The Biology Curator

Issue 23 October 2002

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Editors Note

Due to your editor being promoted earlier in the year, with an attendant increase in workload, I have not been able to pursue copy with the usual zeal and fervour so the current issue of The Biology Curator is therefore a bit thinner than of late. As you will read later in this issue, negotiations for the merger of BCG and NSCG are underway and this may mean that the next issue of the Biology Curator could be the last. I would like to therefore make an appeal to BCG members for papers, articles and short communications you may have been wanting to write, particularly any reminiscences, anecdotes, stories etc from the last 27 years of the groups existence. All contributions gratefully received.

This would also seem an opportune moment to remind the various good people who agreed to do write-ups of the trip to America earlier this year for their copy. Many thanks to those who have supplied their write-ups.

Insect Pests in Museums 11-12th March 2003 The Natural History Museum

A 2 day course led by David Piniger, of interest to those with responsibility for natural history specimens, ethnographic collections, folk collections, textiles etc. Covering: pest monitoring and control and pest management among other topics. Further details from:

Sharing our Skills, Education Unit (Administration), Communications and Development, The Natural History Museum, Cromwell Road, London SW7 5BD. Tel: 020 7942 5555

Collections Disposal

Sandwell Museum Service offers for disposal four cases of mounted birds and animals.

Due to the recent decoration of Wednesbury Museum and Art Gallery, Sandwell Museum Service has four cases of taxidermy available for transfer. The cases were previously on display within the entrance hall at the gallery and due to severe storage and display restrictions cannot be accommodated elsewhere.

As a registered museum service we are committed to the Museums Association guidelines upon disposal of museum objects and are therefore making every effort to ensure that these objects remain within the public domain, preferably at another registered museum site.
The items are:

Case 1: 7 bird specimens (various species), 1004mm (W) x 1820mm (H)

Case 2: 8 pheasants, 1003mm (W) x 1800 (H)

Case 3: 1 fox and 1 rabbit, 708mm (W) x 1005 (H)

Case 4: Various bird species, 093mm (W) x 1005mm (H)

The specimens in case 1 require extensive cleaning and conservation, all other specimens are in fair condition.

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BCG/NSCG Merger Meeting

NHM Entomology Seminar Room, 1pm, Wednesday 24th July 2002.

As instructed by the AGM at Norwich, here below is a report of the business conducted at the first BCG/NSCG merger meeting.

- Attending:- NSCG: Simon Moore (Chair), Kate Andrew, Paul Brown & Donna Young.
  BCG: David Carter, Nick Gordon, Howard Mendel & Steve Thompson.

Chair of the committee

Simon Moore agreed to chair the series of merger meetings and that the post of chair will revolve amongst the committee if he was unable to attend.

- Committee confirmed understanding of the remit given to them by BCG & NSCG AGM's "to write a constitution for the combined organisation and recommend the mechanism for merging".

The Structure of the new group

It was decided that the new organisation should have a central Executive Committee. The Executive Committee will have the power to form subcommittees, as the need arises, to cover 1. Conferences & Meetings, 2. Publications, 3. Membership & Publicity, 4. Collections Management & 5. Conservation.

It was noted that the structure and constitution of the new group should be established so as to allow GCG to merge into the new group at a later date, should they so wish.

Charitable status

The Charity Commission was approached and based on their communications, four options were put to committee:-

1. For BCG to gain charitable status and then merge with NSCG charity. BCG is already considered to be a charitable organisation but is not registered as such.
2. For BCG to be subsumed into the NSCG Charity with change in NSCG constitution to accommodate BCG.
3. For NSCG to close and move into the BCG with change in BCG constitution.
4. For both NSCG and BCG to wind up at next year's AGMs and for both to hand over their assets to one new charity to be set up before next year's AGMs.

Proposals 1, 2 and 3 would be more complicated and require extra general meetings so would take longer to achieve merger. All present agreed that proposal 4 be the best way forward as the process should be as swift as possible.

Committee decided that we should follow option 4 and set up a new charity, dissolving both groups into the new charity at next year's AGM's. The Inaugural meeting of The New Charity would then take place immediately after the two final AGMs. The Trustees of The New Charity will initially comprise of the members of the merger committee.

The new (April 1998) Charity Commission "model constitution" provides a much less complex method for composing a charitable constitution than when NSCG established their charitable status. A new charitable constitution will be written up using the form and agreement on the new Name, the Objects and the Powers for the New Charity will constitute the main area for discussion.

Constitution.

The following set of Objects for the New Charity were presented to, amended and agreed by committee:-

1. To raise public awareness and appreciation of the scientific and cultural value of natural sciences collections.
2. To promote the highest standards in the management, preparation, conservation, care, interpretation and research of natural sciences collections and specimens, for the benefit of the public at large and other users.
3. To encourage exchange of information between individuals and institutions about natural sciences collections and records.

Finance & Membership Fees.

Subscription rates were discussed and will be set between the NSCG membership rate of £10 and will be lower than the combined NSCG/BCG combined rates of £18. A higher rate for Institutional membership is envisaged. Overseas members may not be charged extra as yet.

Publications.

This will require a subcommittee to agree to a new, possibly peer reviewed journal to be published once a year and a newsletter to be published three times a year. This will take some time to develop and might evolve from the improving Biology Curator. The respective editors for BCG & NSCG would be part of this committee with possible referees for peer review. A possible name for a publication could be 'Natural Sciences Collections' or 'The Natural Sciences Collector'.

A Name for the new, combined group.

The name 'Natural Sciences Collections Association' (NSCA, NaSCA or NatSCA) has been selected. Committee agreed that NSCA had the benefit of describing the group accurately, and was all encompassing including a full geological remit as well as the biological and conservation ones. [There is another group using the acronym NSCA (Natural Science Collections Alliance). However, they refer to themselves as the NSC Alliance, and as this is a relatively small American group, there should not be a conflict.]

- Until the merger has actually taken place, the general business of BCG and NSCG will continue as before.
- Decisions made by this committee must be communicated to the NSCG and BCG memberships. This should be in the form of selected bullet points published in 'The Biology Curator' and 'The [NSCG] Newsletter'. These could also be passed on to the Geology Curators Group via Steve Thompson. It was agreed that the process should be as open as possible, with all members being kept up to date with the progress of the merger committee.
- It was agreed that the meeting had gone extremely well and had been well chaired.

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Mammal Collections

Curation, Conservation and Uses

Grant Museum of Zoology, University College London, Gower Street
17th December, 2001

The following two papers complete the previous issues write ups of the mammals meeting.

The Conservation of Vertebrate Collections

Julian Carter, Conservation Officer
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Vertebrate collections are used in a whole variety of ways within the museum environment including display, education and research. Put together our vertebrate collections are a valuable resource. The range of material that forms these collections is very diverse. This includes the traditional 'stuffed animal' or taxidermy mount; skeletal material; study skins; fluid preserved collections; freeze dried material; models and casts; and associated documentation. *(NB. Fluid preserved collections have additional conservation issues to those discussed in this brief article).*

When considering the conservation of these collections it is important to consider what is meant by the term 'conservation' . A suitable definition could be *'the employment of best practise to prevent or arrest the long term physical deterioration of natural science specimens, along with associated artefacts and documents to preserve their scientific and cultural worth'* (Carter and Walker, 1999). Essentially the aim of museum conservation is to halt the processes of deterioration, but to do this in such a way that the specimen is altered or changed as little as possible. Any treatments carried out need to be properly understood and practical to apply. One of the main 'ethics' of conservation practise is to ensure all treatments are 'fully reversible'. In

practise this aim is not achievable, although some degree of compromise can normally be reached.

When considering the care of a collection as a whole there are a number of issues that need to be considered. The use of a form of 'risk assessment' can be useful in order to establish the main risks likely to affect a collection (Waller 1994; Waller 1999). This includes issues such as custodial neglect; insect pests; pollutants; light; humidity and temperature. A good storage environment is vital for the long-term stability of a collection. This includes both the 'macro' environment, which includes the building as a whole, and the 'micro' environment, which includes the storage furniture and units housing the collection. How the collection is to be used will also decide on the approach required for its care.

Museum conservation can be considered in two ways;

1. Preventative Conservation: This includes monitoring the collection area for potential problems, such as pest infestation and environmental changes. The aim is to deal with issues as they arise, not by the time they have damaged the collections. Preventative conservation also includes assessing the stability of materials used for storage and display to ensure their properties are suitable for the long term care of collections. Unsuitable materials can degrade and offgas acidic products causing harm to the collection.
2. Active or 'invasive' conservation: This is where the specimen is affected directly. This can include cleaning and repair, the treatment of pest problems and the movement of collections due to building work or storage furniture changes. It can also include research into specific problems. It is important to record all treatments that are carried out for the benefit of future users and carers of the collection material.

When active conservation is required on a specimen the first stage is to find out what is wrong with the specimen, and to discover the cause of the defect e.g. environmental fluctuation; problems with the original preservation method used; off-gassing products from the storage materials etc. This enables the conservator to decide on the type of action required and to chose appropriate methods and materials, whilst attempting to apply the ethics of conservation! It is worth noting at this point that it is important to take into account health and safety considerations. Many old taxidermy mounts and study skins contain arsenic, and some may contain mercury (often used to treat insect pests in the form of mercuric chloride). A recent edition of the Society for the Preservation of Natural History Collections (SPNHC) publication Collection Forum looks at some of these issues with respect to ethnographic cultural material (text online at www.spnhc.org). These are issues that have to be taken into account, especially when developing educational loan and 'hands on' collections. Also many of the chemicals used in conservation work are potentially dangerous and suitable safety measures should be observed.

There are still many unknowns when developing conservation treatments for natural history collections. However the work of other established museum conservation fields does give guidance into how we can treat our material. Useful work has been carried out by conservators working with art, archaeology, textiles and ethnographic collections and some useful textbooks are available (e.g. Cahan and Haines, 1991; Lee and Thicket, 1996; Timar-Balazsy 1998, Odegaard et al, 2000; Wolbers 2000; Unger et al, 2001). Techniques developed for the cleaning and repair of these materials have been adapted and developed for use with natural science collections.

Museum conservators are regularly called *'cleaners with chemistry degrees'*! However when you start to realise the complexity of the science behind 'cleaning' then this statement is not too far from the truth. The removal of the years of grime that inevitably seems to coat many of our collections is a constant demand, but how best to achieve this dirt removal? Many potential methods exist for the cleaning of specimens (e.g. see Horie, 1989). The most widely used method is to use some form of solvent cleaning. This can involve the

use of organic solvents, or the use of water in some way.

A wide variety of organic solvents could be of potential use with the cleaning of vertebrate collection material. Commonly used solvents are acetone, ethyl acetate and trichloroethylene. Organic solvents can often be the most effective way to remove fats, oils, resins and waxes. However these solvents tend to have some serious health and safety concerns. These materials tend to be highly flammable and carry health risks. Thus they need to be used with care in well-ventilated areas. Another problem is that the action of organic solvents can be too effective e.g. the removal of structural oils from fur and feathers could led to embrittlement of the structural fibres.

Water tends to be the most commonly used cleaning agent. It is the most polar solvent, and when pure is very aggressive in its polar action. Water can dissolve many types of organic and inorganic polar soiling. However its use does require care as water can cause significant shrinkage, swelling and deformation to a specimen. The cleaning action of water can be further improved by the addition of surfactants to the solution. Two main classes of surfactant are available – non-ionic and ionic. Generally the non-ionic class are the most commonly used as these are more stable. Typical non-ionic surfactants are derived from ethylene oxide and this includes Synperionic N (due to be withdrawn from use due to biodegradation problems) and the Tritons. The use of surfactants greatly improves the cleaning action of water, allowing a wider range of soil to be dissolved. However this can cause problems with the redisposition of the removed soil. This can be countered by using soil carriers to prevent the redisposition of the solubilized dirt. PEG, PVP and SCMC are examples of soil carriers, and work by forming layers around the soil particles. The addition of chelating agents can also further improve cleaning action. Typical agents are EDTA or citric acid, which act by binding with metal ions such as Mg and Ca. A 'typical' recipe would be (after Horie *in* Horie and Murphy, 1988):

Non ionic detergent 0.2parts/100	
Soil carrier	0.2parts/100
Chelating agent	0.1parts/100
Water	Balance

Others factors can also aid the control of the cleaning process such as pH. A slightly alkaline pH is considered to be best. This stabilises the surfactant, can aid in the neutralisation of acids and help break down fatty acids. For hard surfaces such as bone a 10% sodium bicarbonate solution can be very effective. However when using aqueous solutions it is important to avoid over wetting or prolonged contact of the surface to be cleaned with the water. Over-treatment can cause swelling and subsequent distortion. Many brief cleaning actions are better than one long one. On non-furry or non-feathered surfaces the use of poultices (e.g. sepiolite) or the use of solvent gels may be of benefit. Essentially the poultice or the gel carries the solvent allowing controlled cleaning in a specific area. (Wolbers 2000).

The repair of vertebrate collection material is often required. Any materials applied to a specimen must be carefully considered for their potential reversibility and long term stability. A huge variety of consolidants and adhesives are now available to the museum conservator (e.g. Horie 1987; Elder et al, 1997). A number of these materials have been in use long enough for their properties to be reasonably well understood. However this is a huge subject area that can only be briefly discussed in this short paper.

With natural science collection material relatively little research has been carried out on the effects of various adhesives and consolidants on the specimens being conserved. However the many different areas of museum conservation can provided a great deal of information on the use of many of these material. Of particular interest is the work of paleontological and ethnographic conservators. Examples of some potentially useful consolidants and /or adhesives;

- Acrylic polymers: These are methacrylate based polymers such as the Paraloids and Pliantex. They have reasonable solubility

in a range of organic solvents. Acrylic polymers such as the Paraloid range are considered to have good long-term stability and reversibility. When mixed with inert materials such as glass microballoons then acrylic polymers can make very good inert and stable fillers.

- Acrylic emulsions: Short chained methacrylate based polymers that tend to be water soluble e.g. Primal WS24. Can be very good for consolidating friable materials with good penetration and stability. However this good penetration makes treatment with acrylic emulsions effectively irreversible, as it can be deeply absorbed. It could also alter biochemical properties of the material being conserved e.g. carbon dating.
- Polyvinyl acetate resins: This includes consolidants such as the Mowiliths and the Vinacs. These are potentially very useful within natural science conservation with good long term ageing properties. The physical properties of the polymers are easy to manipulate by varying the solvent system used.
- Epoxy resins: May be necessary to use for repair on strength grounds. However epoxies are generally avoided due to long term problems from offgasing products and shrinkage.

Insect pests can be a serious problem for our vertebrate collections, particular with skin and freeze dried material and there have been many publications dealing with pest control and associated management methods (e.g. Hillyer and Blyth, 1992; Linnie 1996; Rossol and Jessup, 1996; Rust and Daniel, 1996). It is important to keep a continuous programme of pest monitoring in place. The detection of infestation problems before they can establish themselves can prevent damage to the collections and save considerable time and money. When having to treat an infestation it is important to avoid as far as possible chemical treatments, although a useful permethrin based insecticide is Constrain. Alternatives such as freeze sterilisation and anoxic atmospheres are becoming increasingly utilised methods. Ultimately one of the best methods of pest control is good hygiene and good building design. Keep collection areas as clean as is practical, and avoid over-cluttering stores!

One of the most damaging factors to vertebrate collections is poor storage areas with poor environmental conditions. The effects of fluctuating levels of humidity and temperature can have a very damaging effect on collection material. Humidity levels are particular important as these can cause the greatest structural changes in collection material (e.g. Thomson, 1986; Cassar, 1995). The aim is to avoid fluctuating and excessive temperatures and relative humidity levels. Much can be achieved by using good storage units which can considerable reduce the effects of poor environmental conditions by buffering out the changes. Achieving stable environmental conditions in the building that houses the collection can be far more problematic and expensive to achieve. However many store areas can be significantly improved by improving windows and sealing up draft points. Generally it is probably better to avoid air conditioning units for environmental control. These are expensive, energy hungry and need regular maintenance. Alternative methods do exist, such as conservation heating, which controls relative humidity levels by heating. However it is best to establish the true environmental conditions of a store or building before embarking on control measures. This can be done through the use of thermo-hydrographs or computer dataloggers. By understanding the extent environmental conditions vary within a store or a building allows the extent of appropriate control mechanisms to be decided. The type of material being stored will also dictate the level of environmental control required in a collection area.

This brief article, and its references, provides a brief overview of some of the main conservation issues related to the care of vertebrate collection. Remember that a great deal can be achieved with limited technology and budgets. The single biggest controlling factor is probably the time we have available and the space available to store and use our collections.

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Wolbers, R. 2000. Cleaning Painted Surfaces: Aqueous Methods. Archetype Publications.

Unger, A et al. 2001. Conservation of Wood Artefacts – A Handbook. Springer.

Useful Websites

Conservation online: www.palimpsest.standford.edu

American Institute for Conservation journal: www.aic.standford.edu/jaic/

SPNHC: www.spnhc.org

Documentation of Vertebrate Collections at the National Museums & Galleries of Wales Why document collections?

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There are many reasons to document museum collections but most can be grouped under two headings.

Access:

- Enables fast searches (important for data connected with large biological collections)
- Ability to link many different terms to aid searching
- Makes a wider variety of formats available e.g. web, interactive programmes etc.
- Which in turn enables easier sharing of information
- Easy duplication of data

Accountability:

- Ensures the Museum knows what it has got
- Preservation of information
- Improves collection security
- More efficient collections management e.g. loans, movements, conservation etc.
- Supports demands for audit

NMGW's vertebrate collections consist of:

- 11,000 bird study skins (all on database and on web)
- 7,500 clutches of bird eggs (400 clutches of Biodiversity Action Plan species on database)
- 4,000 osteological specimens in two separate databases. One of 1100 traditional osteological specimens including 120 articulated skeletons of a wide variety of mammals and birds which are an excellent resource for education and one of the more frequently used parts of the collection. The other database is of the Barbara Noddle collection which consists of 2200 lots of domesticated animal bones. These are mainly sheep with smaller numbers of cows, pigs and a variety of other families. This collection is of most use for comparative studies with archaeological finds.
- 1,900 mounted animals (all on database and on web)
- 1,600 fluid preserved specimens (none on database, although work should start shortly in topping up fluid levels and databasing at the same time)
- 1,100 mammal study skins (all on database)
- 258 bird nests (all on database)
- c. 15,000 glass negatives (none on database, massive headache as storage conditions not up to conservation requirements but costs of improvements would be high. NMGW is moving towards a centralised photographic archive which may well result in their documentation and proper preservation).

NMGW adopted a central CMS in 1992 choosing Micromuseé's database system which consists of:

A general database developed from a library system and used for the documentation of the art and archaeology collections
A natural history database developed as separate system and used for the zoology, botany and geology collections.

Because of the way CMS has developed (it was until relatively recently still a Dos based system) it has a number of drawbacks some of which will probably never be fully rectified, these include:

- No front end for web use (should be due in 1-2 years)
- Cumbersome data input
- Cumbersome report / template facilities
- Export ability limited to Excel followed by considerable formatting
- No ability to import records

For this reason the CMS is used as the central accession system as it contains all the accession numbers issued in the zoology section since the early 1900s (work is progressing to do the same for the botany section) and records of all new accessions are added to the system giving an almost complete list of accession numbers used by the department. For day to day operations FileMaker Pro is used.

Since the advent of readily available desktop computers some sections of BioSyB have used Apple Macs. Unfortunately CMS has never been compatible with the Mac operating system and as a result these sections used FileMaker Pro to document certain areas of the collections. In about 1997 FileMaker Pro became available for use on PCs and was used in preference to CMS for day to day operations such as:

- Item documentation of molluscan, marine invertebrate, entomological and vertebrate collections
- Loan documentation
- Catalogue production
- Web publishing as searchable database

FileMaker is very user-friendly, possibly one of the best on the market for ease of use. Anyone with a reasonable grasp of computers should be able to create new databases with customised layouts very quickly. With a little

knowledge of databases it is easy to set up relational files and lookups to speed data entry and reduce possible input errors.

We have used FileMaker to publish catalogues of several sections of the collections including mounted animals and several parts of the herbarium. The herbarium records are held on the CMS and must be taken through Excel to clean up first but once received from Excel a catalogue can be ready to print in 30-40 minutes. Report production can often be aided by having a sort code available which makes sorting records into the most desired order easier. It is best if these are implemented from the start of a database but can be added later.

As our vertebrate collections are small and mounted specimens cover many orders it was decided to incorporate all the higher taxonomy (Class, Order, Family, Sub-family and Genus) into one database. The addition of a code for each record in each field and a calculation field which puts them all together means we can sort any of the databases by systematic order rather than alphabetical which is the result using normal sorting. The code for the genus Homo, for example, would be:
Mammalia = 10
Primate = 14
Hominidae = 013
Sub-family (blank) = 00
Calculation field = 10.14.013.00

Web access to searchable databases was another reason for choosing FileMaker Pro. There was a desire to get BioSyB databases available online but the development of a front end which would allow CMS to be searched online is still, even now, some way off so FileMaker was an obvious choice. Databases can be published online with very little effort, especially with the most recent versions, currently 5.5 (BioSyB uses version 5). However, it was decided to get ours developed by an external company. Our databases can be accessed through the NMGW site at www.nmgw.ac.uk.

Future developments:

- Databasing of the rest of the egg collection is to start next year. With the work expected on the fluid collections this will mean that, with the exception of the negatives, the entire vertebrate collection should be available electronically within 2 years.
- A programme of photographing the most photogenic specimens and adding these images to some of the databases e.g. mounts and skeletal should enhance their usefulness.
- In the longer term we would like to develop a database to be used in our 'hands on' gallery which would link to the current databases but enable a user to explore as little or as much as they want.

Computer Generated Labels for Wet Collections

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INTRODUCTION

Natural history collections preserved in alcohol, or other aqueous preservatives, require labels that accept and retain printed ink without loss of durability in the aqueous medium over the very long-term. For practical reasons, it is also important they can be produced in small quantities at reasonable cost.

Much effort has been spent in recent years to determine the best combination of printer, paper and ink for the purpose. However, any person trying to keep up-to-date with this subject will have met the frustrating problem that suitable products (and their availability) are subject to constant change. Thus the recommendations that we make in this paper are simply those that are practical *at the time of writing*.

PRINTERS

Inkjet: Standard inkjet printers have the advantage of being already in use by many people. While normal inkjet ink (with water-soluble dyes) bleeds immediately on immersion in alcohol (80% ethanol or Industrial Methylated Spirit), most permanent, pigmented inkjet inks, once dry, are stable in alcohol and insoluble in water. In fact they are claimed, by the manufacturers, to be insoluble in all of the commonly used fluid chemicals (i. e. ethanol, ethyl acetate, ammonia, xylene and acetone). Furthermore, such pigmented inks are also more light-stable than inks with water-soluble dyes (Becker & Kasper, 1998).

In general, while prices are reducing, the print quality and the speed of inkjet printers is improving. Inkjets with high resolution are readily available (e.g. 1440 dpi with Epson *Stylus*) and increasing numbers of printers (e. g. Lexmark *5000* and higher) are supplied with cartridges containing waterproof, pigmented ink.

Laser: The lettering image produced by laser printers is precise and many curators claim that their printed labels have remained trouble free in alcohol for a number of years. Nevertheless, many others remain doubtful because labels from this type of printer have a history of poor resistance to abrasion. Many people remember well the phenomenon of 'alphabet soup', where the lettering on laser-printed labels simply came off and floated free in the alcohol (this is commonly seen with labels printed by early laser models from the 1960's and 70's).

In basic terms, the laser-printer method works by depositing dry carbon particles on the surface of the paper and there is little penetration of the paper fibre below the surface. This is generally a weakness but the performance of laser printers varies greatly and is largely determined by the degree of heat and pressure employed. In fact, the manufacturer Hewlett-Packard now claims excellent print strength for its recent models such as the *LaserJet 2100.*

Some curators have baked their labels in an oven (e.g. 30-60 seconds at 160 °C), or simply used a domestic iron, but this is an undesirable complication. Furthermore, the possibility of spraying sealants on laser printed labels is suggested by some, e.g. *Letraset Fix, RTV Silicone, or Krylon Crystal Clear*, but degradation is likely to occur and such methods may not be durable.

Dot matrix: Dot matrix, or impact, printers appear now to be losing ground (in terms of wet labelling) because of their inherent disadvantages: the lettering lacks sharpness, newly printed labels bleed slowly (requiring pre-soaking), and ribbons need frequent replacement or re-inking. Furthermore, over the long term, even after pre-soaking, impact-printed labels in alcohol have tended to fade. However, in step with the on-going improvements with other printing equipment, impact printer ribbons have improved recently and they are now claimed to produce no bleeding at all (University Products).

PAPERS

Paper for labelling should be of archival quality, made of 100% cotton rag, uncoated and with high wet strength. The paper needs to withstand long-term immersion in the preservative without softening or discolouring. Furthermore, the structural characteristics of the paper are important because successful inkjet printing requires deep penetration by the ink into the fibres of the paper.

The following papers have been used for wet labelling :

1. *Resistall* (Byron Weston Paper Co.) is commonly used in the U.S.A. In recent years its manufacture was discontinued but has now been restored (UK supplier: Preservation Equipment Ltd). Packages display a skull and cross bones motif because of the formaldehyde-based coating which makes it resistant to alcohol. It has good resistance to abrasion of the lettering but it is not acid-free and doubts remain about its permanence and archival quality.

2. Arjo Wiggins' *Goatskin Parchment* is also suitable but it can suffer a loss of strength in fluids containing water. In the late 1980's the paper's quality appeared to drop (Carter, 1996) but has now recovered (UK supplier: Arjo Wiggins Appleton plc).

3. Arjo Wiggins *High Wet Strength WT 550* - no longer available.

INKS
(PIGMENTED REFILL INKS for INKJETS)

Now that both printer manufacturers and refillers are providing permanent waterproof inks, variations in print quality and stability might be expected. In recent years, tests at the Natural History Museum, London and at the National Museum of Wales (Carter, 1996) found that *PermaDri* black pigmented ink (used as an ink refill in HP Deskjet 500 cartridges) was alcohol (and water) resistant; it produced a good image and had excellent abrasion resistance.

However, the product sold as *PermaDri* became unavailable as a result of changes concerning the manufacturing company Graphics Utilities. Because of this, the authors of the present article tested various inks to find a replacement for *PermaDri*. We initially found an alternative ink which was equally suitable (in cartridge form): Esselte *Dataline* - "High Capacity Snap-In Kit", black, 94161; batch no. B7.087. Unfortunately, however, this ink also became unavailable because of changes to the company Esselte. We understand that the inks division was taken over by the company Coates Electrographics. From this company, we have now acquired the following ink: "Pigmented black ink JET7534"; batch no. FP02948. This ink is put into cartridges by the company Greenman Toners. The cartridge type is an HP51626A or HP51629. It can be bought from the company Sykom.

TESTS

Tests were carried out to determine the quality and durability of the Coats Electrographics ink compared with that of Permadri. To achieve an accelerated ageing regime, printed labels were subjected to: boiling, storage (in conditions of heat and light), and abrasion (scratching). All labels were printed on *Resistall* paper and left to dry for at least 24 hours before being tested.

Boiling test: Labels were boiled in tubes of 0.1 Molar Hydrochloric Acid (HCl) for one hour. This procedure was repeated using both 80% IMS and de-ionised water. All labels printed with *PermaDri* or Coates' ink were unaffected.

Storage test: Labels were immersed in tubes of alcohol (80% IMS) and placed in a heated cabinet at 40°C for five weeks. All labels printed with *PermaDri* or Coates' ink were unaffected.

Scratch (or abrasion) test: Scratching is defined as: *scraping a scalpel blade across the label in an effort to remove the lettering but without damaging the paper.* We deem the printing to have been successful when the blade cannot remove the lettering without

damaging the paper. We concluded that all labels printed with *PermaDri* or Coates' ink were non-abraded after being subjected to the scratch test.

Long-term test: Labels printed with *Permadri* have been immersed in alcohol (80% IMS) and subjected to daylight by a window for over six years without discernible ill effects. Labels printed with Coates' ink have, at the time of writing, yet to reach two years on test but so far show no signs of fading or other degradation.

DISCUSSION and CONCLUSIONS

Of all the methods available, inkjet printing with pigmented ink is recommended because of: (1) the excellent results; (2) the cheapness and ubiquity of the machines; and (3) because of the dubious history of laser printers.

The two inks tested performed consistently well and it appears from the results that the Coates' ink must be of a similar specification to the original *PermaDri* ink. The printed labels, using *PermaDri* ink, have been stable and durable in alcohol (over six years) and have not been affected by long exposure to light (over six years).

As a back-up for those still unconvinced that printed labels will remain completely durable in the years to come, a unique reference number, handwritten in permanent indian ink, can be added to each computer-printed label.

SUPPLIERS of MATERIALS

Esselte (Machine Supplies Division), Norman Park, Bar Hill, Cambridge CBS 8SS. Tel: 01954 780436, Fax: 01954 782757

Preservation Equipment Ltd, Shelfanger, Diss, Norfolk IP22 2DG Tel: 01379 651527

Sykom Co., Longmead Business Park, Epsom, Surrey KT19 9UP Tel: 01372 746225, Web: www.Sykom.com

University Products, 517 Main Street, Holyoke, Mass 01041-0101 USA. Fax: 1-800-532-9281, E-mail: info@universityproducts.com, Web: www.universityproducts.com

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Becker, D & Kasper, K (2001). Digital Prints: Technology, Materials, Image Quality & Stability. http://www.foto.unibas.ch/~rundbrief/les33.htm

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Carter, D & Walker, A (1999). *Care and Conservation of Natural History Collections.* Butterworth Heinemann.

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The Moths and Butterflies of Great Britain and Ireland Volume 4, Parts 1 and 2, edited by A.Maitland Emmet and John R. Langmaid (2002). Harley Books, Colchester. 326+251pp, 95+63 figs, 146+161 maps, 7+6 col. pls. ISBN (Part 1) 0-946589-66-6 (hardback), 0-946589-72-0 (paperback). ISBN (Part 2) 0-946589-67-4 (hardback), 0-946589-73-9 (paperback).
Price of hardback edition Part 1 £80, Part 2 £80, 2-part set £150
Price of paperback edition Part 1 £44.00, Part 2 £44.00, 2-part set £82.50

These are probably the most important and, in my opinion, the best volumes yet to be produced in this monumental series. Part one deals with the microlepidoptera families Oecophoridae, Ethmiidae, Autostichidae, Blastobasidae, Batrachedridae, Agonoxenidae, Momphidae, Cosmopterigidae and Scythrididae, while part two deals with the large family Gelechiidae. Prior to the publication of these books, the only English language work to provide a guide to the identification of a few of these groups was a slim volume entitled 'Illustrated Papers on British Microlepidoptera', published by the British Entomological and Natural History Society in 1978. Although these moth groups may be unfamiliar to biology curators other than specialist entomologists, a brief perusal of the superb colour plates should be sufficient to engender an enthusiasm for these beautiful little insects, many of which are quite common in gardens and other urban situations.

Part one appropriately commences with a publisher's foreword in the form of a tribute to Maitland Emmet who sadly died shortly before these volumes were published. This remarkable man only took up a serious interest in the Microlepidoptera after retirement but rapidly became an acknowledged expert on the leaf-miners. He contributed to the first volume, published in 1975 and shortly afterwards became co-editor and subsequently senior editor of the series on which he worked tirelessly until his 93rd year. The preface makes the point that there is now a wider interest in our microlepidoptera and that today's lepidopterists tend to be field workers rather than collectors. There has consequently been a huge increase in recording, due largely to the efforts and enthusiasm of people such as Maitland.

In the tradition of this series , the volume starts with a chapter covering an aspect of Lepidoptera biology, in this case a fascinating study of ' The ecology and evolution of lepidopteran defences against bats' by J. Rydell and M.R.Young. This well illustrated chapter describes the different types of echolocation used by bats and the bat-detecting ears and evasive tactics employed by moths. In a section on streetlights, the possible impact of the recent increase in the number of such lights (which emit a considerable proportion of ultraviolet light) is discussed. The conclusion is that the number of moths caught by bats at street lights may be considerable, although they are mainly males. It would be interesting to know if a similar situation occurs with mercury vapour light traps, particularly those that are run on a daily basis.

The main body of the two volumes provides a systematic treatment of the families, genera and species, with checklists, keys and individual species treatments. This is a multi author work with authoritative contributions from no less than ten acknowledged experts on the various groups. As in previous volumes, each species is covered comprehensively, with a detailed description of the adult, life history and distribution, illustrated by a map. Similar species are mentioned and distinguishing features listed. In many cases, line drawings of diagnostic characters or larval feeding behaviour are provided. Every species is illustrated in colour in a superb series of plates by the distinguished entomological illustrator Richard Lewington. Moreover, the male and female genitalia of all species are illustrated by a series of excellent, clear line drawings by Michael J.Roberts. This is the first volume to have the genitalia so comprehensively illustrated and this is an immense step forward as genitalic examination is frequently the only way of identifying difficult species and particularly specimens where the scales are rubbed.

Inevitably in a book of this nature, a number

of minor errors have crept in, some of which are noted on an enclosed erratum slip. However, the publishers have subsequently produced a further sheet of addenda and corrigenda (including a corrected distribution map for *Aristotelia subdecurtella* which in fact was a repeat of the distribution map for *Metzneria aestivella*, erroneously inserted by the printer while making a late correction). This will be included with the paperback edition but those who already have copies of the hardback should request a copy from the publishers.

Although these volumes are fairly costly, they are good value for money, considering the quantity and quality of information that they contain, and are unlikely to be superseded for generations to come. They should be in every lepidopterist's library and deserve a place on the reference bookshelf of all museums that profess an interest the British and Irish fauna.

David Carter, (Department of Entomology, The Natural History Museum)

Classifieds

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