natural History of Zoophytes*[17] (p. 176), which was dedicated to Banks, though not with the same attention to detail that characterized Ellis' work.[9] The *Natural History of Zoophytes* contains descriptions of British and exotic bryozoans and cnidarians, including some from the *Endeavour* voyage. Among the bryozoans is *Alcyonium* (i.e. *Alcyonidium*) *gelatinosum*, but it is the 'Sea ragged Staff' from the earlier 1755 book of Ellis,[3] using the name applied to it by Linnaeus in the 12th edition of *Systema Naturae*[2]—the Ellis–Linnaeus connexion again—as distinct from the "supra Fucos" species of *Fauna Suecica*.[1] Indeed, the account refers solely to the 'Sea ragged Staff' (also referred to as Pudding Weed), establishing the tradition among British writers to apply the name *gelatinosum* exclusively to that species.[6]

For the local fauna and flora, on the other hand, Linnaeus made his own specimen collections on a series of travels, starting with the famous Lapland Journey in 1732.[14] His diaries record, in what was evidently a very lyrical prose style, intermittent observations on landscape, agricultural practices, geology and natural history. The plants and animals were recorded in the two editions of *Flora Suecica* (1745)[18] and *Fauna Suecica* (1761).[1] Marine specimens seem most likely to have been collected on either or both of the two journeys which incorporated sections of the Swedish west coast: Västergötland, which included part of Bohuslän (1746) and Skåne (1749), in the extreme southwest (Figure 2). This would be consistent with the listing of *Alcyonium gelatinosum* in the second edition of *Fauna Suecica*[1]—and his half-hearted acceptance of the animal nature of 'zoophytes'.[3] Unfortunately, English translations of these diaries have never been published, though

there is a manuscript, and a fine and copiously illustrated modern Swedish edition of the Skånska Resa.[19]

On the Västergötland journey,[16] from 12 June until 11 August 1746,[14] Linnaeus was accompanied by an amanuensis. They travelled via the southern side of Lake Vänern, reaching Gothenburg (Göteborg) on 9 July, and thence up the Bohuslän coast (see Figure 2). They sailed down-river from Kastellegården (Kungalv) on 15 July and out to Marstrand, visiting the Carlsten fortress. In the western harbour Linnaeus mentions 'Fucis, Ulvis, Algis', so they clearly visited the shore, though he wrote mainly about the skuas.[14] By 17 July they were at Svanesund on the island of Orust, a short boat trip from Stenungsund on the mainland. Linnaeus again mentions marine organisms. They reached Uddevalla on 18 July, then travelling inland to Trollhätten, returning to Uppsala via the northern shore of L. Vänern.

For the much longer Skåne journey,[20] which lasted from 29 April until 13 August 1749, Linnaeus was again accompanied by one amanuensis (clear maps on the end papers of Torgny[19]). Their route led first to Kristianstad and nearby Åhus (20 May), situated on Hanöbukten on the Baltic coast of Skåne, and then followed the coast southwards to Simrishamn. Leaving the coast they crossed Skåne to Lund, which they reached on 10 June (see Figure 2). From Lund they reached the southwest coast at nearby Malmö, looping southwards to the adjacent fishing villages of Skanör and Falsterbo on the peninsula that marks the southern limit of the Øresund (23 June). They then travelled east, returning to the coast at Ystad (28 June) and again at Dybäck a little to the west of Ystad. Returning to Lund, the two men then circled northwesterly, meeting the Øresund again on the shores of Lundåkrabukten, south of the town of Landskrona, and thence to Helsingborg (Figure 1). They continued northwards around the Kullen peninsula, marking the northern limit of the Øresund, to Ängelholm at the head of Skälderviken, from which they re-crossed Skåne to Kristianstad and returned to Uppsala.

Since it has already been established by Ryland and Porter[7] that no species of *Alcyonidium* can survive in the brackish water of the Baltic proper, the sector of coast from Åhus to Simrishamn cannot have been the source of *A. gelatinosum*. Ystad also seems unlikely, with the salinity at best marginal for the survival of *Alcyonidium* (see Figure 1). That leaves—from the Skåne journey—the southern Øresund, at the Skanör-with-Falsterbo peninsula and Malmö, the northern Øresund from Lundåkrabukten to beyond Helsingborg, and both coasts of the Kullen peninsula, remembering that the present size of the cities of Malmö and Helsingborg would not preclude their being sources for *Alcyonidium* on fucoid algae in the mid-eighteenth century. Further north in Bohuslän (skipping Halland Province)—on the Västergötland journey— Linnaeus had already visited both open and fjordic littoral habitats between Göteborg and Uddevalla, a sizeable section of the Bohuslän coast. Is *A. gelatinosum* currently known from part of all of these sections of Swedish west coast?

In a previous paper two of the present authors[7] reviewed all the known southern Scandinavian occurrences of *Alcyonidium*, from the North Sea through the transitional waters of the Øresund into the southwestern Baltic. We found an abundance of records

throughout the area (+ in Figure 2), with a cut-off salinity of ~10 and an absolute limit ~8 approximating a line from the southernmost point in Skåne to Rügen. We inferred—from information provided by the authors cited—that they represented Linnaeus' *A. gelatinosum*, and that it was morphologically distinct from similar species, such as *A. mytili* Dalyell and *A. polyoum* (Hassall), though *A. mytili* is known from Sylt and was probably present, with *A. gelatinosum*, in the subtidal samples used by Silbermann in 1906[21] collected off Darsser Ort.[22] Since writing that paper we have been able to visit a number of sites in eastern Denmark (though not, unfortunately, any in Sweden) (see Figure 2), and confirm that all the samples we obtained belonged to *A. gelatinosum* as we had defined it and to no other species[23] (• in Figure 1). We thus have a known distribution on the Danish side of the Øresund from Helsingör (directly opposite Helsingborg), east Sjælland (opposite the Skanör-with-Falsterbo peninsula), and the island of Møn in the south; and an inferred distribution[7] in Bohuslän (from the skerries off Lysekil, in Gullmarfjorden, and in the complex of fjords surrounding Orust to quite close to Uddevalla, the Gullmar being only just beyond the northernmost coastal point visited by Linnaeus on the Västergötland journey). These data demonstrate that *A. gelatinosum* could easily have been collected at one or several (in view of the comment "frequens" used by Linnaeus in 1761[1], which also seems to imply familiarity with the species), sites on the shores of Bohuslän and/or of Skåne bordering the Øresund during visits by Linnaeus and his amanuenses in 1746 and 1749 respectively — though, of course, they do not prove it.

While both of these years were well before the 1758 publication date of *Systema Naturae* (ed. 10),[8] we have already pointed out that the zoophytes in that work were heavily reliant on the plates in Ellis,[3] and contain few non-derivative species. Linnaeus' zoological and zoophytological knowledge was in any case criticised[14] and it perhaps took him time to recognize the encrusting films of *A. gelatinosum* as a genuine 'zoophyte', though later he (or perhaps Ellis?) established (and indeed over-estimated) the close relationship between the species "supra Fucos" and the 'Sea ragged Staff'[2] that sowed the seeds of so much later confusion. Linnaeus suffered a stroke in 1774 and died in 1778.

3. *Alcyonium gelatinosum* Linnaeus, 1767: 'The Sea ragged Staff'

The type specimen for the ctenostome bryozoan genus *Alcyonidium* Lamouroux 1813[5] is based on the taxon now stabilised as *Alcyonidium diaphanum* by Porter *et al*. in 2001[24] following much confusion as outlined previously by Thorpe and Winston.[6] To fully unravel this confusion we must go back as far as the earliest known record for this species, which appears to be the description in 1632 by Thomas Johnson,[4] in his *Descriptio Itineris* (see the dedication and first page reproduced in Figures 3-4) where he describes an account of a herbarising expedition made by several members of the Society of London Apothecaries to Kent and Hampstead Heath in 1632.

It is necessary to understand something of Johnson's background and interests to see how the *Descriptio Itineris* came about. Johnson (1595x1600–1644, (the year of his birth remains uncertain[25]), apothecary and soldier, was born at Selby in Yorkshire, of unknown

parentage. Little is known of his early life except that at some time he lived 'in the further side of Lincolnshire'. He must have received a good education because in 1620 he became apprenticed for eight years to William Bell,[26] a London apothecary, and in 1628 took his freedom in the Worshipful Society of Apothecaries of London.[25, 27]

Johnson was keenly interested in botany, and in 1626, while still an apprentice, travelled not only into Kent but also as far north as Yorkshire and Durham, searching for plants and finding several not previously recorded in Britain. In the spring of 1629 he visited Hampstead Heath. Later on that year he made a five-day journey into Kent and then paid a second visit to Hampstead Heath, on each of these occasions in the company of nine companions, mostly fellow apothecaries. Herbarizing events became popular after 1629 and were frequently led by Johnson. Sir Hans Sloane was often an honoured guest.[25]

In addition to pursuing his profession as an apothecary on Snow Hill, in London, Johnson continued to be active as an author and editor and in 1632, after another journey into Kent, he published an enlarged edition of the 1629 plant lists as *Descriptio itineris plantarum investigationis … in agrum Cantianum* 1632 (Figure 3).[4]

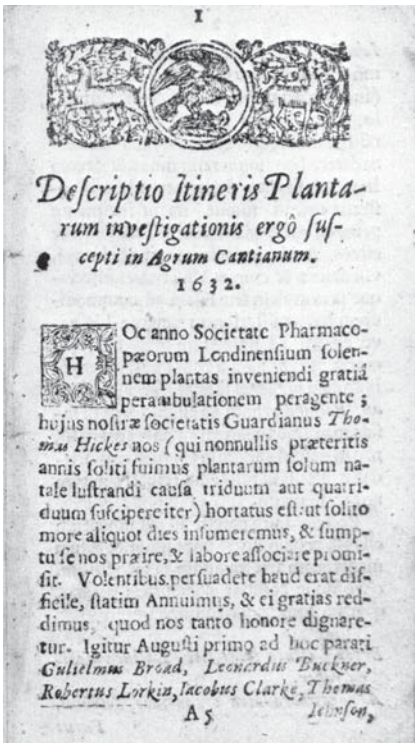
Details of the botanical journeys made by Thomas Johnson and his colleagues can be found in Gilmour.[28] According to Gilmour's account, on the 1st August 1632, Johnson and his party, consisting of Thomas Hicks, William Broad, Leonard Buckner, Robert Lorkin and James Clarke, set out from London on a six day excursion. They sailed down the Thames, arriving in Margate harbour in the evening. The following day they went collecting along the cliffs and shore.

> 'Next morning we sallied forth as far as a fort set on a steep promontory, fortified by nature more than by art, and collected on the shore and on the cliffs the plants whose names follow……'[28]

In Johnsons' *Decscriptio Itineris*,[4] *Fucus spongiosus nodosus* is listed[28] among the species observed during the trip. There is a mention in the text (page 39) and then a plate (no page number). The Sea Ragged Staffe is numbered as Figure 3 and it is definitely erect and not encrusting (Figure 4).

The taxon *Fucus spongiosus nodosus* appears again following publication of the *Descriptio itineris,* in Gerard's Herbal.[29] John Gerard (1545–1612) authored the first edition of the well reknowned Gerard's Herbal which was published in 1597 by John Norton.[29] However, Gerard died in 1612 before a revision could be undertaken and so the second edition was revised by Thomas Johnson and published in the late autumn or winter of 1633.[30] It was Johnson's most important work. In editing this book Johnson used various signs to indicate his additions and major alterations so that it is possible to distinguish the revised from the original text. It was a large volume containing 1634 folio pages, with 2766 wood-block illustrations in the text.[31] It was reprinted in 1636.[32]

It is thought that Johnson's journeys into Kent were not officially concerned with the annual Simplings of the Society of Apothecaries; it appears that they were more of an extension of the activities of the Society and were positively encouraged by Thomas Hicks, the Upper Warden. Thomas Hicks went on to become Master of the Society of



1

Descriptio Itineris Plantarum inveſtigationis ergô ſuſcepti in Agrum Cantianum.

1632.

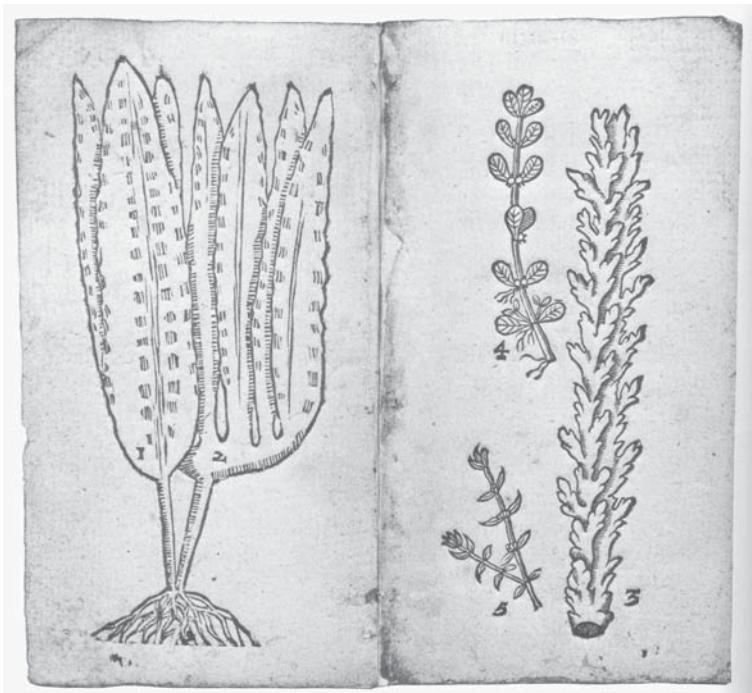
HOc anno Societate Pharmacopæorum Londinenſium ſolennem plantas inveniendi gratiâ perambulationem peragente; hujus noſtræ ſocietatis Guardianus *Thomas Hickes* nos (qui nonnullis præteritis annis ſoliti fuimus plantarum ſolum natale luſtrandi cauſa triduum aut quatriduum ſuſcipere iter) hortatus eſt: ut ſolito more aliquot dies inſumeremus, & ſumptu ſe nos præire, & labore aſſociare promiſit. Volentibus perſuadere haud erat difficile, ſtatim Annuimus, & ei gratias reddimus, quod nos tanto honore dignaretur. Igitur Auguſti primo ad hoc parati *Gulielmus Broad, Leonardus Buckner, Robertus Lorkin, Iacobus Clarke, Thomas*

A 5 *Iohnſon,*

Figure 3 (left). First page from Thomas Johnson's Descriptio Itineris *(1632).*[4] *The original article was written in Latin and then later translated by Charles E. Raven.*[28]

Figure 4 (below). A woodblock illustration of Fucus spnogiosus nodosus, *the Sea Ragged Staffe from Johnson (1632).*[4] *The legend is reproduced below:*

3. Fucus spongiosus nodosus. Ang. Sea Ragged-Staffe.
Haec valde succulenta, & fungosa planta est, pollicaris crassitudinis; flavescit obscure & multis inaequalibus protuberat appendicibus, aut nodis, unde rite & guardiano nostro, Thos. Hickes, vocata fuit Anglicè, Sea Ragged-Staffe. Crescentem non vidimus sed pedalis longitudinis, unam & alteram plantam invenimus.



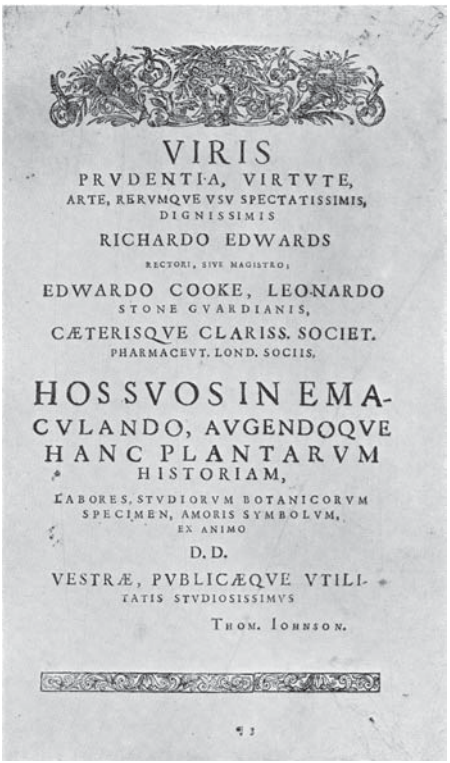

VIRIS
PRVDENTIA, VIRTVTE,
ARTE, RERVMQVE VSV SPECTATISSIMIS,
DIGNISSIMIS
RICHARDO EDWARDS
RECTORI, SIVE MAGISTRO;
EDWARDO COOKE, LEONARDO
STONE GVARDIANIS,
CÆTERISQVE CLARISS. SOCIET.
PHARMACEVT. LOND. SOCIIS,
HOS SVOS IN EMA-
CVLANDO, AVGENDOQVE
HANC PLANTARVM
HISTORIAM,
LABORES, STVDIORVM BOTANICORVM
SPECIMEN, AMORIS SYMBOLVM,
EX ANIMO
D. D.
VESTRÆ, PVBLICÆQVE VTILI-
TATIS STVDIOSISSIMVS
THOM. IOHNSON.

Figure 5. Frontispiece of Gerard's Herball. Note that Thomas Johnson's name is inscribed in the bottom right hand corner.

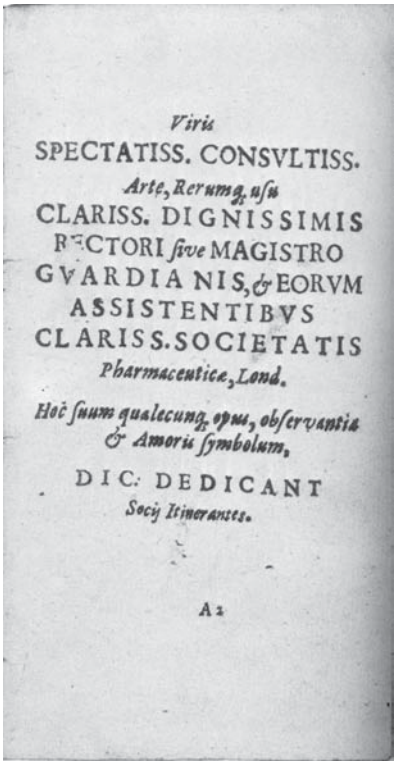

Viris
SPECTATISS. CONSVLTISS.
Arte, Rerumq; usu
CLARISS. DIGNISSIMIS
RECTORI sive MAGISTRO
GVARDIANIS, & EORVM
ASSISTENTIBVS
CLARISS. SOCIETATIS
Pharmaceutice, Lond.
Hoc suum qualecunq; opus, observantiæ
& Amoris symbolum,
DIC. DEDICANT
Socij Itinerantes.
A2

Figure 6. Thomas Johnson's dedication to the Society of Apothecaries, in his edition of Gerard's Herbal (1633).

Apothecaries (1634-1635).[33]

It is in this back section of Johnson's revision of Gerard's Herbal (1636)[32] that *Fucus spongiousus nodosus* next appears. The same illustration shown in Johnson's *Descriptio Itineris* (Figure 4) is used (frontispiece of the Herball is shown in Figure 5). There is text on page 1539 and Figure 3 on page 1570. This time it is entitled "*10. Fucus spongiosus nodosus. Sea Ragged Staffe*". The text is the same as in Johnson's *Descriptio* but given in English. Interestingly, Johnson does actually mention that he thinks it is the first description and they clearly thought it was plant rather than animal. The legend is reproduced below.

> 10. This which I give you in the tenth place is not figured or described by any that as yet I have met with; wherefore I gave the Figure and Description in the fore-mentioned journal, which I will here repeat. This is a very succulent and fungous plant, of the thickness of ones thumb; it is of a dark yellow colour and buncheth forth on every side with many unequall tuberosities or knots: whereupon Mr Tho. Hicks being in our company did fitly name it Sea Ragged Staffe. We did not observe it growing, but found one or two plants thereof some foot long apiece.[32]

Frustratingly, examination of Gerard's Herbal in detail does not reveal for what

purpose '*Fucus spongiosus nodosus*' might have been used.

Johnson had dedicated the volume to the Society in particular the Wardens (Figure 6). John Norton, a wealthy Alderman, publisher and bookseller, had first published "Gerards" in 1597. Johnson's edition was published some thirty-six years later in 1633 by Adam Islip, Joice Norton (widow of John) and R. Whitaker. They commissioned Johnson to prepare a new edition within a year. This time limit was imposed apparently because John Parkinson was writing a rival work.[25]

On 28th November 1633, Johnson presented a copy of the Herball to the Society of Apothecaries. It is recorded that:-

> Mr. Thomas Johnson at Snowe hill did this day present unto this Courte as of his guifte a booke called Gerrards herball.[34]

It is thought that this copy was destroyed in the Great Fire of London, which swept through the city from Sunday, 2nd September to Wednesday, 5th September 1666.

On the 3rd August 1640, Thomas Johnson became a member of the Court of Assistants of the Society of Apothecaries:-

> This daie Mr. Tho. Johnson at Snow Hill was sworne an Assistant of this Company being formerly chosen thereunto.[35]

By 1642 conditions in London had worsened and Johnson, a firm supporter of the royalist cause, left for Oxford where the King had established his court. In May 1643 he was created an honorary doctor of physic, doubtless in recognition of his loyalty as well as for his learning. It is obvious that Johnson had been held in high regard as on 28th July 1643, it was reported in a London newspaper that:-

> " .. and that it is thought M. Johnson the malignant Apothecary (a man formerly of great esteem & eminency in the City of London) shall be made President of the Physicians Garden, a great place and of small profit considering the estimation, which hee hath lost in this City, by professing himselfe so open an Enemy to the liberty of his Country."

By 5th October the Society of Apothecaries had removed Johnson from his position as Assistant of the Society of Apothecaries. He joined the King's forces, and in November 1643, with the rank of lieutenant-colonel, he took part in the defence of Basing House in Hampshire. The following year parliamentary forces renewed their attacks on this royalist stronghold, and on 14 September 1644, during a particularly fierce encounter, Johnson was shot in the shoulder, contracted a fever, and died a fortnight later. In a description of the Siege (1645)[36] it was announced that:-

> "Lieutenant Colonel Johnson Doctor of Physique, was here shot in the shoulder, whereby contracting a Feaver he dyed a fortnight after, his worth challenging Funerall teares, being no lesse eminent in the Garrison for his valour and conduct, as a Souldier, then famous through the

Kingdom for his excellency as an Herbarist, and Physician."

It is likely that Johnson's property would have been regarded as belonging to the state and unfortunately it is not known what happened to his material. Interestingly, in commemoration of his achievements an American genus of shrubby plants was subsequently given the name *Johnsonia*. Philip Miller in 1752 quotes:-

JOHNSONIA. The Title of this Genus was given by the late Dr Thomas Dale, of Carolina, in Memory of Dr Johnson, who published an Edition of Gerard's Herbal, improved and corrected.[37]

Thomas Dale, d.1750 was the nephew of Samuel Dale of Braintree. Thomas was a physician (degree Leyden 1723) in London, and then afterwards at Charleston, South Carolina. He went on to become a Member of the Upper House of Assembly and a Judge. Importantly his uncle, Samuel, was a neighbour of John Ray (1627–1705), the naturalist and theologian.[38]

John Ray [formerly Wray] (1627–1705) was born at Black Notley, near Braintree, Essex, on 29 November 1627, the third child of Roger Wray (bap. 1594, d. 1655), a blacksmith, and his wife, Elizabeth (c.1600–1679), who was noted for her piety and her knowledge of medicinal herbs. Until 1670 Ray spelled his surname with an initial W, which he dropped in order to facilitate the latinizing of his name.[39]

Wray went initially to the grammar school at Braintree, and from there entered Trinity College, Cambridge, on 12 May 1644. On 28 June he moved to St Catharine's College. Following the death of his tutor Wray transferred back to Trinity. Wray took his BA degree in 1647/8, and on 8 September 1649 was elected to a minor fellowship. He held a succession of positions eventually becoming a Greek lecturer in 1651. In addition to college lectures and exercises, he also preached at Trinity and in Great St Mary's, including, in 1659, the funeral sermons of John Arrowsmith, master of Trinity, and John Nidd, a senior fellow. With Nidd and others Wray began to develop interests in natural philosophy during the 1650s, particularly through the study of embryology and chemistry. He decided not to take up a position in the church despite his piety and cast himself 'upon Providence & good friends', saying that 'Liberty is a sweet thing'.[40] The main explanation for this slightly controversial decision, was his determination to travel in pursuit of natural philosophical observations, specifically botanical specimens.[41]

Wray already had considerable familiarity with the existing English botanical literature and its limitations; he was struck by the absence of anyone proficient in the subject at the university. He decided, therefore, in the early 1650s to start work on a catalogue of all the plants that he had found during his walks in the countryside around Cambridge. Wray's *Catalogus plantarum circa Cantabrigiam nascentium* (1660)[41] described 558 species of native plant, as well as crops growing in Cambridgeshire. The catalogue was arranged alphabetically, and also included titles used by Gerard, Parkinson, and brothers, Jean and Gaspard Bauhin.[39]

Wray spent the next few years undertaking long journeys with colleagues collecting

material and inspiration for some of the important works which followed later. Inbetween these trips Wray spent his time in Essex, with friends in Sussex, or visited Cambridge. On 7 November 1667 he was elected a Fellow of the Royal Society, having been proposed by John Wilkins. In the following years Ray (as he now called himself) was taken up with further experimental work with his close friend, Francis Willughby. Until Willughby's premature death on 3 July 1672 the two of them worked together for much of the time at Willughby's home—Middleton, on their respective natural history projects. Ray's travels had established the basis for his collaboration with Willughby and they provided information on birds, fishes, and insects, initially intended for use by Willughby, but later written up by Ray. The journeys had allowed him to expand his knowledge of plants, and build up a formidable collection of specimens.[39]

The culmination of Ray's botanical career came with the publication of his *Historia plantarum*, the two folio volumes appeared in 1686 and 1688,[42] with a further supplementary volume eventually being published, in 1704.[42] Despite its ambitions to completeness Ray's herbal lacked illustrations, mainly due to anxieties about their cost.

In 1690 Ray published the first edition of his *Synopsis methodica stirpium Britannicarum*.[43] Synopsis 1 was produced in 1690,[43] Synopsis 2 in 1696[44] and finally Synopsis 3 was published posthumously in 1724[45] and was expanded by Dillenius (see later). It was this third volume that Linnaeus used to gain much of his knowledge of British species. Below is the entry in Ray's third synopsis relating to *Fucus spongiousus nodosus* (Text Page 8. There is no figure). Ray noted that the same had been observed by Mr (Samuel) Dale in Mersey Island.

> 12. *Fucus spongiosus nodosus Ger. emac Spongia ramosa altera Anglica Park. Sea-ragged Staffe Propè Margate in insula Thanet Cantio adjacente invenit Tho. Johnsonus: Spongiae potiùs quàm Fuci species effe videtur; verùm de re nobis nondum visa nihil temere pronunciare audemus*. The same hath been observed by Mr Dale in Mersey Island.[45]

Regarding Ray's personal life, in June 1673 he married Margaret Oakeley (*c*.1653–*c*.1727), whom he met as a member of the household at Middleton. The couple left Middleton during the winter of 1675–6, moving initially to Coleshill, then settling at Sutton Coldfield in April 1676. By this time his friend Willughby's mother had died and Willughby's widow had married Sir Josiah Child, in the process quitting Middleton with her children. Ray's relations with Emma Child worsened over the next few years, and she declined to assist with the costs of Ray's edition of her late husband's work on fishes. They also quarrelled over the administration of the trust resulting from his will. Deprived of the library at Middleton, Ray considered going abroad as a tutor, but instead moved back to Essex. Later the death of his mother on 15 March 1679 allowed him and his wife to move back to Black Notley, and to settle in the family house at Dewlands, where they lived for the rest of their lives. They had four daughters, Margaret and Mary (b. 1684), Catharine (b. 1687), and Jane (b. 1689), all of whom assisted their father in the collection of insects during the 1690s. Ray felt Mary's death from jaundice in January 1698 as '*a sore blow*',

writing to Edward Lhwyd on 12 March 1697 that she '*was very ingenious, & helpfull to me, & upon that account the more dear too*'.[39]

During much of the 1690s Ray was engaged in correspondence with Edward Lhwyd and others about the nature of fossils. It was his belief that they were the remains of once-living creatures, he also suggested that their current distribution might be due to observable changes in the nature of the surface of the earth. He qualified these opinions by stressing that the fossils discovered to date were not unlike known plants and animals, and so their burial might be due in part to the biblical flood, as well as to natural effects. With much foresight he argued that those remains that seemed as yet unfamiliar might represent species of which the surviving representatives had not yet been discovered.[39]

The last years of Ray's life were devoted to preparing the *Methodus* (1705)[46] and *Historia* (left unfinished at his death, but published in 1710) of insects.[47] He suffered from chronic ill health during this period, from incurable ulcers on his legs which, he reported in a letter to Sloane, he took '*to proceed from invisible insects*' and from tumours '*which may be the nests of these insects (like ant-hills), they seeming to be gregarious*'.[48] He was lame and in great discomfort much of the time and eventually passing away at Dewlands on 17 January 1705.[39]

After Ray's death his widow complained to Hans Sloane of her straitened circumstances, estimating that she had been left only £40 p.a. to support her family.[49] Ray left his papers to Samuel Dale giving instructions that he should be buried privately in the churchyard at Black Notley, and that his corpse should be '*nailed up that none might see him*'.[50] His writings in natural theology proved influential throughout the eighteenth century. Linnaeus was so aware of his stature that he misrepresented his views in order to cite him as a fellow proponent of classification by a single variable and Linnaeus further honoured him by naming a genus of yams after him. In the twentieth century Ray's biographer, Charles Raven, co-opted him in an attempt to heal the breach between science and religion, suggesting that '*the concept of organic design could explain the unfolding of divine purpose through evolution*'.[39]

There was substantial correspondence in the years before Ray's death between himself and Sir Hans Sloane, and in a letter to Ray dated 10 August 1686, Sloane discusses a sampling trip to Sheppey and appears to talk about *Alcyonidium*. Sloane says, "*…near King's Ferry, in Sheppey, where also is cast upon the shore the Fucus spongiosus nodosus Ger. emac*." He goes onto say, "*I send you down specimens of them, and Axtius de pice conficienda, and Arboribus coniferis, by carrier; as also the Fucus I formerly told you of, to look like a honeycomb, which I found cast upon the shore on Sheppey, as well as at Nesson*."[51]

In a later letter dated 24 August 1686, however, Ray tells Sloane, "*As to the plants, the Fucus is no other than that described and figure in J. Bauhine's history by the name of Alga marina platyceros porosa [Flustra foliacea, Linn., not a plant but a zoophyte], and is frequently cast upon our shores; I take it to be that they call silken wrack in 'Phytologia Britannica*".[52]

Significantly, Hans Sloane's collections later became the start of the British Museum

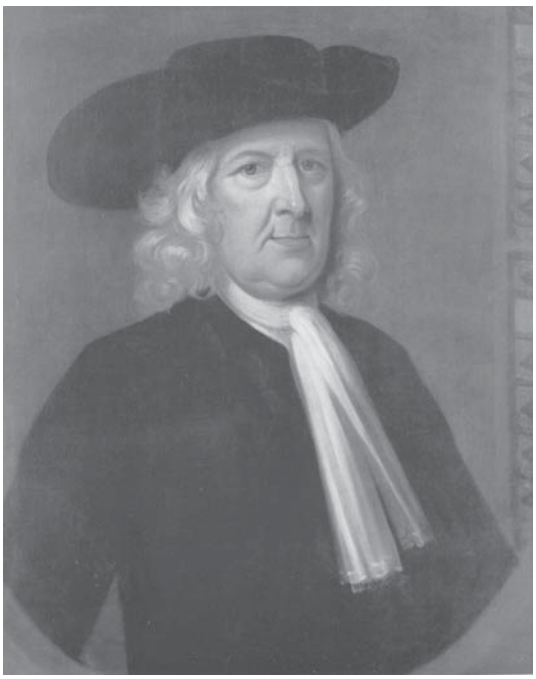


Figure 7. A portait of Samuel Dale, artist unknown, circa 1730. reproduced by kind permission of the Society of Apothecaries of London.

and the British Library.

Samuel Dale (1659–1739) (Figure 7) was, as explained previously, the executor of the Ray estate and in common with Thomas Johnson was an apothecary. He was apprenticed for eight years to Thomas Wells, a London apothecary, on 5 May 1674 and was in Braintree, Essex when he received a licence to practise medicine, on 3 April 1682. As he did not intend to practice in London he did not bother to claim his freedom of the Society of Apothecaries.[38]

Dale lived first at Bocking End, Braintree and later at the Old House in Bradford Street, by invitation of his cousin John Ruggles. Dale became a close friend of Ray who then lived at nearby Black Notley. Both in the *Historia*[42] and in the three editions of the *Synopsis methodica stirpium Britannicarum*[43-45] Ray acknowledged the valuable assistance he had received from Dale's critical knowledge of plants, and it is in Dale's letters to Sir Hans Sloane that the last hours of Ray's life are detailed.[38]

Dale's own chief work was the *Pharmacologia*, which first appeared in 1693;[53] a supplement was published in 1705,[54] a second edition in 1710,[55] a third in 1737,[56] and others after his death (6th June 1739). His books on botany and his herbarium were bequeathed to the Society of Apothecaries; the herbarium was eventually moved to the British Museum (South Kensington), and the neat and elaborate tickets to the plants, many of which he obtained from the Chelsea Physic Garden and from numerous correspondents, indicate that he was indeed an accomplished botanist. Linnaeus commemorated Dale's

services to botany in the leguminous genus *Dalea*.[38]

One consequence of Ray's death was that John Jakob Dillenius (1687–1747) took Ray's third synopsis and expanded it significantly. The background of Dillenius reveals how this came about. Dillenius was a botanist, born at Darmstadt where his family, formerly Dill and later Dillen, were civil servants in the state of Hesse[57]. His father was professor of medicine at the University of Giessen, where he latinized his name to Dillenius. Dillenius practised medicine in Grunberg, Hesse, and qualified in 1713. His botanical interests led to his being elected to the Caesare Leopoldina-Carolina Academia Naturae-Curiosorum and he contributed several papers, mostly botanical, especially on cryptogams and their sexual organs. In 1718[58] (with another edition in 1719[59]), he published *Catalogus plantarum circa Gissam sponte nascentium*, with many new genera and sixteen plates drawn and engraved by the author. The work attracted lots of attention, but Dillenius made little progress in Germany, because he criticized the classificatory system of Augustus Bachmann (Rivinus), preferring the system of John Ray!

The British consul at Smyrna, William Sherard, persuaded Dillenius to move to England, which he did by August 1721. Dillenius stayed with Sherard at Oxford and afterwards in London, but also had lodgings in London 1728 at Barking Alley. In 1721 he was appointed the first president of the Botanical Society. With John Martyn as its first secretary, the society met in the Rainbow Coffee House, Watling Street. Sherard wanted Dillenius to arrange his herbarium and compile an encyclopaedia (*Pinax*) of all names given to plants, according to a 1623 plan originally conceived by Gaspard Bauhin (1560-1624). He also wanted to endow the existing chair of botany at Oxford and appoint Dillenius to the post, but the unendowed chair was then occupied by Gilbert Trowe (*c*.1685–1737).[57]

Dillenius's first published work in England turned out to be the third edition of Ray's *Synopsis stirpium Britannicarum* (July 1724),[45] to which he added many species and twenty-four plates of rare plants; the basis for this work, which was effectively the textbook of British botany until the publication of Hudson's *Flora Anglica* (1762),[60] was his Synopsis herbarium, now preserved at Oxford. Dillenius was elected FRS in 1724 and was foreign secretary of the Royal Society in 1728–47. In about 1724 Dillenius, at James Sherard's (William's brother) suggestion, had begun illustrating and engraving plates for the *Hortus Elthamensis sua plantarum rariorum quas in horto suo Elthami ... Jacobus Sherard* published in 1732.[61] Two large folio volumes were illustrated by 417 drawings, some also coloured himself, with the relevant specimens preserved at Oxford University. The work is important because of the new genera described, and later used by Linnaeus, and because of the accuracy of the plates.[57]

In 1728 William Sherard died, bequeathing his herbarium, library and 3000 pounds to to provide a salary for the professor of botany at Oxford, on condition that the university pledge greater financial support for the botanic garden and that Dillenius should be the first professor. Dillenius finally gained the post in 1734 after six years' wrangling between Sherard's executors and the university, and Trowe's resignation.[57]

Before August 1724 he had begun research on his greatest work, the *Historia*

muscorum (1742).[62] The *Historia* is particularly significant because it was one of the first English botanical books to include references to the work of Linnaeus, who in the summer of 1736 spent a month with Dillenius at Oxford after which the Swedish naturalist dedicated his *Critica botanica*[63] to him. Dillenius is reputed to have been a somewhat corpulent character and due to various problems with publications in March 1747, he was apparently 'seized with apoplexy', from which he died in Oxford on 2 April 1747; he was buried at St Peter-in-the-East, Oxford.

William Hudson (1730x32–1793) was born at the White Lion Inn in Kendal, which was kept by his father. He was educated at Kendal grammar school and subsequently apprenticed to a London apothecary. Significantly, whilst he was an apprentice, he obtained the prize for botany given by the Apothecaries' Company,[64] which was a copy of Ray's *Synopsis*. From 1757 to 1758 he was resident sub-librarian of the British Museum,[65] and his studies in the Sloane herbarium enabled him to adapt the Linnaean nomenclature to the plants described by Ray. In 1761 Hudson was elected a fellow of the Royal Society, being proposed by F Willoughby; W Watson; H Baker; Js Parsons; P Collinson; Cha Morton; Emanuel Mendes da Costa.

> "Mr William Hudson of Panton Street Apothecary a person exceedingly well versed in natural history in general, but more particularly in Botany, for which he is deservedly eminent, being desirous of offering himself a candidate for election into the royal Society, is recom[m]ended by us upon our personal knowledge, as beleiving [sic] that if he is elected he will be a very usefull member."[66]

In the following year appeared the first edition of his *Flora Anglica*,[60] which, according to Pulteney and Sir J. E. Smith, marked the establishment of Linnaean principles of botany in England. At the time of its publication Hudson was practising as an apothecary in Panton Street, Haymarket. A neighbour, Benjamin Stillingfleet (1702–1771), the learned botanist, translator, publisher and minor poet, is credited both with introducing him to the Linnaean system and with writing the preface to *Flora Anglica*. The publication of this work gave Hudson a considerable reputation as a botanist.

From 1765 to 1771 Hudson acted as *praefectus horti* and botanical demonstrator to the Apothecaries' Company at Chelsea Physic Gardens. A considerably enlarged edition of the Flora appeared in 1778[67] and a third edition in 1798.[68] In 1783 fire swept through his house in Panton Street destroying his collections of insects and many of his plants. What materials he had assembled for a *Fauna Britannica* were unfortunately lost as a result. Hudson retired to Jermyn Street, where he lived with the daughter (and her husband) of the apothecary to whom he had been apprenticed and whose practice he had assumed. In 1791 he joined the newly established Linnean Society. He died in Jermyn Street from paralysis on 23 May 1793 and was buried at St James's Church, Piccadilly. He bequeathed the remains of his herbarium to the Apothecaries' Company, and significantly some of his specimens became part of the collections at the Natural History Museum and at Kew. The contemporaneous Linnaeus commemorated him by giving the name *Hudsonia* to a North

Figure 8. Herbarium specimen (1963.2.16.1) now housed in the bryozoan collection at the Natural History Museum. This specimen was collected at Sheerness in 1729; though it is not clear who collected it, it is the earliest known specimen of what is now known as Alcyonidium diaphanum *(Sea Ragged Staffe) and is likely to be the specimen Hudson used to illustrate the* Flora Anglica *(1762).*

American genus of Cistaceae.[64]

In recent years a herbarium sheet (NHM 1963.2.16.1) (Figure 8) was transferred from the Botany Department of the Natural History Museum, London to the Zoology Department (Bryozoa section) and was just recently identified as the material on which Hudson's account of the species in the *Flora Anglica* (1762, 1778, 1798) is likely to have been based. Hudson would have had ample opportunity to access this material either whilst at the Apothecaries Company, or during his time working as sub-librarian at the British Museum. Of particular significance is the fact that this material is at present the earliest known specimen of the taxon *Fucus spongiosus nodosus* and from the illustration and herbarium specimen quite clearly corresponds to the same taxon described by Johnson in his *Descriptio Itinerum*.[4] It was collected at Sheerness, the type locality, in 1729 but frustratingly it is not clear by whom. However, in view of the activities of the Society of Apothecaries and the numerous connections illustrated between society members, it seems likely that all three specimens could have been collected from the strandline on one of the many simplings that were conducted.

Porter *et al*.[24] redescribe this material in detail for the first time, and provide justification for regarding contemporary, loosely sympatric specimens as representing the same species. In this diagnosis newly recognised lectotype series and topotype specimens are described and illustrated, thus stabilising the identity of what is now known as *Alcyonidium diaphanum* but which was called Sea Ragged Staffe by Thomas Johnson in 1632,[4] Ray in 1696[44] and Ellis in 1755,[3] *Fucus gelatinosus* by Hudson in 1762[60] and *Alcyonium gelatinosum* by Linnaeus in 1767.[2]

4. Concluding remarks

Over the course of this article we have come full circle back to Linnaeus and the problems caused by his multiple use of the binomen *Alcyonium gelatinosum*. Through researching for this article is has become clear that there were many and varied connections between the various botanists and apothecaries and of course Linnaeus himself at different times during the period 1632 to the late 1700s. These connections occurred via activities of the Apothecaries Society (see Figure 9), via correspondence which was conducted between them, through journeys they undertook and through the consultation and use of the various publications of note produced along the way. Thorpe and Winston[6] went some considerable way in noting the problems caused by Linnaeus, in his multiple use of the name *Alcyonium gelatinosum*. In the absence of type material and in an effort to clarify the situation they went on to designate specimen NHM 1983.1.1.1 as representative of the *Fucus* encrusting *Alcyonidium gelatinosum* (Linnaeus, 1761).[1] They provide a complete synonomy of that taxon. The misdiagnosis of the specimen has been dealt with earlier in this article and previously in other publications.[7] Thorpe and Winston[6] also provided a complete synonymy of the erect growing *Alcyonium gelatinosum* (Linnaeus, 1767),[2] but interestingly designated no type material for it. In their extensive synonymy, Vahl[69] refers to this taxon as *Ulva diaphana*, a name which was then

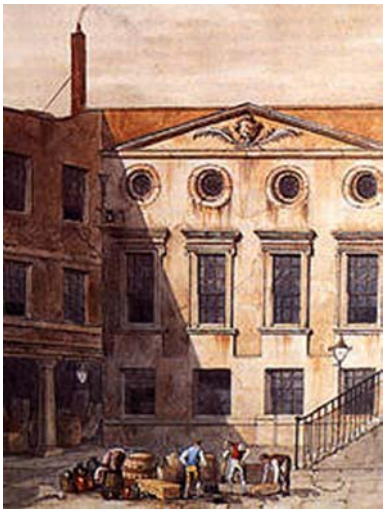


Figure 9. The courtyard of the Apothecaries Hall in Black Friars, London, painted by George Shepherd (1814) following its rebuilding after the Great Fire of London and subsequent expansion.

picked up by Hayward[12] in his Ctenostome Synopsis, and later designated by Thorpe and Winston[70] as *Alcyonidium diaphanum*, the name by which it is currently known. Interestingly there was still at this stage no type specimen for *A. diaphanum*; a problem subsequently addressed by Porter *et al*.[24] in the light of herbarium material being transferred from the Botany Department of the Natural History Museum, London to the bryozoan section and the realisation of its potential historical significance. Following several years of research by various authors and much confusion over a period lasting more than two centuries, we feel that the mystery of the confusion between the two entities *Alcyonium gelatinosum* Linnaeus, 1761[1] and *Alcyonium gelatinosum* 1767[2] is finally unravelled.

5. Acknowledgments

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