An unusual preparation of an eighteenth century spider and its consequences

Keywords

Historical natural history specimen, preservation, Arachnida, spider, The Hunterian (Zoology Museum), William Hunter

Background

William Hunter (1718-1783) built up a museum, the whole contents of which were transferred to the University of Glasgow in 1807.[1] It contained a collection of insects that numbers over 7,600 specimens. The bulk of the insects were accumulated from about 1765 to 1783. The inclusion of animals such as centipedes, scorpions and spiders in the same cabinet as insects was then part of the accepted view of classification. They were treated within descriptive texts under the heading 'Aptera', or wingless insects.[2] They were preserved often as dried examples, pinned into cork-lined and papered drawers in the same manner as beetles or butterflies. Later the normal method for preservation of spiders and most other non-insect invertebrates was by immersion in fluid preservatives such as solutions of formaldehyde or a variety of alcohols. Although ethanol is currently the most widely used alcohol both methanol and propanol can be found in jars in museum collections. Fluid preservation varies according to tradition, historical precedence, the nature of specimens, the purpose for which they are needed for future study, the development of new techniques and the discrediting of old ones.[3] For modern research purposes arthropods with softer integuments need to be manipulated to examine the often delicate appendages for identification which would otherwise be damaged if dry. In spiders the abdomen has a softer integument than the rest of the body and is subject to differential shrinkage. This can mask the baso-ventral epigyne of the female spider, an important feature for identification in that sex. Therefore, dried specimens are not preferred except for display when it is common for larger specimens to be eviscerated and padded out with cotton wool to present a more natural appearance.

[insert fig of old spider near here]

Fig 1 Mygalomorph spider dating to between 1768 and 1783 showing wires appearing at tip of abdomen and near apices of legs.

Fig 2 X-ray image of spider showing hooked wires extending from one leg to another on opposite side of the body. Shorter wires connect other appendages. Of particular interest are the separate short wires holding each of the terminal leg segments in place.

Description of preserved eighteenth century spider

In Hunter's collection are a number of dried and pinned spiders but one was seen to have small pieces of wire protruding from the legs and abdomen (Fig. 1). To ascertain the extent of these wires the specimen was x-rayed and it was found to have a complex arrangement that connected various appendages and body parts (Fig. 2). The number of wires was greater and their deployment more complex than expected. Each of the spider's eight walking legs has wires connecting them in pairs on opposite sides of the body but not symmetrically. For example, the left foreleg and the right hind leg share a wire but the right foreleg is connected to the third left leg. These wires terminate in hooks which appear from between the last joint of the legs. There is only one pedipalp whose wire ends in the basal section of the third left leg; the left one is thought to have been lost historically. Pedipalps are long anterior appendages associated with the mouthparts and in female spiders are similar in appearance to walking legs giving a superficial appearance of having five pairs of legs. The two main body parts in spiders are the abdomen and cephalothorax, the latter being a

fused head and thorax. This is unlike insects which have three body parts with their head and thorax physically and functionally distinct. In Hunter's spider specimen the body is kept together with a single wire. To complete the arrangement each of the fang-bearing segments has a short wire fixing it in place. The most unexpected feature revealed by the x-ray image is the short wires dedicated to each terminal (apical, or claw-bearing) leg segment. These may have been placed in position separately as it would have been difficult to bend the wires without damage. In addition, or possibly the main reason, the termination of the leg wires is hidden from view and so it might have been done for cosmetic reasons. The hook-like bend at the end of each of the leg wires appears from apex of the penultimate segments (Fig. 3). Its function would appear to hold all the segments together and prevent them falling off, analogous to stringing beads.

Fig 3 Hooked end of a leg wire appears from between the two apical segments; the existence of a short wire attaching the claw-bearing segment was only revealed by x-ray.

Why would a spider be prepared in this way?

In the eighteenth century cabinet the specimens were arranged in glass-topped drawers so they could be both admired and studied.[4] To be most presentable in such a collection a perfect specimen would be the ideal. Other desirable qualities were rarity and exoticness, but unique (in a literal sense) was the ultimate value. There were limited opportunities for obtaining non-European specimens. If a particular species was unusual in any way but in poor condition it was not a feasible option just to go

back and get a better example. During the voyages of exploration by sailing ships various kinds of terrestrial invertebrates (insects, centipedes, spiders, etc.) were preserved in 'spirits of wine' as were small vertebrates, such as lizards and frogs. Instructions to collectors were issued:

> '*In Relation to* INSECTS, *as* Beetles, Spiders, Grasfoppers, Bees, Wafps, Flies, &c. *these may be Drowned altogether, as foon as caught in a little wide Mouth'd Glasf, or Vial, half full of* Spirits, *which you may carry in your pocket. But all* Butterflies *and* Moths, *as have mealy Wings, whose Colours may be rub'd off, with the fingers, these must be put into any fmall Printed B, as soon as caught , after the same manner you do y^e^* Plants'. [5]

Subsequent to arrival in London the insects and related specimens could then be dried out and pinned before being placed in the cabinet.

Specific evidence for the acquisition of spiders by William Hunter is found in his archives: 'Collection of curiosities … A very large Scarabaeus from the river Gaboon in Africa, dry. A very large Tarantula from Africa, dry. Ditto, in spirits. Sunfish … [etc]'. [6] Hunter's collection contains six large spiders and none of them have associated data labels. This is a typical but frustrating condition found with many eighteenth century specimens. Unusually, however, the 'very large Scarabaeus' can be provenanced as it was unique to Hunter's collection.[7] The circumstances and difficulties of collecting and preserving specimens during the period are also provided by first hand accounts of some African explorers some of whose specimens entered Hunter's museum.[8]

Alcohol preservation

Identifiable problems during the collecting and transporting processes are physical damage, the attention of pests, attack by moulds and the lowering of alcohol strength. Body fluids leak out of the specimens and dilute the solution, particularly when the numbers increase in the containers. Modern practice is to replace the alcohol after the samples arrive in the museum or laboratory immediately following field work. [9] We thought that this was not generally understood during the period when this spider was collected, 250 years ago, but found a most interesting detailed early account. It is here

quoted in full showing that John Hunter (1728-1793), William's brother, was well aware of this problem:

> 'OF CHANGING THE SPIRITS
> Animals, or parts, that are put into spirits, should have the spirits changed, because the first spirits which enter the substance of the part to be preserved, will be considerably lowered and discoloured by the juices of the animal; perhaps it will not be necessary to change it oftner (sic) than once: the proper time for doing which, will be a fortnight after the first immersion; for by this time the first spirits will have united sufficiently with the part, and have checked putrefaction, as far as such diluted spirits can, but will not be sufficiently strong to continue the preservation of the part; however the time will vary according to circumstances. If in a hot climate they may require changing sooner; if in a cold one, later; if the part is soft, or gelatinous, it will also require their being changed sooner; and if a hard, or firm part, it may be later.
>
> Another advantage arising from a spirit sufficiently strong, is it own preservation; for when much diluted and joined with the animal juices, it changes from spirit to vinegar, the effect of which is, that the bones of the animal or parts, are softened so as to be unfit for a skeleton. The first spirit may be distilled'.[10]

The above account not only shows John Hunter's appreciation of the problems of dilution by the specimens but seems to refer in the second paragraph to the fixative properties of ethanol. Ethanol and a few other preservatives have been described as 'dehydrating pseudo-fixatives; if there is greater than 70% (v/v) ethanol performs adequately.[11]

In addition to dilution loss of ethanol by evaporation exacerbated the situation. This latter factor is a constant issue for curation even under today's more controlled conditions. Testing the strength of the preservative and using a top up procedure rather than total replacement has recently become available in the modern museum situation.[12] In the context of the discussion on this spider the result of weaker solutions is that the softer intersegmental membranes of arthropod joints are the first to decay and more likely to separate (personal observation). This is influenced by the

kind of arthropod that is under consideration. For example, many long-legged flies have legs that are quite deciduous in nature, a defence mechanism akin to the tails of some lizards. If placed in alcohol all their legs readily become detached which is rather annoyingly for future study when more than one specimen is in the same container.

Physical damage

Exploratory sea voyages undertaken in the eighteenth century could last for several years. Rough physical conditions during the journey caused by storms and extremes of environmental change would be adverse factors in the safe return of the naturalists' gatherings. A less dramatic example of the effects of physical disturbance can be seen in a modern situation. A jar of spiders from The Hunterian teaching collection has been used for demonstration classes for undergraduates during a number of classes. In the jar are 15 spiders in ethanol; two abdomens have become detached as well as nine entire legs. Also there are seven separated basal sections of legs and five loose terminal segments (Fig. 4). These data provide an example of the way in which physical handling can cause breakages at the vulnerable joints in the external skeleton of an arthropod. It can be imagined what the effect would be on similar specimens after being in barrels of spirits of wine in transit for months or even years onboard a sailing ship.

Fig. 4 Contents of a jar of fifteen spiders that have been used for teaching.

Replication

Having deliberated the possible reasons for the old specimen's treatment that allowed it to be presented as an acceptable specimen in Hunter's cabinet it was decided to attempt to replicate the process. A fluid preserved example of a tropical mygalomorph spider of a similar size to the eighteenth century specimen was chosen for replication, a South American species *Psalmopoeus cambridgei* (Pocock), Acc. No. GLAHM:104441. It occurs in Trinidad & Tobago and as a result of entering the pet trade has acquired 'Trinidad Chevron Tarantula' as a vernacular name. The specimen was dismembered and then pieced together using soft iron wire. It was not possible to test the tensile strength of the original wires. The wire was selected of comparable diameter (0.07mm) and is of the kind readily available for horticultural use. Guided by the X-ray image of the old specimen the main body parts and leg segments were reattached (Fig 5). The abdomen was secured to the cephalothorax and the ends bent over to keep the two parts tightly in contact. Each leg wire was precut to an approximate length to minimize damage if shortening was required after pushing through the body of the spider. The ends were bent using artery forceps. Whoever wired the original specimen was obviously intent on preserving it in a lifelike pose in the way the legs are bent. To replicate this was difficult to achieve without causing damage to the hairy vestiture. The old specimen is substantially bald which may have been a result of either the same conditions that resulted in it breaking up or to handling during setting up. It is for this reason that old spider proved difficult to identify to species, having lost the diagnostic body patterns, but is a specimen of *Theraphosa blondi* (Latreille), the giant bird-eating spider of South America. Spider hairs, particularly on the abdomen are naturally deciduous but it was intended to minimise their loss from handling in the modern example. The finished attempt was scanned to compare with the original specimen (figs 6, 7, 8).

Fig. 5 Modern spider showing wire being deployed to connect and attach the second right foreleg and left hind leg

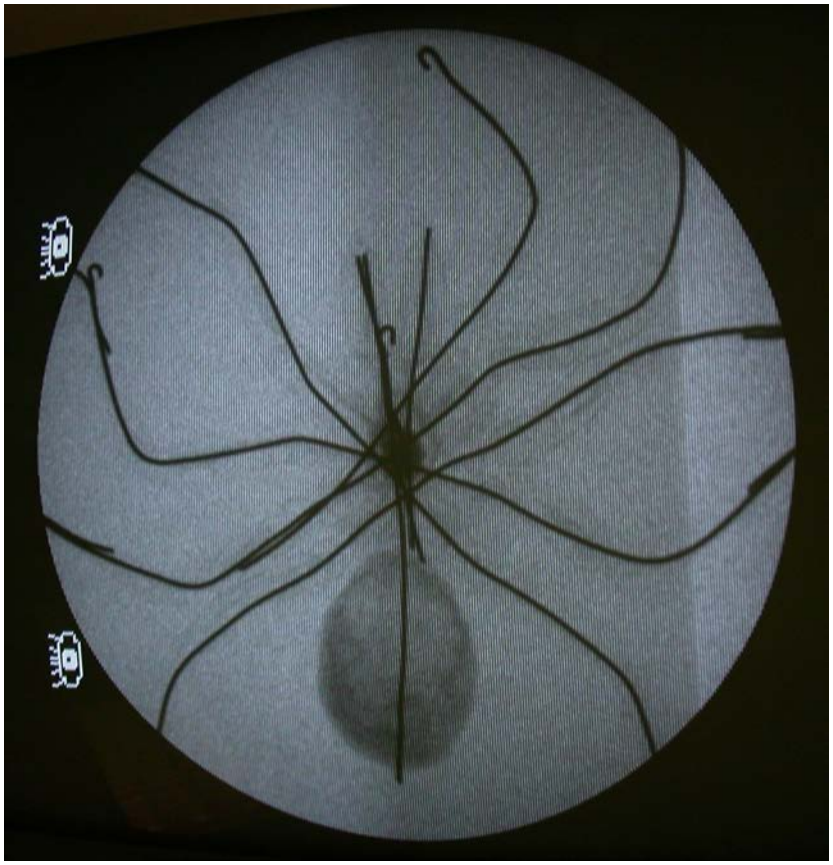

Fig. 6 Fluoroscan of eighteenth century spider

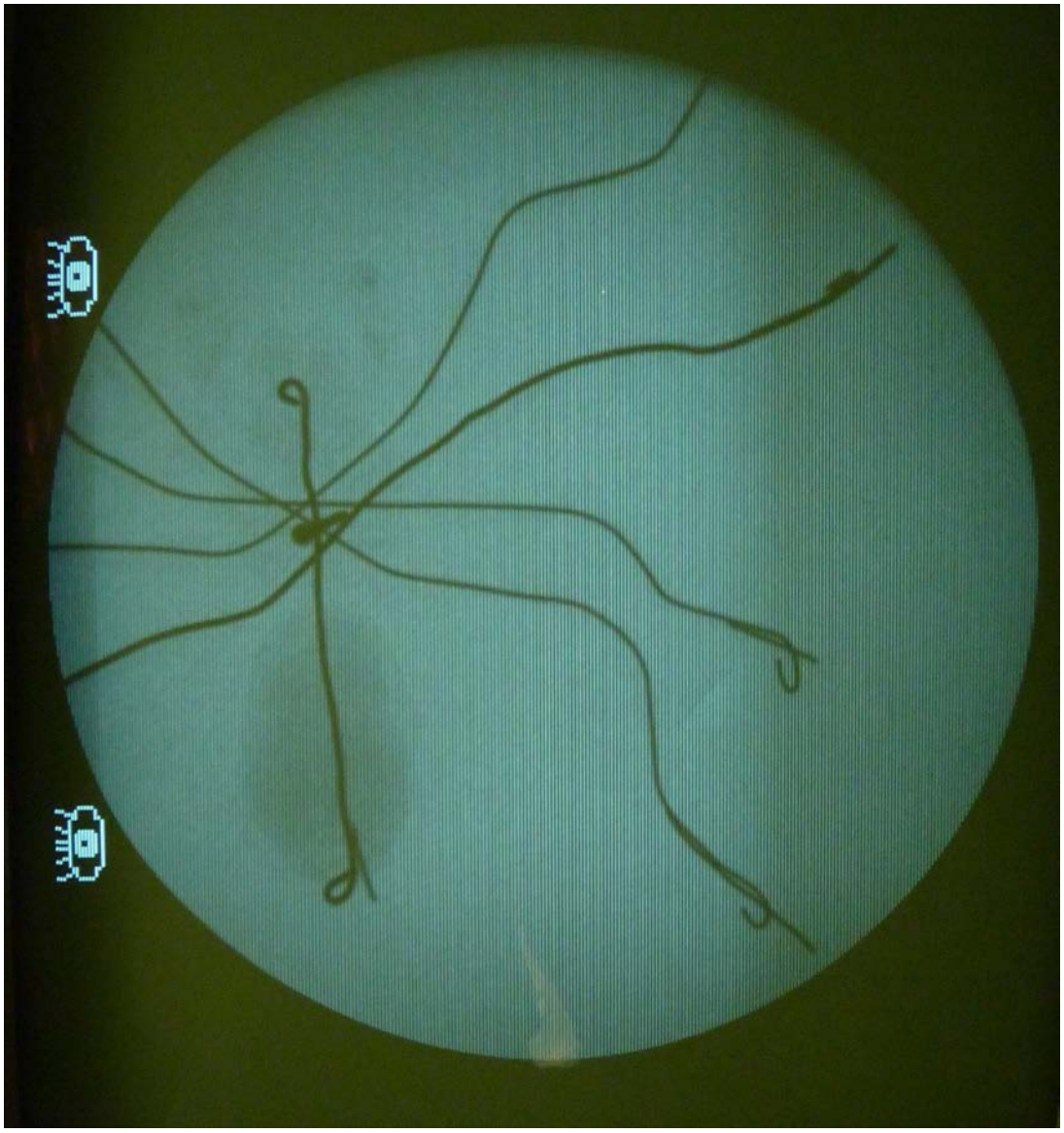

Fig. 7 Fluoroscan of modern spider

Fig. 8 Modern spider with legs re-wired in place and entomological pin inserted through centre of cephalothorax to allow placing in an insect drawer.

Enquiries directed to other major British museums have not revealed any spider specimens from any period prepared in a similar way to this example. However, it is well known that taxidermy processes utilise wire and other aids to support bird and mammal specimens in life-like poses.[14] Also, in repairing or stabilising insects sometimes supports such as extra pins or thin slivers of wood have been used. For example, some texts encourage the use of stiff horsehair, pig's bristle or a grass stem which are to be inserted prior to drying through a dragonfly's abdomen from the apex up into the thorax. Their abdomens are likely to become detached with the slightest degree of mishandling. [15, 16] In practice this could destroy parts of the anal appendages and is not recommended for scientifically important specimens; generally dragonflies would be prepared in this manner only for life-like display in an exhibition.

Two spiders have been located in the Alexander Macleay collection in Sydney that have internal support. [17] Not only are these spiders of the same South American species as that in Hunter's collection but have been repaired or stabilised using wires plus a few pins. One has a superficially similar arrangement but differs in fundamental ways (Figs 9, 10). Instead of pairs of legs on opposite sides of the body being connected by one piece each leg has its own wire with the addition of extra pieces for some individual segments. The feet are not attached separately. The indication is that given its history this specimen was repaired in response to the same issues of preservation and presentation. The use of a pin inserted in one of the legs is possibly later. The second specimen (Fig. 11) is quite different as the x-ray shows hand made pins securing the legs at their bases to the body, criss-crossed through the cephalothorax. These have the distinctive profile of hand-made pins unlike the longer and thinner pins that have been used at the extremities of some of the legs which are probably machine made and so added later. [18]

Conclusion

Our initial curiosity as to how and why Hunter's spider was repaired with wires eventually resulted in an attempt to replicate it. This was mainly to test our suppositions about how it might have been done, with what ease and result. The research into the history of the eighteenth century collections on Glasgow has been

driven by several factors. The integrity of the insect cabinet in particular is quite remarkable. It is substantially complete and retains most of its original layout and arrangement, which we know from comparison with contemporary manuscripts and publications. Also, it has benefited from benign neglect, by which is meant a lack of latter day, well-meaning but often destructive, curatorial practises often carried out in the nineteenth century. Several other historically equivalent collections have been moved from their original drawers without noting their positions relative to each other, incorporated with other collections or selectively 'weeded' of specimens thought to be of little interest. In these respects, having avoided such attentions, Hunter's stands out amongst the few extant collections that date from the Enlightenment. The relative lack of historical information on such old collections in general and Hunter's in particular is slowly being rectified by publications on its history and importance, some of which are referenced here. The spider has been included in a display as part of a temporary exhibition in The Hunterian as a result of its interesting condition.[13]

It is concluded that The Hunterian specimen and those in the Macleay collection demonstrate unusual and unique features of preparation that are of some historical interest but modern techniques and requirements circumvent any need to replicate them as a procedure for current purposes.

Footnotes

1 Lawrence J. Keppie, *William Hunter and the Hunterian Museum in Glasgow, 1807-2007*. (Edinburgh: Edinburgh University Press, 2007).

2 Hunter engaged the premier entomologist of the time to curate his zoological collections, Johann Christian Fabricius (1745-1808). He obtained arthropod invertebrates and arranged them during his frequent visits to London according to his own classic standard works of which the first was Johann C. Fabricius, *Systema entomologiae, sistens insectorum classes, ordines, genera, species, adiectis, synonymis, locis, descriptionibus, observationibus*. (Flensburg and Leipzig, 1775). Fabricius was the principal and immediate entomological successor to Linnaeus and one of his star pupils.

3 Two standard British publications cover the whole range of natural history curatorial practices including wet preservation, viz: Geoff Stansfield, John Mathias & Gordon Reid, (eds), *Manual of natural history curatorship*. (Museums & Galleries Commission, London: HMSO, 1994); David Carter & Annette Walker, (eds), *Care and conservation of natural history collections*. (Oxford: Butterworth-Heinemann Series in Conservation and Museology, 1999).

4 The development of this apparently simple arrangement was crucial to the growth of collections of insects during this early phase of descriptive entomology and necessary for its progress. The aspects of importance in this 'technology of curation' were the use of pins and placing the specimens in paper-covered cork-lined drawers with glass tops to allow viewing and exclude dust. Some detail is provided in Geoffrey Hancock, Georgina Brown & Brian Jowett, 'Pinned down: the role of pins in the evolution of eighteenth century museum insect collections', *Museum History Journal*, 4 (2011): 29-45.

5 James Petiver, *Brief Directions for the Easie Making and Preserving Collections of all Natural Curiosities*. (London, [1700]). Petiver (c1665-1718) is an early example. Later, for example, equally terse advice was given by John Coakley Lettsom, *The naturalist's and traveller's companion containing instructions for collecting &*

preserving objects of natural history (London, E & C. Dilly, 1774) p.6, 'It is necessary only to observe here that all kinds of insects with no wings, may be preserved in spirits, brandy or rum, …'. Spirits of wine, also known as Aqua Vitae, contains ethanol at about 80% or more (v/v). It was produced from a distillery manufacturing brandy by multiple distillations to increase the strength. It was readily available in the eighteenth century and used to preserve specimens and to fix their tissues.

6 Glasgow University Library, Special Collections, H.176 [no date]

7 E. Geoffrey Hancock, E.G & A. Starr Douglas, 'William Hunter's Goliath beetle, *Goliathus goliatus* (Linnaeus, 1771), re-visited', *Archives of natural history*, 36 (2009): 218-130.

8 The experiences of both explorers in the field and the London-based collectors who commissioned them are discussed in A.S. Douglas & E.G. Hancock, 'Insect collecting in Africa during the eighteenth century and William Hunter's Collection', *Archives of natural history*, 34 (2007): 293-306.

9 This is infrequently referred to in curatorial literature but see for example the chapter by Tony Irwin, 'Curating', in Peter Chandler, (ed.) A Dipterist's Handbook *The amateur entomologist*, 15 (2010), pp. 81-95.

10 [John Hunter] *Directions for preserving animals and parts of animal for examination*. c.1770s, pp.32. This letter press pamphlet was clearly produced to advise collectors going to exotic locales. John Hunter as a comparative anatomist was anxious to obtain as many different animals as possible. If species were too large to cope with they were not required whole; an indication of particular organs or other parts to be preserved was provided.

11 Details of how various agents operate in fixation are given by R.W. Stoddart, 'Fixatives and preservatives, their effects on tissue', in C. Velson Horie, (ed.) *Conservation of natural history specimens; spirit collections* (University of Manchester, 1989), pp. 1-25.

12 David G. Notton, 'A new practical method for profiling and topping up alcohol preserved entomology collections', *Natural Sciences Collections Association News*, 21 (2011): 44-49.

13 The bicentenary of the first publication describing the contents of The Hunterian has been marked by an exhibition 'This Unrivalled Collection', 15 March – 11 August, 2013. The title is a quote taken from the first line in Captain J. Laskey, *A general account of the Hunterian Museum, etc*. (Glasgow: John Smith &Son, 1813). Selected items from the collections described by Laskey were interpreted by using his original text verbatim with modern commentary alongside, see websites http://www.gla.ac.uk/hunterian/visit/exhibitions/currentexhibitions/unrivalled/ http://www.scotsman.com/the-scotsman/scotland/arts-reviews-hunterian-museum-marilene-oliver-calum-mackenzie-1-2875320 accessed 15 July 2013.

14 Pat A. Morris, *A history of taxidermy: art, science and bad taste*. (Ascot, PBP Publishing, 2010), p.39. An historical example is the impressive combination of a lead bar and several wires was revealed by x-ray examination of an Amazon parrot, dating from 1781.

15 Cynthia Longfield, *The dragonflies of the British Isles* (London: Warne & Co, London, 1937), p.37.

16 Reginald Wagstaffe and J.H. Fidler, 1955. *The preservation of natural history specimens, Volume One, Invertebrates*. (London: Witherby, 1955), p.57.

17 Specimens from Alexander Macleay (1767-1848) are of eighteenth and early nineteenth century origin having been acquired by him from other collectors and at London auctions of the period. On becoming Colonial Secretary for New South Wales in 1825, his collection emigrated with him and formed the basis of the Macleay Museum, University of Sydney. See 'McLeay, Alexander (1767–1848)', Australian Dictionary of Biography, National Centre of Biography, Australian National University, http://adb.anu.edu.au/biography/mcleay-alexander-2413/text3197, accessed 10 August 2013.

18 The history of use, characteristics and availability of pins, prior to mass production methods of production introduced in the late 1830s, is discussed in E Geoffrey Hancock, Georgina Brown and Brian Jowett, 'Pinned down: the role of pins in the evolution of eighteenth century museum insect collections', *Museum History Journal*, 4 (2011): 29-45.

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Abstract

Investigation into an eighteenth century spider in the collection of the Hunterian Museum, Glasgow, revealed an unusual and intriguing mounting method for a natural history specimen. This article discusses research into how and why the spider had been mounted using such a method, including attempts to replicate it to test the theories developed. The specimen exhibits interesting aspects of preservation linked to historical collecting practices of the period.

Biographies

Geoff Hancock is Curator of Entomology in The Hunterian, University of Glasgow, based in the Zoology Museum since 1997. After studying Zoology at the University of Bristol a career in natural sciences in museums followed from completing the postgraduate course in the Department of Museum Studies (University of Leicester), 1970. Previous posts have been at Liverpool Museum, Bolton Museum and Art

Gallery and Glasgow Museums (Kelvingrove). Main research interests are in the systematics of nematocerous Diptera and the history of insect collecting and museum collections with a fairly even division between these subjects in numbers of publications.

Georgie Brown studied and worked in several research laboratories at Sydney University for 15 years before obtaining a degree in Biological Sciences from Central Queensland University. In Cairns, north Queensland, worked for the Tropical Public Health unit carrying out research on mosquito vectors of viral disease. During this time joined an expedition collecting and surveying insects in the forests of Papua New Guinea. In 1997 moved to the U.K. and completed a certificate course in applied Parasitology and Medical Entomology at the Liverpool School of Tropical medicine. Became research assistant at The Hunterian from 2005 – 2008, employed with a Leverhulme Trust funded programme researching history of William Hunter's insect cabinet.

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Materials and suppliers

[We didn't use any materials for this work apart from the bit of wire, a piece left over from some gardening work at my house ! I have slightly embellished the description of it in the text and hope this is sufficient.]

Please could you provide a list here of all the materials you used for your replication and the addresses of the suppliers ?

Captions

Fig. 1 Mygalomorph spider dating to between 1768 and 1783 showing wires appearing at tip of abdomen and near apices of legs.

Fig. 2 X-ray image of spider showing hooked wires extending from one leg to another on opposite side of the body. Shorter wires connect other appendages. Of particular interest are the separate short wires holding each of the terminal leg segments in place.

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Fig. 4 Contents of a jar of fifteen spiders that have been used for teaching.

Fig. 5 Modern spider showing wire being deployed to connect and attach the second right foreleg and left hind leg.

Fig. 6 Fluoroscan of eighteenth century spider

Fig. 7 Fluoroscan of modern spider

Fig. 8 Modern spider with legs re-wired in place and entomological pin inserted through centre of cephalothorax to allow placing in an insect drawer.

Fig. 9 Spider with wires visible in legs from Macleay Collection, EN2013.262

Fig. 10 X-ray of Macleay specimen, EN2013.262

Fig. 11 X-ray of Macleay specimen, EN2013.263, pin positions indicate fractures were limited to the bases of the legs. The other pins and a piece of wire may have been deployed later.