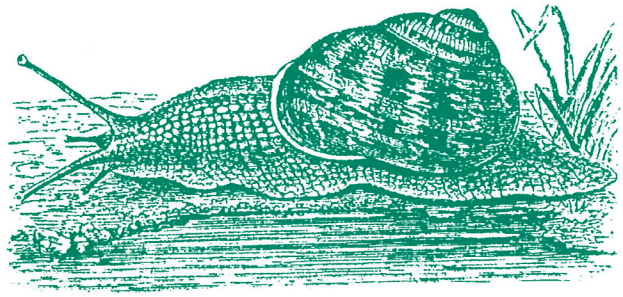
BIOLOGY CURATORS GROUP



NEWSLETTER

May 1994 Vol 6 No. 4

"Here it is at last" I hear you all exclaim as the entire natural sciences staff of every UK museum rushes to open the latest and slightly overdue edition of the newsletter. Well unlike the Museums Journal we do not carry job advertisements on our back pages although there is something approaching one below. The attraction of this issue lies in the complete set of papers from last years spirit meeting which will be of great practical use to members. In order to fit everything in you will be pleased to hear that the editor edited out the editorial. However please note that this is likely to be the last newsletter before the first issue of *The Biology Curator* later in the summer. Meanwhile please continue to send in notes, reviews, moves and postings. This is your publication, please support it!

PEOPLE

Outside of the large research institutes it is not particularly common for museum staff to be allocated resources for research involving more than a trip to the local SSSIs for surveying. It is particularly gratifying to report the enlightened attitude of the management of the National Museums and Galleries on Merseyside who did make sure that such resources were available to BCG member **Clem Fisher** who has recently returned from Australia where she was following up her research into the activities of John Gould's collector John Gilbert. Clem was able to take up a three-month fellowship at the Macleay Museum, Sydney where she worked primarily on a transcript of the diary which Gilbert kept during the Leichhardt Expedition of 1844-45. She also examined in detail the museum's collection of 9000 birds and mammals, naturally rich in australasian species, which contains specimens from the Layards, father and son, who also sent specimens to H.B. Tristram now in Liverpool's collections. Clem was able to recognise at least 250 Layard specimens in the Macleay collections, some from type series and others which represent rare or extinct species. All in all Clem's trip seems to have highly worthwhile for all concerned. Well done Liverpool for making it happen. Other museums please note well.

Congratulations to BCG member **Maggie Reilly**, Curator of the Glasgow Hunterian Museum's zoological collections on the safe arrival of a son earlier this year. We understand that Maggie will be returning to work after her maternity leave but too late to travel with the University expedition to Trinidad. **Geoff Hancock** of Glasgow's Kelvingrove Museum will be going to examine the entomological predators on the amphibian populations of the native forests there.

It was the pursuit of international efforts to study and conserve plant biodiversity that took **Professor David Ingram** FRSE, Regius Keeper of the Royal Botanic Garden Edinburgh, to the Komarov Botanical Institute in St Petersburg in December last year. Here a UNESCO-funded conference focused attention on the plight of the many important botanical collections held in the countries of the former USSR. These are now desperately starved of resources and the conference addressed the action needed to ensure their future integrity. The herbarium of the Komarov Institute alone holds over seven million dried plant specimens and is of global importance. (This note originally appeared in *The Botanics* Issue 16 from which it is reproduced with thanks).

Sally Cowan, previously a technical assistant at the Australian Museum with experience of curation and field collection of insects and spiders as well as their computer documentation, is in the UK and is looking for temporary work (preferably paid). Likewise **Peter Rowland**, an ornithologist, will be here in August. Both are British passport holders. If you can assist please contact Clem Fisher on 051 207 0001.

Mark Simmons is also available for paid employment, the one year flood recovery scheme here in Perth,

Scotland having come to an end. This is not the place for testimonials but anyone wanting confirmation of the high standard of Mark's curatorial skills should contact the editor.

Tatton Park, Knutsford is looking to reinstate its collection of ethnographical/natural and social history items in the historic Tenants Hall Museum at Tatton. The project includes the preparation of an action plan for refurbishing showcases and redisplaying a wide range of exhibits, as well as carrying out research and documentation to provide a detailed inventory and catalogue to the collections. Assessment of objects for conservation treatment is included in the project brief which should result in the production of a detailed, costed collection management plan. For further details of the project, which is funded by the North West Museums Service and Cheshire County Council, contact Maggie McKean, Collections Officer, Tatton Park, Knutsford, WA 16 6QN. Tel: 0565 654822.

DIARY DATES

Not much to report in this the quiet season for meetings

26-29 May 1994. Paris. Meeting of the Natural History Committee of ICOM on Natural Sciences, Environment and the Educational Role of Museums. The meeting has to prepare a proposal for the triennial action plan of ICOM to be adopted at Stavanger next year. The meeting will include visits to the new Galerie de l'Evolution at the Museum National d'Histoire Naturelle the Arboretum of Chevrelpoup near Versailles and a natural history museum outside Paris. For further information see below.

12-16 Sept 1994. Museums Association Conference Brighton. Watch out for the BCG/UKIC session on orphan collections.

BCG Study Trip To Amsterdam/Leiden

Nov 2-6 1994. Yes, BCG can truly claim a genuine interest in the European museum scene with this our second foray into the dark continent. The trip has attained a critical mass and will now certainly proceed. Travel has been arranged via Hull and the coach will pick up in London and Doncaster. The price (approx £160) includes accommodation in a twin berth cabin, dinner and breakfast on the ferry (have you seen the size of those breakfasts !?) on the outward and return journey and accommodation (half board) in a twin room in Amsterdam. Offering excellent value for money, this is an opportunity to see some very important collections and partake of good food and terrific company. Our welcome is guaranteed to be a warm one and staff of the museums involved have been very supportive. Members and non members alike are welcome (subject to availability) so please tell your colleagues. Further details from Kathie Way, Zoology Dept., The Natural History Museum, Cromwell Road, London SW7 5BD.

19-21 April 1995. Manchester. International Conference on the value and valuation of Natural Science collections. A major meeting. First circular out. Further details from the Valuation Conference Secretariat, Manchester Museum, University of Manchester, M13 9PL.

1995 Stavanger. ICOM 95. Will include sessions on the theme of Museums and Biodiversity. See below.

ICOM

BCG has recently made contact with the natural history committee of ICOM through its UK representative Christopher Hill. There is no doubt that the UK has largely remained in blissful ignorance of the existence of this organisation, a situation which we will rectify with future notes of forthcoming meetings etc. I am sure Dr Hill, 12 Clarence Road, Kew, Surrey will be pleased to supply any further details of the events noted above. ICOM membership can be obtained via the UK Treasurer, Bob Bracegirdle, Scottish Fisheries Museum, St Ayles, Anstruther, Fife, KY10 3AB. The current annual subscription for individual membership is £35. Watch this space for more details.

WANTED

Request for scientific literature - do you have any scientific books or journal series that you no longer use and would like to donate for distribution to Cuba? The Association of Systematic Collections is developing a programme to exchange systematics and biodiversity information between the USA and Cuba. ASC will arrange shipment of any books etc. Please contact Elizabeth Hathway, ASC, &30 11th Street NW, Second Floor, Washington DC 20001-4521.

Microlepidoptera of Middlesex, an appeal for records - by the London Natural History Society which is now working towards the publication of a checklist covering the entire area of vice-county 21. Further details of this five year project and the form of data required are available from the London Natural History Society's lepidoptera recorder, Colin Plant at the Visitor Centre, East Ham Local Nature Reserve, Norman Road, London E6 4HN. All communications will be acknowledged and records from outside Middlesex from mixed lists will be forwarded to appropriate recorders.

Pick up a polecat! - there has been considerable interest recently in the pattern of spread and genetic status of the Polecat (*Mustela putorius*) in Britain studied by the Vincent Wildlife Trust's Polecat Project. (See British Wildlife volume 5, no 1 for an overview). Several museums in the English Midlands - currently the main area of spread - are playing a key role in recording and publicising the polecat story (three museums now have specific displays on the polecat). Recent evidence suggests that in addition to naturally spreading from its Welsh stronghold as far as Warwickshire, Derbyshire, Oxfordshire and Wiltshire, it has reappeared in parts of its former range in

Cumbria and Argyll as a result of *ad hoc* reintroductions by private individuals.

It is difficult to keep track of such covert efforts and odd occurrences of the species can no longer be instantly dismissed as polecat-ferrets or hybrids. Dr Andrew Kitchener at the Royal Museum of Scotland is assessing the extent of cross-breeding between polecats and feral ferrets based on skull morphometrics, pelage examination and DNA fingerprinting (the latter in collaboration with Dr Huw Griffiths at Leeds University).

A large sample of undamaged polecat, feral polecat-ferret and hybrid corpses from across Britain are needed if the project is to succeed. Andrew would be grateful for access to any specimen handed in to local museums and can be contacted on 031 225 7534.

Any curators interested in promoting local publicity on the polecat's recovery may apply to the Vincent Wildlife Trust's Polecat Project at 3 Knell Cottages, Harcourt Road, Mathon, Nr Malvern, Worcs WR13 5PG, for a free sample of polecat leaflets and associated artwork.

PUBLICATIONS

Wilthew, P. 1994. *Bugs, or beating unwanted guests.* SSCR Journal Vol 5 (1). - is an account of the 12th meeting of museum conservation scientists at the V&A last november with outlines of speakers accounts of pest control strategies, monitoring and treatments.

In the USA the ASC has published the report *Guidelines for Institutional Database Policies* the result of its two year study and workshop on data sharing and database ethics. Although the sections an the law relating to data are not likely to be of practical use to BCG members, sections on data sharing agreements, data sharing, transfer policies and the responsibilities of owners and users could be of use in developing models in what is as yet a very poorly developed area here.

Goulet, H. and Huber J. (eds) 1993. *Hymenoptera of the world: an identification guide to families.* Published by Agriculture Canada and available via Books Express, PO Box 10, Saffron Walden, Essex CB11 4EW. (Price approx = $63.35). A fully illustrated, minimal jargon key to all 99 families of Hymenoptera and to the subfamilies for the ichneumonoid wasps and the aculeates.

Back Issues

All parts of BCG Newsletter are available from the editor price £2.50 incl. GB p&p **except** the following:

Vol 1 parts 7 and 8
Vol 2 parts 1 and 3-7 inclusive
Vol 3 part 1
Vol 6 part 1

Masochist Needed

All volumes of the BCG Newsletter up to and including volume four were indexed. There has been no index for volume five thus far because no-one has volunteered (or been volunteered) for what can only be described as the equivalent of hard labour. Would anyone with a particular desire to indulge in this secretive and highly specialist activity which I suspect has been carried out in secret for generations by a band of dedicated disciples please contact the editor?

PAPERS FROM THE SPIRIT MEETING OF 25 OCTOBER 1993

The following papers have been submitted by speakers at the highly successful BCG meeting at the NHM last year, including those which for various reasons could not actually make it on the day. They provide a particularly useful compendium of practical knowledge and the editor would like to thank not only the authors for their valuable contributions but also Jane Mee (Ludlow Museum) for her tenacity in eliciting such a complete account of the day for the benefit of BCG members. The presentation of such a mass of useful information bodes well for the proposed metamorphosis of *BCG Newsletter* into the *Biology Curator.*

ON THE STATE OF PRESERVATION OF DNA FROM MUSEUM SPIRIT COLLECTIONS.

Museum collections around the world contain many millions of biological specimens which are preserved in formalin or alcohol. A large number of these specimens were collected at great expense from remote parts of the globe, and would be difficult or impossible to recollect. Some represent extinct species, and others represent species which are threatened to become extinct in a few years from now. The fact that molecular techniques have progressed tremendously in the last few years has widened very much the scope of museum collections, so that they can now be analyzed in different ways and their study can provide invaluable new information.

The molecular data obtained from DNA work is a precious complement to morphological and physiological studies, and sometimes provides a clear answer to problems that cannot be solved with the more traditional morphological approach.

This is the case, for example, with organisms that display a limited variability or a limited number of distinctive characters in their morphology, and are for these reasons difficult to discriminate or classify.Molecular data can also be used, as in the case of the quagga, to establish the phylogenetic position of an extinct animal, or as in the case of rare and endangered species, to make an informed choice on which conservation policies should be adopted to preserve authentic genetic diversity in critical areas of the world. In other cases the use of museum specimens can facilitate the study of organisms that are temporarily uncollectible for reasons of cost, availability, security, politics or geography.

Spirit collections are very heterogeneous and include all collections of biological specimens which have been prepared by an initial fixation of the tissue and then submerged in preservative fluid and stored in a closed vessel.The purpose of fixation is primarily to arrest the physical and chemical changes that would occur upon the death of a tissue. Fixation aims principally to preserve the overall form and appearance of a specimen and also serves the purpose of sterilizing the specimen, by killing any bacteria or fungi that may be present. True fixation is generally achieved using formaldehyde, which can be used as an aqueous or buffered solution known as formalin (Simmons,1991; Pabst,1987).

Formalin (which may be used in conjunction with other substances like glutaraldehyde or phenol) involves the formation of permanent covalent bonds which link together the molecules that compose a tissue, so that they are unable to undergo rearrangement (Alberch,1985). The fixative serves as the linking agent in this process and it becomes permanently incorporated in the fixed material.In practice, some fixation reactions are not truly irreversible, and dissociation may slowly occur in the absence of excess fixative, or as a result of a fall in pH in the preserving medium, or by treating the specimen with substances able to remove the fixative.

In theory, most fixation procedures are directed at the immobilization of protein, so that in fact nucleic acids and other molecules become fixed almost fortuitously. Nucleic acids also offer some substrate for fixation, as for example amino groups, nitrogenous heterocycles and hydroxyl residues, but some of these are involved in internal hydrogen bonding, and so may not be very reactive (Stoddart,1989).There are several ways in which nucleic acids can be damaged by fixation. DNA can be generally damaged by the cross linking of the molecules, but there are some more specific sites on the DNA molecule which are susceptible to damage. For example, the cleavage of the CN link between the sugar and the base leads to a loss of bases, while the hydrolysis of the phosphodiester bonds at positions 3' or 5' leads to shorter strands of DNA. Moreover, the bases can undergo oxidation, which will prevent the two complementary strands of the DNA molecule to pair correctly (Eglington and Logan,1991).

Since DNA from fixed specimens can present any combination of the four problems mentioned above, it is not surprising that the molecular data from museum specimens is often incomplete and fragmented.

Another important class of compounds widely used in the preservation of museum specimens are the pseudo-fixatives. These compounds are less damaging to DNA, and they are sometimes also used as preservatives. They include ethanol, methanol, industrial methylated spirit (IMS), chloroform, acetone, and acetic acid, and they act by unwinding and disordering protein, and by altering the patterns of hydrogen bonding in the tissues by removing water (Stoddart,1989). The net result of this process is a sort of macromolecular tangling, mainly composed of protein, but also involving nucleic acids and other molecules. This kind of process causes less damage to the DNA and is usually reversible, especially if high percentage ethanol is used both as fixative and as preservative medium. DNA molecules retrieved from specimens treated in such way are usually in relatively good shape.

According to my own experience in dealing with museum specimens, it is possible to extract viable DNA from the majority of specimens. However, the yield and state of conservation of the DNA are very variable. The fact that very often the procedures of preservation for particular specimens have not been recorded in detail means a lot of guess work for the molecular biologist, who will never be able to predict which specimen will yield viable DNA, and may waste time and resources. When I worked with pickled lizards I had at my disposition a few specimens, which ranged from 50 years old to contemporary, and most of them were known to have been fixed in formalin and preserved in IMS. However, I could not refer to a detailed record of the procedure used, concerning for example any preliminary or intermediate treatment of the animal, time of fixing, or if the formalin had been injected, all of which can make a difference in the state of conservation of the DNA. There are still many things that we do not know about the way in which DNA is affected by preservation procedures, and a detailed record of these procedures could help us to study the link between preservation procedures and molecular damage.

Perhaps the most rewarding museum specimen I have ever come across is a hundred years old lizard which had been simply pickled in cheap brandy by a collector and never touched since. It gave by far the best yield of DNA and no problems when it came to gene amplification by PCR, in spite of being much older than the formalin-fixed lizards (Criscuolo, 1992). This is a good example to illustrate the paradox that alcohol is traditionally considered a very poor fixative, compared to formalin, and yet, the oldest fluid museum specimens, which have survived 300 years were prepared without formaldehyde, which came into use only 100 years ago. It is only very recently that curators have begun to realize that formalin-fixed specimens might not last for as long as it had been thought.

The study of DNA from museum collections is a very recent field, and we are only now beginning to acquire some of the specialized knowledge that will be useful to the next generation of curators and researchers.
It is in this context, that I would like to stress a few important points:

a) the age of a specimen may affect the state of conservation of the DNA less than the preservation procedures

b) a detailed record of the preservation procedures helps the molecular biologist tackle some of the problems posed by DNA alteration

c) there is a need to reconsider some of the preservation procedures on newly collected specimens so that they cause minimal damage to DNA

d) there are alternative methods of preservation of animal tissue or of entire specimens for DNA work, for example the use of 90% or absolute ethanol, or deep freezing at –70°C.

Molecular biology is a fast evolving field, and new techniques and applications are constantly being devised that are relevant to spirit preserved museum specimens. Many museums around the world now have molecular biology facilities, and *ad hoc* policies are being introduced to regulate the loan and sampling of biological specimens. Curators and molecular biologists are beginning to collaborate towards a new understanding of specimen conservation, and I have no doubts that in the near future all newly collected biological specimens will be preserved with its possible use in molecular biology very much in mind.

Acknowledgments

I wish to thank Tim Littlewood of the Natural History Museum for his feedback on the manuscript and his advice on the subtleties of the English language.

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Giuli Criscuolo
Department of Zoology, The Natural History Museum

THE REORGANISATION OF THE NATURAL HISTORY MUSEUM'S AVIAN SPIRIT COLLECTION

Introduction

The Natural History Museum's avian spirit collection, currently comprising *circa* 15000 specimens of 3000 species, is the third largest in the world and the one holding the greatest number of species (Zusi *et al* 1982). The collection was moved from London to Tring in 1972 and is now situated on the specially ventilated ground floor of a purpose-built air-conditioned building. Jars of specimens were arranged in family order in accordance with Peters' *Checklist of Birds of the World* (1931-86) and placed on rows of open steel cabinet shelving. Further information on the composition of the collection and on its curation in the mid 1970s may be found in Blandamer and Burton (1979).

Preparation of fresh material had led to considerable expansion of the collection and had created a considerable overcrowding problem. This adversely affected both respiriting and the location of specimens. Fortunately, there remained three empty rows of cabinets set aside for expansion at the end of the collection which could be utilised, and a major reorganisation project for the whole spirit collection was decided upon in 1992.

Aims

-To eliminate the existing overcrowding problem, making specimens accessible.
-To shelf-label and index the collection at the generic level to aid efficient location of specimens.
-To locate and separate all extinct and endangered species from the main collection.

Procedure

Following a preliminary rough assessment of the amount of space each family would require, the rearrangement of jars began. Two staff members working backwards from the end of the collection towards the beginning, arranged the jars for each family in alphabetical order of genus using the free shelving as working space. Once in alphabetical order, the jars were then shifted to their new location at the end of the free shelving and arranged in Peters' order of genus and species. The jars were positioned only 1-2 deep on the shelving to facilitate the reading of specimen labels as well as to assess spirit levels. The bottom shelf of each cabinet was left empty wherever possible to allow for future expansion. Temporary 'post-it'labels were used to list the contents of each shelf of every cabinet.

At the same time all unlabelled, illegible or clearly misidentified jars of specimens were removed from the collection and set aside for a further two staff members to work on. Once the problems were rectified, these jars were re-incorporated into the newly arranged collections.

Jars which were labelled with obsolete generic names were temporarily given 'post-it' notes with their modern names. When the general reorganisation was complete, permanent internal labels were prepared and added to these jars without removing the original labels. All extinct and endangered material was removed from the main collection and incorporated into a separate extinct and endangered collection which is housed, also in Peters' order, in three locked steel cabinets. Once the rearrangement of the collection was complete, new family labels were printed for each

cabinet, and new genus labels for each shelf within each cabinet, using a word processor and thin card.

To facilitate the location of specimens, a comprehensive hand-held index, arranged in alphabetical order, was later compiled, indicating genus, species and their corresponding cabinet numbers. A word processor was also used to print an index of family and subfamily names, again with their cabinet numbers, which was attached to both ends of each row of cabinets.

With the reorganisation complete after a man-year of work, the Natural History Museum's avian spirit collection is now conveniently housed and easy to use. This not only improves accessibility to the collection for both visitors and staff, but also ensures a higher standard of preservation of specimens and therefore should increase the general 'shelf-life' of the collection.

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LABELLING OF SPECIMENS PRESERVED IN SPIRIT COLLECTIONS

Introduction

Many, if not most spirit collections in UK museums have traditionally used paper-based labels. In 1961 it was reported (Ross 1961) that so-called Goatskin Parchment was a satisfactory material for the long-term labelling of specimens immersed in alcohol and other aqueous-based materials. However, like the Holy Roman Empire, the term 'Goatskin Parchment' is somewhat of a misnomer and is actually a rosin-sized wood-pulp paper. Recent changes in the method of sizing (from tub-sizing) causes the parchment to soften and weaken in the preservative solutions after a relatively short period (Kishinami 1989).

The introduction of computer-based labelling systems offered the opportunity to generate large quantities of individual, neat labels quickly and easily. Unfortunately, laser-printed labels were found to be impermanent as they are based on a plastic powder, being heat-fused to the paper. Alcohol and other solutions caused the powder pigment to become disassociated from the paper and fall in a heap at the bottom of the jar.

Solutions

High quality and cellulose papers are found to be resistant to most preservative solutions. Byron-Weston Resistall papers which are of a high quality cellulose material have long been used in the U.S. and are now available in the U.K. Alternative materials have not been so successful for a number of reasons. Tyvek - a spin-bonded polythene material - although resistant to most solvents, floats in many of them and is sometimes difficult to write or print on. Plastic and plastic-coated papers such as Synteepe and Polypaper are also difficult to write or print on permanently (Pettitt 1976).

There appears to be a number of solutions to the labelling problems. Rotring 17 ink (Williams and Hawks 1986) is a suitable writing medium for most paper-based labels, being relatively fadeproof and solvent resistant. Most commercial oil-based printing inks are also fine for immersed labels, but standard typewriter inks can leach out into alcohol solutions colouring them a deep purple. Possible answers to long-life computer generated labelling may involve the use of dot-matrix and ink-jet printers and tests are currently being carried out to assess them.

Recently a number of firms have started producing so-called permanent labelling with both writing and bar-code options. For instance, Computer Imprintable Labels Systems Limited (Unit 30, Home Farm Business Centre, Home Farm road, Brighton, BN1 9HU. Tel 0273 681000) provide a range of durable labelling systems that offer hope for the future of rapidly produced permanent labels.

Perhaps the best current advice, is not to use any Goatskin Parchment that has been purchased in the last ten years, and to use a high quality paper alternative, such as Byron-Weston Resistall paper, or Atlantis Archival Copysafe. Tried and tested inks and printing methods should be continued until the new systems have been adequately evaluated.

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ENVIRONMENTAL CONTROL FOR SPIRIT SPECIMENS

Introduction

There are various external influences that can act on a liquid preserved specimen. Various texts have discussed the properties, monitoring and control of these influences in considerable detail [see refs]. The conditions required for optimum stability of a particular specimen are determined by its current sensitivity to these influences. In turn, this sensitivity is a complex function of response of the individual components and their subsequent interactions when exposed to the external influences. Relatively little research has been carried out into the effects and relative importance of these influences. Although recommendations for standard conditions have been made (MGC 1992), these must be regarded as provisional.

The present state, both physical and chemical, of a specimen is the result of its original state and the changes undergone. This response to external influences is of course superimposed on, or modified by, the internal interactions already occurring between the specimen's components. Frequently the specimen will have reached an equilibrium with the external conditions which it would be unwise to disturb without being prepared for the possible damaging effects of change.

Each of these external influences can be characterised by both its absolute value and by the change in this value. Sometimes the change in a value may cause a shift in equilibrium. Alternatively the absolute value of an environmental influence is inappropriate. The significant external influences on spirit collections are:

* Temperature
* Relative humidity
* Light and UV radiation
* Pollutants
* Mechanical stress
* Oxygen

The influence of oxygen is one of the main factors which fluid storage is designed to remove. The container is usually assumed to act as an oxygen barrier so reducing oxidation of the specimen. This assumption breaks down when the seal breaks down. Effects and control of oxygen concentration will be ignored for the rest of the paper.

Temperature

The absolute value of temperature is not usually considered important when environmental controls are considered. Few museum materials change their properties rapidly or dramatically at different temperatures. Those that do usually involve a change in state. One example is the melting of chocolate (Cox 1993) at about 320C. At about 320C crystals of washing soda (sodium carbonate hexahydrate) decompose to form the monohydrate. It involves a change of crystal form, resulting in the dissolution of the sodium carbonate in the released water of crystallisation.

Similarly, spirit undergoes a change of state, from liquid to vapour. This is encouraged by an increase in temperature leading to an increase in vapour pressure. If one sealed a spirit container at 150C and heated it to 250C, the internal vapour pressure would rise by around 24mm of mercury, or 3200 Pa. On a 4" square container this would be ca. 0.3 N or, 30 gf, pushing the top off.

The typical spirit jar has at least 3 significant components, thermally speaking: the glass jar, the spirit and the air. These have different thermal expansion rates. Like a bimetallic strip, a change of temperature will result in stresses or strains, ie increased fragility or distortion.

Take 1l glass jar with 100ml of space in it. Heat up from 15 to 250C. The glass expands and the liquid expands, so compressing the air which would also like to expand. This results in an increased air pressure of 4% ie about 4000 Pa. If this jar has 2ml of air, heating it up to 15 to 250C increases the air pressure rises by 12% ie 13,000 Pa. To this of course should be added the effect of the increased vapour pressure.

An increase of temperature leads to an increase in internal pressure that is likely to put the seal at considerable tension stress, which is the most damaging stress for the "battery jar" type of seal. It is apparent that the jars are best filled at a slightly warmer temperature than they will be stored subsequently. This will cause the seal to be sucked on tighter, i.e. compression stress. If the seal is airtight a partial vacuum will be maintained which will reinforce the top against knocks. The vacuum will also be improved by the reaction of oxygen, in the air bubble or dissolved in the spirit, with the contents of the jar.

Recommendations for temperature control for storage and examination should therefore include good stability of temperature at a fairly low level, preferably below that of the temperature of the jar when sealed. The MGC *Standards* recommend a value of less that 180C.

Relative Humidity

Assuming that the jar and seal are impervious and unaffected by water in the atmosphere, there should be no interaction between the external atmosphere and the contents. If the seal on the jar is tight, there is no interchange between the external air and the internal bubble. Unfortunately, as any visit to a spirit store will confirm, the smell of alcohol and the cost of its replacement demonstrate the failure of the seals. If there is a leak in the seal, alcohol vapour will leak out and air leak in.

70% alcohol will tend to evaporate ethanol or absorb water, so driving the concentration towards a more dilute solution. The higher RH, the more likely that

water will condense in the spirit. Gradually the liquid will become less and less of a preservative. The lower the RH the less likely is condensation to occur, or conversely the more likely water is to evaporate alongside the ethanol. The vapour pressure of water in a 70% spirit solution is equivalent to around 35% RH. So this RH will ensure that the ethanol and H20 will evaporate at the same rate. Although the level of the liquid in the jar may be dropping, at least the preservative properties will remain the same. A low RH will also contribute to the lack of rusting of metal clips on bottles etc., though it will not reduce the internal rusting of metal lids due to the contained water and acids. Keeping the RH this low in a storeroom requires the use of a dehumidifier.

Light

All the components of the specimen will be affected by the energy in radiation to some extent. The effect of light on the water and any dissolved oxygen will tend to produce radicals which react rapidly with susceptible groups in the specimen. This is the principle of bleaching by light used for linen and in paper conservation. Various components of the specimen will react, the colouring agents, dyes and pigments, being particularly reactive because both of the absorption of radiation and of the presence of unsaturated chemical groups, such as double bond sequences, which are easily oxidised.

The ultra violet radiation is of course more energetic and damaging than visible radiation. The glass of jars will absorb the most energetic wavelengths of UV but will still allow through quite a bit. Also the liquid itself will absorb some of the UV. However about half the fading of (textile) colours is caused by the UV component of sunlight. The rest is caused by the visible component. Only a small proportion of this is absorbed or reflected by the glass and liquid. The most accessible reactants are those in solution, so light will encourage the degradation and discolouration of the fluid. This is probably one reason for the staining of jars as the degrading materials react nearest the light source.

Light also supplies energy in the form of heat to the jar, which might act as an effective greenhouse. Light will go in but infra-red radiation cannot come out. Care must be taken to limit the exposure of jars to strong light for this reason. The MGC *Standards* recommend a maximum of 200 lux and the complete elimination of UV radiation. In general it is sensible to prevent light exposure, except when viewing is required. This can be achieved simply by switching off the lights in blacked out store rooms. Alternatively one can use storage cupboards whose doors are shut and opaque.

Pollutants

Dust and grime are the most obvious pollution problems, especially in major cities. This can obscure labels and make handling unpleasant - or even dangerous. Preventing, by filtration, the dust from entering the store room can be expensive. High levels of pollutant gases, sulphur and nitrogen oxides will affect the labels, but can also diffuse into the jars, though less readily than H2O and O2.

Controls

Air extraction is usually necessary in spirit stores. The seals on jars are seldom good enough. Leakage of alcohol and formaldehyde into the air creates hazards, mostly toxic. If people are working in the room, the levels must be kept down to the Occupation Exposure Standards, OES for ethanol 1000 ppm (HSE 1991), and preferably lower for comfort reasons. We were advised (F. Howie) that 70% ethanol was not a fire risk, though it is of course sensible to take precautions against build-up of vapour, sparks etc. In practice in our spirit store room, we find that an air change rate of ca. 5-7 changes/hour is the minimum to keep the atmosphere tolerable. This means sucking in air at a rate faster than could be practically filtered or dehumidified. As a result, the shelves and jars become dirty. Fortunately, the RH in the building is already fairly low throughout the year. We are addressing this problem by a programme of rebottling into more secure jars, as finances allow.

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WHAT FLUID IS IN THIS BOTTLE?

One of the most tedious and necessary chores of museum curators is the maintenance of fluid-preserved collections which involves a great deal of topping up. Although museum jars are being developed to reduce evaporation it still occurs. Polythene acrylic tape (PEA tape) wrapped around the junction of jar and lid has been found to reduce evaporation even further (Steigerwald and Laframboise, in press - SPNHC *Collections Forum*).

None the less curators are faced with daunting rows of jars containing (normally) colourless fluids and either resort to:

1. Nasal analysis - Health & Safety Officers get very twitchy as the results can eventually be disastrous to the health of the curator.
2. Filling the jars with museum spirit and never mind if the specimens are in formalin - disastrous for the specimens.

3 Filling the jars with water - even more disastrous for the specimens.

Alternatively they can use:

4 Leuco-basic fuchsin impregnated papers which go pink with formalin and other aldehydes (including curators' hands) which may be fine but can be messy, time consuming and the curator is still inhaling fumes from the discarded papers.

5 Use an LCD readout specific gravity meter - a small amount fluid is sucked into the meter using a rubber bulb and a precise readout of the fluid's specific gravity is obtained - fine for alcohols but it will not distinguish between low grade alcohols and formalin; the meter is expensive and slow to use.

6 The Simon Moore method (below). Although this also does not distinguish between low-grade alcohols (of which there should be none in your collection!) and formalin it has the advantage of being much faster, cheaper (home-made), much safer (no sniffing) and it's accurate!!

You will need: a dropping bottle with reservoir and mapping pins of assorted colours with heads small enough to fit into your dropping bottle reservoir.

1 Make up a range of those preservative solutions for which you will be testing.

2 Remove heads of red, yellow and blue pins using pliers (these colours are not obligatory!).

3 Test flotation of pin heads in solutions and replace pins (point first) into pin heads to weight them.

4 Trim off pins to various lengths so that some will float, some will sink in the various solutions: eg yellow has no pin, red has half a pin, blue has pin right through.

5 When each pin has been trimmed to correct weight, push the remainder of the pin into the head.

6 Put weighted pin heads into bottle's reservoir.

7 Test - suck up fluid into reservoir, give a shake to get rid of any adherent air bubbles, note the distribution of floaters and sinkers:

8 Yellow will float below 55% alcohol and in 10% formalin, it sinks in 60-80% alcohol; red will float in 30% alcohol and 10% formalin, it sinks in 50% and 70% alcohol; blue floats only in formol-glycerin.

9 A simple method of just distinguishing between 70% alcohol and formalin will only require one red ball - floats in formalin, sinks in alcohol (if strength greater than 55%).

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A SHORT NOTE ON PRESERVATIVES THE IDENTIFICATION PROBLEM - A POSSIBLE SOLUTION

During the course of a one year, externally-funded conservation project in the Hunterian Museum (Zoology Section) in Glasgow, work was undertaken to address a backlog relating to various parts of the collections, including the wet material. Some 2,000 jars were dealt with in the available time.

The main problem encountered in this project with regard to preservative was one of identification. Many curators rely on smell, but this was obviously not to be recommended where some of the jars contain formalin or unidentified, possibly toxic, fixatives or preservatives. There is a published method using a strip test to distinguish between formalin and alcohol, but it was found to be difficult, time consuming and expensive to make the strips up. The method used in this project to tell preservatives apart was more or less discovered by chance while labelling the jars.

It was found that a strip of Goatskin Parchment label (8mm x 20mm), when dropped flat on the surface of preservative behaved in different ways:

* Alcohol (down to about 30%) will soak through the paper immediately and the label sinks after a short time.
* Formalin (even at low concentration) repels the paper and the label will float on the meniscus for a long time, sometimes curling up at the edges.
* Phenoxetol is neutral, being mostly water, and the label sits flat on the surface for a time until the fluid slowly soaks through.

Although this method has not been rigorously tested, it never failed in use, and sometimes identified alcohol when the nose could not. It also identified the common situation where the preservative is mostly alcohol but with a little formalin residue from the fixing process (this mixture frequently fools the strip test method). With practice, it was also possible to recognise some other preservative types, eg alcohol with glycerine. At the very least, the method readily identified formalin which the nose should never be allowed near!

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Hampshire Museums
(Curatorial/conservation assistant at the Hunterian Museum 1992-93)

LIQUID PRESERVATION - HOW LITTLE WE KNOW

There is a wealth of information in specialist books and journals on the liquid preservation of biological material, but very little of this concerns plants. Following the reorganisation of the science departments at the Natural History Museum in 1990 a newly-formed Curation Programme undertook the task of monitoring and improving methods of specimen conservation. In my role as Curator of Algae I had to decide the fate of the largest liquid-preserved collection in the department as well as manage other disparate holdings, such as pressed herbarium specimens,

microscope slides and rocks housed in packets and boxes.

Recently, I began the search for published information on fixatives and preservatives specifically tailored to suit a range of botanical material. To my surprise I discovered that very little research has been carried out on the liquid preservation of plants and that the long-term effects of preservatives on gross and fine structure are not well documented.

Why liquid-preserve in the first place? Some plant groups, such as succulents, do not lend themselves readily to the squashing and drying which is used for the preparation of traditional herbarium specimens. Similarly, the flowers and fruits of some groups, such as orchids, are difficult to dissect out when dried and, therefore, have been preserved routinely in alcohol.

Illustrators prefer to draw plants fresh or liquid-preserved, rather than dried, and where an accurate measurement is essential it is easier to obtain dimensions from wet-stored material than from specimens glued flat to a herbarium sheet. Micro-algae and diatoms are usually liquid-preserved in the field and the samples taken back to the laboratory for processing onto microscope slides and identification, unless the researcher has the opportunity to examine the fresh material immediately after collection.

It is likely that most curators of higher plant wet stacks use 60% or 70% industrial methylated spirit (IMS, aka alcohol) as preservative, whilst algal material will be in 3-5% formaldehyde (8-10% formalin). Health and safety issues have highlighted the possible dangers of exposure to formalin and this, combined with its unpleasant smell, has encouraged many curators to transfer their holdings to alcohol. This may be better for the safe handling of material but what of the effects on the specimens? The collection has to be the important issue here, not the convenience of the curator. It is quite possible to plan a facility and practice for the safe handling of formalin-preserved material which will also satisfy Health and Safety requirements. In your wet stacks you could be using alcohol, formalin, the two combined or mixed in various proportions with other substances.

What to use for the successful, long-term preservation of a wide range of botanical material should be the objective of the conservator or curator. Should different materials be preserved in fluids specially devised to suit their particular requirements or will one universal preservative suit all? To change the fluid, or, if the collection has been neglected, to leave it dry or top it up? Do we know what actual mix and strength of preservative was used for an old, inherited collection? All these questions are of vital importance but when we look for answers we find a deplorable lack of hard facts.

For a range of, apparently, tried and tested fluids for fixing and preserving biological material there are some published accounts, eg Horie (1989); Wagstaffe & Fidler (1955 and 1968); and for botanical material only, Bridson & Forman (1992). Unfortunately most recipes are not accompanied by a reference to any previous experimentation or laboratory testing, and are handed down like "tablets of stone". Most of the assessments of long-term effect are based on zoological and pathological material and are no real basis for use with botanical specimens, where the tissues are so different.

This article seeks to promote an awareness of the problem amongst curators and asks them to search out references, unpublished data or any information that will improve the maintenance of botanical wet stacks. If, from your own or a colleague's experience, you know of date-lined, documented collections I would be grateful for data on their condition so that I can start a do's and don'ts of botanical liquid preservation for publication at a later date.

Meanwhile, a few "in-house" experiments are planned which will monitor the effects of different preservatives, methods and storage conditions in both the long and short term.

One positive contribution to our knowledge of fluids in the preservation of botanical material is that of Page (1979). He carried out experiments on conifer specimens hoping to find a method that would prepare them for eventual dry or herbarium storage. His chemical pre-treatment involved the use of ethyl alcohol and glycerol but immersion was temporary and the material was not stored wet.

There are other treatments where fixation and preservation are adapted to the specific needs of electron microscopy or cytology and these topics are not covered here. Finally, the question of appropriate containers and storage is almost as important as the preservative used and there is still no real solution for the large, older collections housed in less than perfect conditions. The resources needed to re-bottle and re-house these specimens are enormous and the final decision should be the right one based on adequate research. Here at the Natural History Museum a long-term study of containers has persuaded the Zoology Department to abandon all but ground-glass stoppered jars for alcohol-based storage. However, in the Botany Department we have had good results with the use of the so-called "Copenhagen" or "Danish" museum jars supplied by Grathwol. Our formalin-based preservatives does little damage to the plastic snap-top lids, unlike the alcohol used in zoology, which makes the plastic brittle and liable to split.

Comments on, or answers to, the questions raised above are sought by the author who will endeavour to make the findings available to all those who are interested.

In conclusion

Both published and unpublished data, including casual observation, on botanical material in liquid preservation needs to be collated and evaluated.

Where a new collection is set up, or an old one re-curated, the opportunity to monitor the condition of the specimens should be taken.

Experiments should be set up to assess the long-term effects of diverse preservatives, containers and storage conditions on a wide range of plant material.

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LIFE AFTER DEATH II

An account of the UKIC Natural Sciences Conference

24 Feb 1994 at Liverpool Museum

Well, having been many moons in gestation the first UKIC natural sciences section meeting finally blossomed at Liverpool Museum. Possibly to ensure that this meeting would be at least slightly different, no sooner had we arrived than the fire alarms went of and we all had to troop out into the cold and damp Liverpool morning. This was only a temporary diversion however, and not enough to stop the meeting starting on time.

Having renewed our by now cold drinks, we got down to business. We began with Simon Moore and his chums, who had plenty to show us from their study trip to North America. It turns out that even the Canadians have their problems, despite the glowing reports we often get from there - which is not to say they haven't achieved an enormous amount which they clearly have.

Wendy Simkiss continued the morning with more studying, this time closer to home, in Cambridge, where she spent eight weeks on the geological conservation course. This looks like an entertaining as well as an educational experience, but it was pointed out that few curators were going to be able to get an eight week slot to attend the course. Anything shorter possible?

Jeanette Pearson told us how they had gone about restoring the Maidenhall Mammoth to at least something like its former glory. A very interesting talk showing how less than ideal conditions were coped with, something which most of us regard as the normal state of affairs.

Adrian Doyle completed the morning with a wry account of the refurbishment of the marine reptiles at the NHM. I thought that it was a pity that more hadn't been done on the interpretation of the material. After all, it doesn't come much better than this. (PS - have you got any spare ones ?)

Following a superb lunch, Kirsten Walker opened the afternoon session by showing us how they were going about improving the lot of the collections at the Horniman Museum. Again, another story of coping with dubious circumstances, and a major undertaking which would be interesting written up as a case study.

Marion Kites' contribution was in some ways the most interesting of the day dealing as it did with the conservation of natural history material after it has been turned into social history material in the form of clothes and ornaments. This is an angle that most of us rarely consider.

Jenny Moore gave us a light-hearted account of two problems currently being dealt with at the NHM, namely how to deal with an herbarium when someone has dropped a bomb on it, and what to do when your glue has been turned into condoms. Whatever next!

Angus Gunn finished off by giving a summary of a recent survey of methods and materials used in British herbaria. It was a pity more people didn't respond to the requests for information, but the replies that came back revealed a surprisingly wide range.

The afternoon session was followed by the section's AGM, which included a short time for discussion - people were examining their watches by this time. The one issue which was discussed was the provision of training in conservation. No conclusions were drawn on this occasion but it is an ever recurring topic and an area the section could usefully contribute to.

As you can see, a wide-ranging meeting, and a very appropriate first meeting, giving us a taste of what we might expect to see covered in future events. It was reassuring to see such a good turnout, as the attendance of over fifty delegates exceeded the current membership. Hopefully this will increase as a result of the meeting. I was a little disappointed to see so few curators (only a dozen or so) as we had hoped the section would draw together the curatorial and conservation communities, but perhaps we will do better in future. All in all, an enjoyable and promising meeting. Our thanks to angus and his colleagues for their excellent organisation.

Steve Thompson
Scunthorpe Museum

LETTER(S)

We have one this issue - a massive improvement on the last. Is there anyone out there? Opinions, contradictions new facts and snippets are always welcome and help to add a topical flavour to the regular meat. Please feel free to contribute your views in this section.

Re the item referring to Emerald Collectibles in BCG Newsletter vol.6 no.3 (Jan 1994). I must question whether these eggs are such wonderful replicas as is claimed. I have, admittedly, seen only one, that of the Golden Eagle, which struck me as such a poor fake that it would not have deceived a child for five minutes. It would certainly not have deceived any curator who had any experience of eggs. I must also point out misleading statements in the description of Colin Harrison "for 26 years curator of the British Museum's famous collection". Firstly, the British Museum has no egg collection, famous or otherwise. The collection referred to is that of The Natural History Museum, formerly the British Museum (Natural History), now housed at Tring. Secondly, Colin Harrison was only ***nominally*** *curator of this collection for 26 years. He actively curated it for no more than 10-11 years. All the curation that has been done on it since it was moved to Tring in 1972, has been done by myself. Colin Harrison retired some years ago and has no connection with the collection now. It should also be pointed out that, contrary to the implication carried in the advertisement, The Natural History Museum collection was in no way connected with this project.*

Michael P. Walters
The Natural History Museum, Tring

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Subscription rates are £8.00 for individual membership and £15.00 for institutional and overseas membership. Application forms from the Membership Secretary on request.

Published and Printed at Northern Whig Ltd.,
Limestone Road, Belfast, BT15 3AH.
 ISSN 0144 - 588X