Chapter 5
Collection Care
Handling, Storing and Transporting Human Remains

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The handling and storage of the human remains held in the British Museum collection follows the recommendations set out in the *Guidance for the Care of Human Remains in Museums* published by the Department for Culture, Media and Sport (DCMS 2005, 18–19). All human remains are treated with respect, care and dignity and are stored in conditions that are actively managed and monitored to meet the required standards of security, access management and environmental control which are proportionate and appropriate to their age, origin and modern cultural significance (Trustees of British Museum 2013, 3–4). The working practices presented here are drawn from the *British Museum Guidance for the Care, Study and Display of Human Remains*, an internal guidance document prepared by the British Museum Human Remains Working Group,[1] and takes into account a range of considerations from possible cultural preferences in the way human remains are stored to health and safety implications. This chapter will discuss the issues faced by staff curating human remains, with a strong emphasis on skeletal remains as these represent the majority of the collection held at the British Museum.

Risks associated with human remains

> Pathogenic bacteria and viruses that were once the cause of death of individuals excavated in archaeological or osteoforensic contexts do not represent a health risk to archaeologists and museum personnel. In contrast, organic pesticides and heavy metals represent a real threat (Arriaza and Pfister 2007, 214).

The possible risks to British Museum staff involved in the excavation, storage, handling or analysis of human remains are carefully evaluated in advance by the completion of a risk assessment (see English Heritage and the Church of England 2005, 45; Arriaza and Pfister 2007, 205–21; Cassman *et al.* 2007; see also Chapter Six, Appendix 1). For human remains from English burial grounds, which represent the largest proportion of remains in the British Museum collection, the most likely sources of risk to health appear to be the presence of pathogens, psychological stress and contamination by heavy metals such as lead (English Heritage and the Church of England 2005, 45). With human remains that are less than 100 years old, the risk of any of these factors affecting staff or researchers working with human remains may be relatively high and such work is carefully assessed on a case-by-case basis (English Heritage and the Church of England 2005, 45; see also Galloway and Snodgrass 1998; Cox 2000; Crist 2001; Konefes and McGee 2001). For human remains that are over 100 years old, the risks are regarded as significantly lower and possible dangers associated with pathogens such as anthrax and smallpox appear to have been overestimated (English Heritage and the Church of England 2005, 45). The risk of staff being exposed to tetanus and leptospirosis during an excavation is greater, but it is on par with the risk associated with gardening (English Heritage and the Church of England 2005, 45). Heavy metals, such as lead, are used in some coffins and may result in a risk of poisoning (Cox 2000; English Heritage and the Church of England 2005, 45).[2] Normal hygiene procedures, such as hand washing, must be observed at all times and gloves ought to be worn when preserved soft tissues are present. Additional protection, such as suitable

filter masks, may be necessary in dusty environments or during laboratory sampling of bone for analysis. Bone dust is an irritant and can lead to sensitization with regular exposure (English Heritage and the Church of England 2005, 45). Suitable masks should be used when working with powdery bone or when drilling bone/teeth for scientific sampling (Díaz-Jara *et al.* 2001). Other environments where the wearing of masks may be advisable include areas such as crypts where dust, lead and high concentrations of fungal spores may be present (see Cox 2000).

The British Museum also holds human remains from around the world, which were buried and have survived in very different environments. The risks associated with their handling appear to be similar to those concerning human remains from English burial grounds. For most human remains, pathogens are extremely unlikely to survive for over 100 years or remain infective for long enough to present a genuine threat to curators, researchers or conservators working on burials from archaeological contexts (see Arriaza and Pfister 2007, 205–6). The majority of living organisms found in ancient human remains are probably the result of recent contaminations or represent soil microorganisms. Viruses found in relatively recent mummies from the 16th century have good structural preservation, but their viability was shown to have been lost and they are unable to cause disease or reproduce (Arriaza and Pfisterl 2007, 205–6). Even under 'ideal' cold and stable conditions, the remains of 19th-century smallpox victims preserved in the permafrost of the Arctic, as well as those from the 1918 Spanish influenza outbreak buried in the permafrost in Alaska, did not contain any viable viruses (Arriaza and Pfister 2007, 205–6). An amoeba-infecting *Pithovirus sibericum* virus was recently revived after lying dormant and remaining infectious for 30,000 years in the Siberian permafrost (see Legendre *et al.* 2014), but the conditions found in most archaeological sites are unlikely to suit the long-term survival of pathogens. In contrast, very little is known about the preservation of prions (proteinaceous infectious particles with no nucleic acids) that cause BSE and Creutzfeldt-Jacob disease. Prions may have the potential to survive long term, but they have not, as of yet, been recovered from archaeological specimens (Arriaza and Pfister 2007, 206–7). Staff and researchers working on very recent material (less than 100 years old) or at historical cemeteries (particularly from New Guinea where the prion disease *kuru* is endemic), should be aware of this risk and are advised to wear protective equipment (Arriaza and Pfister 2007, 206–7; see also Galloway and Snodgrass 1998; Konefes and McGee 2001). Crist (2001), however, also discusses the risks associated with working on recently buried human remains from historical graves and concludes that:

> The absence of living cells after death, fragility of most microorganisms, and unfavourable post-mortem conditions are all important factors that significantly reduce, and may exclude, the likelihood of infection from skeletonised human remains (Crist 2001, 98).

Any outbreak of moulds, fungi or the presence of anthrax endospores may also be a risk, but healthy adults have a low probability of being adversely affected by these, and the likelihood of contracting anthrax appears to be small (Sledzik 2001, 71–7). Nonetheless, outbreaks of mould should be avoided as susceptible individuals can be at risk of developing mould-induced hypersensitivity pneumonitis, an inflammation of the lungs caused by repeatedly breathing in a foreign substance (Arriaza and Pfister 2007, 207). The prevalence of this condition is low, but cases of sensitization among museum staff working on materials other than human remains have been published. Indeed, the risk is not specific to human remains and mould growth on human remains poses the same risks as any other mould growth (see Kolmodin-Hedman *et al.* 1986; Wiszniewska *et al.* 2009).

The greatest potential hazard with human remains appears to involve the use of pesticides on museum collections. Pesticides have been used to preserve mummies in some museum collections and the conservation records or treatment history of any human remains should be checked for such risks. These details may not always be available as the treatment may have occurred prior to acquisition or may not have been noted. Where the use of pesticides is suspected, human remains should be handled with gloves. If the remains are fragmented and dusty, dust-filtering masks should also be worn to avoid ingesting any toxins present within the dust (see Arriaza and Pfister 2007, 216–17). This also applies to human remains in which prions may be present (see above). Funerary practices may also add unexpected biological hazards. Examples include highly toxic chemicals such as arsenic (e.g. bright yellow pigments used to decorate some Andean mummies), lead (e.g. human remains recovered from lead-lined coffins) or mercury (e.g. present in some Peruvian funerary textiles) (Arriaza and Pfister 2007; Konefes and McGee 2001).

Handling human remains: considerations and care

Psychological stress and high staff turnover can be associated with work on well-preserved and/or relatively recent human remains (English Heritage and the Church of England 2005, 45), and some individuals may not wish to work with, or feel comfortable handling human remains for cultural, religious or personal reasons. For some, this may include all forms of human remains (e.g. skeletal, cremated, mummified or bog remains and objects made wholly or in part of human remains), or may only apply to well-preserved remains such as mummies. British Museum staff who are likely to be involved in the handling of human remains are offered the opportunity to discuss any concerns they may have with an appropriate member of staff as this may have implications for working with specific collections and in specific storage areas. Prior to coming into contact with such collections, it is useful to determine what category of human remains they feel comfortable handling, whilst taking into account the origin, age and degree of preservation of the remains. This can be ascertained by discussing images in publications or on the British Museum's Collection Online database, rather than the human remains themselves. It is also important to determine to what extent a person is prepared to handle human remains. Unless they are involved in specific tasks such as conservation and display mounting work, or the analysis of human remains for research purposes, handling does not usually involve any direct contact.

When human remains require handling, this must be done with great care and respect, in a dedicated or appropriate environment and preferably over a clean cushioned surface to prevent damage (see Roberts 2013; Cassman and Odegaard 2007a; 2007b). Anyone handling human remains should have received appropriate training (e.g. in physical anthropology, bioarchaeology, conservation or museum handling) and should be made aware of their ethical obligations with regard to human remains. The condition and fragility of the human remains is assessed and taken into account before they are transported, unpacked and handled. The use of analytical or measuring equipment by researchers can result in wear and tear in heavily studied collections (see Chapter Three, this volume) and should be supervised and carefully monitored. For example, in order to avoid marking bone, metal recording instruments such as measuring callipers are, as far as possible, avoided and the use of plastic (coated) equivalents is encouraged. It is also no longer advisable to write information on human remains (such as site codes or registration numbers) as this may be regarded as inappropriate by some cultures. Advice on how to clean/process human remains is sought from a trained conservator on a case-by-case basis and passive conservation is encouraged so as not to affect the research potential of the human remains (see Chapters Three and Six, this volume). The use of resins as consolidant and/or adhesives should also be avoided and only applied by a trained conservator under the guidance of a person with the appropriate anatomical knowledge, such as a physical anthropologist. In particular, teeth should never be glued into their sockets as roots are a source of valuable biological information and should remain observable. Overall, there are no substitutes for training and detailed guidance from an experienced physical anthropologist or conservator (see Chapter Six, this volume; Cassman *et al.* 2007; Cassman and Odegaard 2007a; 2007b).

The storage of human remains

Providing appropriate storage is also an essential part of caring for museum collections. Museums and research collections may, depending on space and resource availability, develop different storage solutions for the human remains in their collection (e.g. Cassman and Odegaard 2007c; Mays 2013; McKinley 2013; Redfern and Bekvalac 2013; Roberts 2013; Scott 2013). As the human remains themselves vary in their specific nature, coming from many different cultural contexts and burial environments, so do the storage solutions. In the British Museum, different types of human remains are stored in environmental conditions appropriate to their specific nature (see Chapter Six, this volume). Although the storage conditions may vary, the basic duty of care remains the same and the Museum aspires to follow strict storage guidelines. All materials used in storage (including boxes, bags, labels and pens) are, as far as possible, inert and of conservation grade with long-term stability. Ideally, inert metal shelving is used. These should be raised at least 100mm above the floor to protect from accidental flooding and pests, and to allow for cleaning. Boxes or other appropriate containers used to store human remains should always be clearly labelled with a registration number and other pieces of relevant information. Labels should also state that these boxes or containers enclose human remains. If the human remains are less than 100 years old and covered by the Human Tissue Act 2004, this must be clearly stated on the outside of the box (see Chapter One, this volume).

The human remains in the British Museum collection are stored in a respectful way that ensure their long-term preservation. Whenever appropriate and possible, the British Museum may also be guided by the cultural preferences and sensitivities of communities that have cultural continuity with the remains, or for whom the remains have cultural importance (see Giesen and White 2013). This may cover the selection of materials used to pack the human remains, the location of the remains within the storeroom and the position, orientation or articulation of the remains. Decisions to keep objects associated with human remains together are determined by cultural context and made on a case-by-case basis. Wherever possible, associations between human remains and funerary objects are maintained (e.g. a dedicated space for the human remains within a general storage area). For composite objects made in part of human remains, specific advice is usually sought from a trained conservator. Human remains in the British Museum's care are also regularly inspected to ensure they are stored appropriately and do not show signs of deterioration. Condition assessments are undertaken by trained and authorized staff as appropriate for the collection stored (see Cassman and Odegaard 2007b). The Museum may also have in its care recently excavated human remains that are not yet registered parts of the collection, in addition to human remains that the Museum is studying or storing temporarily. These are stored and handled using the same principles.

In most circumstances, human remains are kept in discrete areas away from the main activity of the store. All storerooms holding human remains should be:

- Secure with access restricted/monitored.
- Watertight and sealed from potential pests and dust.
- Kept clean and monitored for pests, damage and other potential threats.
- Maintained as areas where no food or drinks are permitted.
- Regularly monitored regarding the relative humidity and temperature.
- In conditions where light (both daylight and artificial light) is kept to a minimum as this may damage the human remains, boxes and labels.

The majority of the human remains held in the British Museum collection are skeletal remains and, when appropriate and possible, they are stored in wire-stitched carton rigid boxes (e.g. 505mm x 250mm x 243mm) and elements are bagged separately using clear polythene bags (500 gauge), with Tyvek® labels in each bag (see examples in Chapter Six, this volume). Frequently accessed collections may be stored differently to ease access and minimize handling (e.g. trays or inert boxes with supportive inert packing). When appropriate and possible, teeth should not be stored in occlusion (i.e. upper and lower teeth positioned against each other) and no pressure should be applied to the teeth as this may cause the enamel to peel away. Unless there

Plate 1 The mummy of Irthorru (26th Dynasty, British Museum, EA 20745) displayed on a handling board for the exhibition *Journey through the Afterlife: Ancient Egyptian Book of the Dead* at the Western Australian Museum, May 2013

are any cultural objections, a robust and complete skull should be stored resting on its top (upside-down with the teeth/maxilla pointing upwards), using appropriate support if necessary (e.g. acid-free tissue 'doughnuts'; see Chapter Six, this volume). If suitable, the mandible should be stored separately with the teeth facing up and nothing should rest on top of the dentition. The heavier long bones of the arms and legs should be placed at the bottom of a box so that they are flat and do not cross (i.e. parallel to each other) to prevent breakages, with the more fragile bones (such as the pelvis) on top. Different parts of the skeleton should preferably be stored in separate sealable bags and identified with Tyvek labels recording the site name, context/skeleton number and a description of its contents. Storing a skeleton into several bags protects the bones from being damaged, provides some padding and allows direct access to specific parts of the skeleton. This prevents a whole skeleton being unpacked when a researcher only wishes to study part of the skeleton (e.g. only teeth may be required when studying dental diseases). Ideally, the skull, mandible, vertebrae, ribs, hands, arms (humerus, ulna and radius), pelvis, sacrum, scapulae, legs (femur, tibia, fibula and patella), feet and any loose teeth should be packed separately in sealable bags, separating left and right. When bones are fragmented, each bone should be bagged separately (e.g. the bones of an arm – humerus, radius and ulna – should be separated into three bags).

Unless the bones are fragile and require careful packing, an entire skeleton should ideally be stored in a single box (this does not apply to commingled remains). In order to save space, and as long as bones are carefully arranged to avoid any damage, incomplete or smaller skeletons can be stored together within a shared box, with each individual placed in a clearly identifiable and labelled sub-container (e.g. a larger bag or smaller box). Importantly, recently excavated bones may be damp or contain residual humidity (widespread in British material) and each bag should have small perforations so that the material can slowly dry out, preventing condensation or mould growth. When appropriate, fragile and/or pathological bones should be supported with an inert material (e.g. Plastazote® or acid-free tissue) and bagged separately with a Tyvek label. Fragile bones are often wrapped in acid-free tissue, but this is not an ideal solution as you cannot see – or adapt your handling of – the fragile part until it has been unwrapped. Creating a supporting 'nest' around and below a fragile bone is often more appropriate as it offers high visibility. Mummified and other well-preserved remains, such as bog bodies, are particularly fragile and often require special storage solutions, as well as guidance from a trained conservator (see Chapters Two and Six, this volume).

Transporting human remains: examples from the Egyptian collection

Additional levels of care are required when human remains are moved, particularly if they need to be transported as part of a loan or an exhibition. This requires careful planning by collection staff in addition to tailor-made solutions that match the specific requirements of the individual remains. As with other parts of the collection, human remains are condition assessed by the Conservation Department at the British Museum before any kind of travel or loan is agreed (see Cassman and Odegaard 2007b; 2007c). Many variables are taken into account, including the transportation mode(s), the length of the journey, the prospective display conditions, as well as the current state of preservation of the remains. If approved for transport, and once any conservation treatments have taken place, conservation and collections staff usually discuss whether the packing needs to accommodate fragile areas with additional support or protection. Articulated bodies, such as mummies, are particularly fragile and should be fully horizontal and supported during travel. For this reason, mummified remains are traditionally placed on a handling board, on which they stay for the duration of travel and display and possibly also whilst in storage at the British Museum (see Chapter Six, this volume). Depending on the purpose and duration of travel, the materials used may differ (e.g. Chapter Six, this volume; Cassman and Odegaard, 2007c). The materials used in long-term displays, transit, loans and storage are tested to determine their chemical stability and level of inertia. Handling boards recently made for mummies on display as part of the international touring exhibitions *Mummy: The Inside Story* and *Journey through the Afterlife: Ancient Egyptian Book of the Dead* were made from an aluminium coated Cellite® board fitted with a 5mm layer of Plastazote and covered with calico and jersey.[3] A layer of

Plate 2 The coffin of Horaawesheb (22nd Dynasty) containing the mummy of an unidentified female of the 26th Dynasty (British Museum, EA 6666) packed for travel to *Journey through the Afterlife: Ancient Egyptian Book of the Dead* at the Western Australian Museum, May 2013

Plate 3 Detail of the coffin and mummy shown in Plate 2 (British Museum, EA 6666)

Melinex® cut to the shape serves as a barrier between the jersey and the linen wrappings of the mummy (**Pl. 1**). Mummies are sometimes permanently stored in their original coffins, and depending on their condition and stability, they do not require a handling board as the coffin itself provides the required support (**Pl. 2**). Alternatively, a handling board may be placed under the coffin to support both the coffin and the mummy. Transporting mummified remains to a local hospital for a CT scan may not require complex support and a simple MDF board covered with a layer of Plastazote or foam with a barrier layer of tissue or Tyvek is usually sufficient.

External packing for transportation should be tailored to the form and nature of the remains and their supporting structures (e.g. handling boards). Any crate or box used should allow a minimum of 10cm of packing space for the addition of foam or similar supportive and cushioning substances around the maximum measurements of the remains (or the coffin in which the remains are stored). Crates are generally painted with gloss enamel paint to ensure they are waterproof if accidentally exposed to rain (or other hazards) whilst being loaded onto trucks or planes. Wrapped mummies are often uniform in shape, but the body itself is not visible and great care must be taken to provide enough support to prevent movement in transit without applying too much pressure on the actual remains or coffin. Mummies will generally travel in treated plywood and timber crates lined with a medium or soft density foam. The handling board is laid in the bottom of the crate, and pads made from foam and covered with Tyvek are cut to size at intervals to fit the negative space and prevent the mummy from moving. These pads are designed to be removed in sections, so that they will not rub against the surface of the object on its removal or insertion into the crate. The pads are also labelled according to their position in the crate to ensure that the person repacking the crate is able to place them in their original positions. Depending on the original material(s) covering the mummy, an extra barrier layer of non-abrasive material (e.g. Tyvek or Melinex) will also be applied. Beaded, heavily painted and fragile areas of linen should, if at all possible, be packed so that they do not come into contact with other materials, and mummies stored in coffins may require extra support to prevent movement within the coffin (**Pls 2–3**). Unwrapped and naturally mummified remains can prove more challenging due to the variability of positioning and unsupported fragile articulations. The recently CT-scanned Predynastic mummy of Gebelein Man (see Chapter Three, this volume) was laid on a handling board, covered with tissue and packed into a wooden crate. The negative space was then filled with plastic sealed bags loosely filled with polystyrene beads. This was an effective solution in that it allowed a malleable packing material to be used that would fit the complex shape of the body being packed without exerting any pressure. Especially sensitive and fragile areas of the mummy's anatomy, such as an extended hand and fingers, could also remain untouched by careful placement of the packing materials. Contact with the naturally preserved tissues and hair was also avoided. Disarticulated bones and incomplete remains can also be packed in the same way, but are usually transported in acid-free boxes lined with acid-free tissue and placed into crates or protective boxes.

Crates in transit will inevitably travel by several forms of transport until they reach their final destination. To limit vibrations, fragile remains are usually carried by hand and require vehicles with suspension facility (e.g. 'air-ride' trucks) that dampen vibration. Loans are accompanied by a British Museum courier, but crates should also have clear labelling to specify how they should be handled, with arrows indicating the orientation in which they should be kept at all times. Customs and the carrier may need to be notified that human remains are being transported, and the regulations and legislation governing the transport of human remains at the destination must be confirmed before leaving the UK (see Márquez-Grant and Fibiger 2011; Giesen and White 2013; Hall 2013; Sharp and Hall 2013). Loans are condition checked on arrival at the borrowing venue to assess whether any changes have taken place during transport. Representatives from the British Museum and the host institution carefully determine if any damage has occurred and all noticeable changes are photographed and recorded. The environmental conditions in which the remains are to be stored and displayed (e.g. temperature, humidity and light) are also agreed in advance as part of a loan agreement (see Chapters One and Three, this volume). It is the British Museum courier's responsibility to ensure that these

conditions are met in accordance with the loan agreement. Human remains, as with all parts of the collection, are also checked after de-installation and once they have returned to the British Museum. It is now possible to monitor the condition of wrapped and encased bodies, such as Peruvian and Egyptian mummies, and determine whether they have suffered adversely from having been transported by comparing old x-rays and CT scans with more recent ones. Such condition checks are an essential part of caring for the collection at the British Museum and help monitor – and in turn limit – any damage that may occur during the transportation of human remains.

Conclusion

Curating human remains is both a privilege and a responsibility. If museums are going to continue to benefit from the public's trust and support, they must make sure that the human remains held in their collections are always handled, stored and transported with great care and in a respectful and dignified way. Such ethical considerations should cover the full spectrum of the curatorial process, from what occurs behind the scenes (e.g. storage and handling) to the display of human remains in museum galleries. This also applies outside the museum and, for example, the sensitivities of hospital staff, patients and visitors should also be considered when CT scanning mummified remains. Collection staff should also be aware of the health and safety implications associated with the human remains in the collection. When appropriate and possible, the handling, storage and transportation of human remains should take into account any cultural preferences and sensitivities of communities that have cultural continuity with the remains, or for whom the remains have cultural importance (see Giesen and White 2013; Chapter One, this volume). The methods used to handle, store and care for the human remains in the British Museum collection endeavour not only to be appropriate and respectful, but they have been developed to ensure the long-term preservation of this unique and important collection for future generations.

Notes

1 The British Museum Human Remains Working Group includes representatives from the Curatorial and Conservation and Scientific Research departments, as well as Collection Services and the Directorate. It acts as an internal forum to discuss the human remains in the British Museum collection in order to maintain best practice and develop guidance documents.

2 A detailed discussion of the health and safety aspects of crypt archaeology, including issues such as exposure to lead oxide, post traumatic stress disorder, infectious disease and personal protective equipment recommendations can be found in Cox 2000.

3 Not recommended for CT scanning as metal interferes with the X-rays. Suitable alternatives include resin-coated Cellite boards and wood.

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