DIVISION OF MAMMALS
COLLECTION MANAGEMENT PROCEDURES MANUAL

MUSEUM OF SOUTHWESTERN BIOLOGY
UNIVERSITY OF NEW MEXICO

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INTRODUCTION

The Museum of Southwestern Biology Division of Mammals (DOM), established in 1936, is rich in natural history material containing over 285,000 catalogued specimens. DOM is worldwide in scope (75 countries) with particularly strong holdings from the western United States, Latin America, Mongolia and greater Beringia. DOM is also taxonomically broad, representing 27 orders, the majority from the Orders Rodentia (>200,000), Chiroptera (>25,000), Carnivora (>20,000), and Soricomorpha (>11,000). Over the past 5 years our average increase in catalogued specimens was >10,000 per year. Use of the collection has increased tremendously through the utilization of our web-based database that demonstrates the value of open accessibility. Increased use also reflects new trends in specimen-based research, including informatics, genomics, pathogen screening, and stable-isotope ecology. We adhere to the American Society of Mammalogists standards with regard to Systematic Collection accreditation and database standards.

History of the Collection

The Museum of Southwestern Biology (MSB), a distinct administrative unit of the University of the New Mexico (UNM) Biology Department, contains collections of national and international significance in all vertebrate classes, invertebrates, plants, and genetic materials. Beginning in 1928, several collections were established and housed in Castetter Hall (Biology Building) on the UNM main campus and originated from the collecting efforts of Edward F. Castetter. Formal management and maintenance of the collections began in 1936 when William J. Koster joined the UNM faculty. The mammal collections grew slowly until 1955 when James S. Findley assumed duties as curator of mammals. Between 1955 and 1978 more than 36,000 specimens were added to the collection. The initial focus of the collection was regional with Findley and his students conducting research on mammals of New Mexico and the southwest. Later, Findley's students acquired significant collections of mammals from Costa Rica, Panama, Africa, and Mexico. Findley's doctoral student, Clyde Jones, came up with the name "Museum of Southwestern Biology" during a visit to the mammal collection in the 1960's. DOM also began a major educational program in mammalian ecology and systematics during this period at the graduate and undergraduate levels and sixty students received graduate degrees under the direction of Dr. Findley.

In 1978, Findley was appointed Chairman of the Biology Department and Director of the MSB and Dr. Terry L. Yates was appointed Curator of Mammals. The hiring of Yates added new dimensions to the mammal collection. In 1979, the Division of Mammals began saving ancillary collections that would form the beginnings of the Division of Genomic Resources (DGR). These new materials formed the nucleus of what is now the largest collection of frozen mammalian tissues (heart, liver, kidney, spleen, etc.) in the world. A large percentage of the current MSB collection of mammals now consists of "holistic" voucher specimens that include not only skins and skulls, but postcranial skeletons, frozen tissues and in many cases chromosome preparations, frozen cell suspensions, and endo-, ecto-, and protozoan parasites. The majority of parasite material collected prior to 2003 has been archived primarily at the Manter Lab at the University of Nebraska-Lincoln, the USDA National Parasite Collection (Beltsville, MD), and the Smithsonian Institution. Recently large collections of parasites were obtained from the Beringian Coevolution Project, Mongolian Vertebrate Parasitology Project (with the University of Nebraska and University of Kansas) and the historic collections of Robert and Virginia Rausch are now archived in the newly formed MSB Division of Parasitology (DOP).

Yates and his students added major collections from Japan, much of North America, Scandinavia, and Latin America, much of the latter as a result of two NSF surveys of the mammals of Bolivia in collaboration with the American Museum of Natural History. The Bolivian survey project resulted in major additions of Bolivian mammals and later comparative samples from Paraguay, Ecuador, Chile, Costa Rica and Honduras. In 1989, UNM received support to establish a long-term ecological research site (LTER) on the Sevilleta National Wildlife Refuge and series of local mammals have been added each year to the MSB collections since that time, accompanied by large amounts of ecological and climatic data. Beginning in 1994 and continuing through 2007, the UNM has conducted NIH / CDC funded programs on the ecology of infectious diseases, predominantly investigating the relationships between hanta and arenaviruses and their muroid rodent hosts. These studies have resulted in the deposition of a large series of small mammal voucher specimens from throughout North, Central and South America, but primarily the Southwestern US, Panama, and Chile.

In 1994, vertebrates from the USGS Biological Survey Collection in Fort Collins, Colorado (BS/FC) were moved to the MSB. The collection was started in support of predator food habits studies conducted by the Bureau of Biological Survey in the Western U.S. in the late 1920's. The mammal collection now contains over 25,000 specimens of dry and fluid-preserved mammals and is particularly rich in specimens from western Federal lands, especially Nebraska, Wyoming, Colorado, Utah, Arizona, and New Mexico. USGS Biological Survey Mammal Collection is managed by the staff of the USGS Arid Lands Field Station and is now integrated into the DOM.

Dr. Joseph Cook was appointed Curator of Mammals in 2003 and continues the tradition of heavy research use of collections as well as expansion of the collection through field expedition that produce integrated (host-parasite) specimens that are fully digitized and available via the WWW. DOM has more than doubled in size under Cook and continues to support an array of student-based and other research projects in ecology and evolution, including host-parasite studies. The NSF sponsored Undergraduate Opportunities Program has placed 46

undergraduate students in research projects largely based on museum specimens. NSF, NIH, and other federally supported projects (e.g., USDA, USGS, USFWS) are adding new materials at a rate of >10,000 specimens per year from northwestern North America, Latin America, and Asia (including the incomparable Robert Rausch collection) and from the Southwest. In 2005, we accessioned a large collection of specimens (>32,750) from the southwestern US, Latin America, and Alaska that had been orphaned from the University of Illinois (Donald Hoffmeister's collection). In 2015-16 the mammal voucher and tissue collections from the New Mexico Museum of Natural History and Science were transferred to the DOM. With the addition of these holdings, the MSB Division of Mammals ranks third in size among collections of mammals in the world and recently surpassed the Museum of Vertebrate Zoology at UC Berkeley to become the largest university-based mammal collection in 2011. The collection has also become a locus for new educational efforts through the NSF sponsored AIM-UP! Research Coordinating Network.

LOCATION AND ARRANGEMENT OF THE COLLECTION

The dry collections of mammals are housed in Room 231 on the second floor of the CERIA building (#83) on the UNM main campus. This room also houses the MSB bird collection. Mammal skins and skeletal material are stored in standard museum cases that sit on manually operated moveable carriages. Currently, oversized skeletal material of large mammals and small- to medium-sized taxidermy mounts are housed in cabinets that sit on moveable carriages and on open shelving along the north wall. Tanned skins are stored in three large cabinets alongside the skeletal cabinets. There are about 300 type specimens (holotypes, paratypes, syntypes, viral and parasite symbiotypes) of mammals located in the designated "type case" at the front of Room 231. The type case is kept locked at all times and use of type specimens must be arranged with the curator.

Fluid preserved specimens are housed on open shelved movable carriages in a specially designed room controlled for light and temperature on the first floor of CERIA (Room 145). These collections are co-located with all MSB wet collections. Refer to Appendix 1 for a map of the dry (Room 231) and wet (Room 145) mammal collections. A frozen tissue collection and chromosome collection located on the third floor, CERIA 324. There is also a separate teaching collection for mammals located in a newly renovated teaching laboratory in the basement of Castetter Hall.

Taxonomic arrangement

The collection of the Division of Mammals follows the taxonomy of Wilson and Reeder (2005). Major arrangement deviations in the DOM dry collection are: Perissodactyla are at the beginning of the collection; Lagomorpha follow Chiroptera; Rodentia follow Lagomorpha; Carnivora follow Rodentia. The DOM wet collection follows Wilson and Reeder (2005) without the above deviations.

The collection is arranged phylogenetically by Order and Suborder. Within Suborder, Families are arranged alphabetically; within Family, subfamilies are arranged alphabetically;

within Subfamily, specimens are arranged alphabetically by Genus, then Species. Within Species, specimens are arranged geographically in alphabetic order by Country, State, and then County. Within County, specimens are ordered numerically by MSB catalog number. See Appendix 2 for a complete listing of the taxonomic arrangement.

ACQUISITION OF SPECIMENS

Overall Strategy for Acquisition of New Materials

Our goal is to acquire broad spatial and temporal representation of populations of mammals from western North America, Latin America, and beyond. These comparative materials usually are collected through integrated field studies that emphasize the need to archive multiple datasets and modes of preservation in an effort to stimulate the maximum number of scientific and educational studies that can be conducted on each voucher specimen. Typically, traditional methods of preservation (skin, skeleton) are combined with the preservation of ultrafrozen tissues (e.g., heart, liver, kidney, spleen) and endo and ectoparasites. We also archive well-documented voucher specimens prepared in the course of non-systematic investigations especially those conducted by state and federal resource agencies.

Sources

Specimens are acquired as the result of collecting trips, exchanges, salvaging, donations, purchases and "permanent loans." Many accessions result from fieldwork done by biologists at the University, as well as acquisitions from state and federal agencies and private collectors. Exchanges are made with other collections for specimens that are otherwise difficult to obtain. Purchases are rarely made. The Division of Mammals can also receive endangered or protected species from state and federal agencies which have been either collected or confiscated. Material can be already prepared, often from field collecting, or be in the form of unprocessed frozen specimens.

Conditions of acceptance:

Acquisitions must support the purpose of the Collection; namely to document and support investigation of the mammalian fauna of western North America, Latin America and regions beyond. All acquisitions should be approved by the Curator. Specimens will not be accepted unless accompanied by copies of all relevant legal documents authorizing collection, exportation, importation, or shipment. Specimens lacking complete data may be accepted to augment the teaching collection of the Biology Department.

Legal and ethical considerations:

Personnel associated with the Mammal Collection are required to conduct all transactions in a legal and ethical manner. Anyone who knowingly performs an illegal act in obtaining and/or transporting specimens will not be supported by the Museum. Individuals planning field work should be aware of, and in compliance with, federal, state, local, and/or international laws.

More generally, the term "museum conscience" (Grinnell, 1922) describes respect for the knowledge derived from the careful accumulation of well documented specimens. Earlier workers have invested lifetimes of effort in natural history collections. They, and we, have done this with the expectation that specimens will receive perpetual care and respect, and will be complimented by new material of similar quality and significance.

Permits

Non-US material: All CITES member nations require Export and CITES permits (and often collecting permits) on their protected wildlife. It is our responsibility to know the laws of the countries in question and to comply fully with them. Prior to arrival in the United States, U.S. Fish & Wildlife Service (USFWS) Form 3-177 must be filled out. Declaration must be made at customs at the point of entry. Theoretically, a USFWS agent must validate the importation at the time of entry. If frozen tissue is being brought into the country, an APHIS permit (US veterinary permit for importation & transportation of controlled materials & organisms & vectors) may be required and then shown to the USDA inspectors.

U.S. material: Specimens must have been obtained legally. Collecting and salvage activities may require both state and federal permits.

Endangered/Threatened Species: This permit is required when previously legally acquired specimens are exported or re-imported. Declarations must be made to USFWS agents prior to the shipment of specimens. If material which has been collected illegally is brought to the Mammal Division, our instructions from our regional US Fish & Wildlife agent are to take possession of the material, get as much information about the donor as possible (name, address, etc.), and contact the pertinent authorities.

Once all legal issues have been resolved, an assessment of the specimens value and appropriateness for the collection must be made. A number of questions should be asked: What are the collections current holdings of this taxon? Does it fit within the scope of collections? Does it contain complete data? Upon adequately answering these questions, a decision can be made whether or not to accession the specimen into the main collection or the teaching collection, or investigate a possible exchange or transfer with another institution, or to discard the specimen appropriately.

Accessioning

A specimen or group of specimens received from a single source at a single time comprises an accession. Although collections received from a single source at approximately one time can include birds, arthropods, or reptiles in addition to mammals, a single accession is assigned in order to facilitate specimen processing, record retrieval, or reporting requirements. An accession number demonstrates museum ownership and is required before specimens can be processed or specimen data are entered in the database. The accession number is recorded sequentially in the Mammal Accession logbook and entered into the Arctos database; the following information is recorded: donor name and contact info, date accessioned, and nature of

the collection material (see Appendix 3 for an example from the Arctos accession page). If the specimen is to be prepared at a later date, it should be sealed in a plastic bag with all available data and placed in the freezer. Specimens that are to be made into study skins should be double bagged to prevent freezer burn. Frozen specimens must be very clearly labeled and include the following minimal data: species identification, locality, collector, date, and accession number. Material not so labeled may be (and likely will be) discarded without notice. Freezer labels must be waterproof. The label will almost invariably become moist, and may become soaked with blood. The paper and ink must be water-resistant, and the label must be secured to the package or inside plastic bags.

Material in the freezers tends to be moved around. All specimens are fragile, but small mammals in particular should always be placed in boxes that will protect them from breakage.

Photocopies or originals of all associated field notes, journals, permits, correspondence, or other data are scanned and linked to the Arctos accession record and the originals are filed in a manilla folder bearing the accession number. The accession number should accompany the material through cataloging and will remain linked to those specimens even after they have acquired MSB catalog numbers.

Donor Form

Occasionally the division receives material donated by community members. Staff should obtain the following information and enter it into the electronic database (see Documentation): name and address of the donor; name and address of the collector; place and date of collecting (specific locality). If available, field catalogs and notes should be acquired.

Handling new material:

Specimens usually come to the Museum in one of three conditions:

1) Raw or frozen carcasses.
2) Dried skins or fluid-preserved carcasses, either of which may be accompanied by dried skeletal material.
3) Completely prepared specimens.

These conditions also represent stages in the process of adding to the collection. Raw or frozen material (1) must be prepared immediately or frozen in one of our temporary-storage freezers. Partially or completely prepared specimens (2 and 3), except for fluid-preserved material, must be fumigated.

MSB Division of Mammals
Accessioning of incoming material

1. All incoming material **must be accessioned** before being placed in the freezers.
2. Fill out the next consecutive accession number in the Accession book, then add the accession to the Arctos database.
3. Minimally include Donor name; Contact Information; Nature of donation (include numbers of and species of specimens if available); Date of deposition.
4. Include a card with the accession information inside the bag.
5. Clearly label the outside of the bag with a label containing the accession number.
6. **Update** the accession inventory and locator sheet.

7. Cross off any accessions once they have been removed.
8. Material from/for Cook lab research should be placed in Cook Research Freezer.
9. Other incoming material can go in Freezer 2 or 5.

See Jon Dunnum with any questions
277-9262; jldunnum@unm.edu

Fumigation:

Arriving prepared mammal specimens (except fluid specimens) must be placed in the Museum's -20 C IPM freezer for 10 days. The date when specimens were placed in the freezer and the accession number must all be noted in the **freezer logbook.** When included on the outside of box, the packing invoice should be stamped with date of receipt and placed in the Collection Manager's mailbox. If no invoice is attached to the outside of the box, a dated note must always be left in the Collection Manager's mailbox to advise him that specimens have been received and placed in the freezer.

After specimens have been frozen for 10 days, they must be removed from the freezer, appropriately logged-out (freezer logbook), and placed in holdup cases to await cataloginf and installation.

FIELD-PREPARED SPECIMENS; Consists of Prepared Skin, Unprocessed Carcass, Tissue Samples, Field Notes and Catalogs, and Other Materials.

1) Acquire accession number from Collection Manager. Indicate this number on all bags or other containers where the specimens are being kept.

2) Fumigate all incoming skin specimens by placing in fumigation freezer. Fill out depository slips to indicate material origin, date, and person placing this material into the collection. After the skins are fumigated (usually 10 days at -20C) remove from freezer, thaw, place in holdup cases.

3) Hang carcasses in preparation room to dry. Double tag all carcasses with dymo-labeler (usually duplicating the NK number) to prevent tag loss during subsequent processes. Once dry, bag carcasses in accession groups or by NK number and place in holding freezer prior to bugging.

4) Make a photocopy of all pertinent field catalog pages and keep this information in drawers with the study skins. Original notes are filed in notes case alphabetically by collector.

5) Arrange specimens according to collector's field catalog numbers in one or more drawers. If the NK (New Mexico Kryovoucher) system is being used in addition to the collector number, arrange specimens by NK number.

6) Rinse fluid-preserved specimens (12-72 hrs) to remove formalin residues and place in 70% ethanol alcohol. These specimens are to be stored by taxa and locality in jars marked "To Be Cataloged." Specimens from different localities from the same state and county can be placed in one jar with appropriate labeling to conserve jars and shelf space.

7) After checking that each tube is clearly marked, place nunc tubes containing tissue in holdup ultralow (-80 EC) freezer in the Division of Genomic Resourses. Notify Collections Manager of other ancillary materials and of their deposition.

8) Deposit completed NK pages or other field data sheets with the Collection Manager. IDs should be verified by CM and data entry into ARCTOS should be done as soon as possible to allow for assigning of catalog numbers and label generation. Complete final data verification of all material. The Curator, Collections Manager, or other expert may be asked to complete this step.

9) Osteoscribe following those procedures. Install computer generated labels.

10) Install specimens (including alcoholic, anatomical, tanned, and ancillary specimens). If further study is required, place in research case. No specimens are to be installed until all of the above procedures have been completed. Never discard an original tag, label or field note. See installation instructions for complete details.

SPECIMEN PREPARATION:

Whole animals, or raw parts of animals, have to be prepared as museum specimens. There are several options to be considered depending on the condition of the material and the needs of the Collection. In general we strive for a balance of skin, skeleton and fluid preserved specimens of each species from each locality.

In current practice, most of our mammal specimens are comprised of three parts: a study skin, skeletal material (particularly the skull), and frozen tissues. In the process of preparation, different parts go to different places for different treatments. Maintaining their associations with each other and with their original data is critical and demands care.

Tissue sampling should be preformed first, then removal of the GI tract if for parasite examination is to follow. If specimens are not being examined for parasites and are going to be fluid preserved, leave the GI tract inside the specimen. If the specimen is to be a skin/skeletal preparation then remove the GI tract and all excess tissue.

Study skins:

Small mammal study skins are prepared according to methods described by several American authors (e.g., Hall, 1981). The animal's right fore and hind limbs are kept with the skin, left limbs go with skeleton. If the study skin will fit in one of our large specimen trays, then it can be stuffed and dried. If it is larger, it must be "salted out" for tanning.

Skeletons:

After removal of the skin, as much muscle should be removed as possible. The tongue should be removed and the skull tag should be run through the mandible. Roll the carcass into a compact form with all extremities and tail tucked in to avoid later breakage. Tie the carcass together using the skull tag string or additional thread if needed. Hang the skeleton to dry thoroughly before packing up for shipment.

Fluid-preserved specimens:

Historically, fluid preserved specimens were typically "fixed" using 10% buffered formalin followed by H_20 rinsing and storage in 70% ETOH. Methods of fluid preservation are described in Genoways et al. (1987) and in Hangay and Dingley (1985). However, as utilization of fluid preserved specimens in molecular analyses has greatly increased, preservation without formalin fixation is now preferred in order to facilitate the ability to extract usable DNA from the specimens.

Specimens should be placed in 95% ETOH for the initial preservation. The mouth should be open (stuff with cotton if needed) and the body should be reasonably straight. The abdominal cavity should be slit open and the diaphragm should be cut to insure rapid and complete preservation. Animals larger than squirrels may require pressurized perfusion and/or injection. Tags should be of museum quality paper and ink should be indelible and appropriate for storage in ETOH. Following the initial preservation period, specimens should be transferred to 70% ETOH. The specimens should not exceed 2/3 of the volume of the archiving jar.

Every one to two years alcohol preserved specimens should be checked for alcohol percentage and the general condition of the specimens. This will be done by measuring the percentage of the alcohol, measuring the pH, and by personal observation.

Over time it is not unlikely the alcohol percentage declines. To measure the percentage (specific density) of the alcohol a digital density meter is used. Only a small sample (2-4ml) of alcohol needs to be taken form a bottle with specimens. For every percentage there is a specific density (r) (temperature depending. If the percentage is lower than 65% (r=0.894 g/cm3, T= 20°C)), alcohol in the bottle should either be renewed by 70% (r=0.881), or mixed with 95% (r=0.807) to get 70% alcohol. Before mixing the 75% (r=0.869) or 70% alcohol out of 95% and H2O, density of the 95% should be verified. It is not unlikely that some dilution may have occurred, especially when specimens in alcohol have been stored in the lab for months. For a 75% solution, mix 100 volumes of 95% alcohol with 29.5 volumes of H2O. For a 70% solution, mix 100 volumes of 95% alcohol with 39.2 volumes of H2O. If a mix has been previously made, then its percentage must be verified. The alcohol in the bottle should be within one or two percent of 70 or 75%. More important for the preservation is a stable environment to prevent the specimens from (early) deterioration.

The acidity of the fluid must also be checked. The alcohol should not have a pH lower than 5, and not higher than 8. This can easily be checked with pH paper.

Fluid preserved specimens are arranged as described in the general paragraph about this subject. Name of species, location, date of collection, and MSB numbers of all the specimens will be written on a waterproof label and put into the bottle with the specimens.

Tissue Sampling Procedures

1. Use Nalgene System 100 tubes (1.5 ml) for all tissues.
2. Place colored inserts in tubes depending on tissue type.
    a. Red cap for heart, kidney, lung, spleen

   b. Yellow cap for liver
   c. Blue for muscle
   d. White for blood, parasites (endo, ecto), brain
   e. Green for karyotype cell suspension
3. Label cryotubes with Sharpie pen.
   a. Write NK number on cap and on tube, then put corresponding barcode sticker on if available.
   b. Include tissue type (e.g. blood, muscle, h for heart, lu for lung, l for liver)
   c. Write out date (e.g. 20 Nov 2007).
4. Fill out NK page with a permanent (uniball) ink pen (see procedures under NK pages).
5. Tissue sampling
   a. Minimally take 2 tubes of tissue per animal (1: heart, kidney, 2: liver). .
   b. Heart, kidney, spleen, liver are most desirable, lung is good for viral work, least useful is muscle.
   c. Number and type of tissues taken may depend on nature of the study. [Balance cost of archival with taking sufficient samples].
   d. If only a skull is available (i.e. carnivore skulls received from trappers) then take muscle and brain.
   e. Take double tubes of heart, kidney and liver on large animals.
   f. Tubes should not be filled more than 2/3 full to avoid problems with expansion when freezing.
6. Take tissue or blood samples and put them in liquid nitrogen as soon as possible. Keep frozen during storage and transport at minimally -20° but preferably -80° C.

SOP: Collection of Tissues in RNA*later* Reagent.

Qiagen RNAlater Stabilization Reagent (Cat. # 76106)

Store at room temperature (15-25°C)

1.) Before excising the tissue, estimate the volume (or weight) to be stabalized in RNA*later* Reagent.

2.) Add at least 10 volumes of RNA*later* Reagent (10ul reagent per 1 mg tissue) is required.

3.) Excise the tissue and, if necessary, cut into slices less than 0.5 cm thick. Perform this step as quickly as possible and proceed immediately to step 4.

4.) Completely submerge the tissue piece(s) in the collection vessel containing RNAlater Reagent.

5.) Store the tissue submerged in RNAlater Reagent for up to 4 weeks at 2-4°C, up to 7 days at 10-25°C or up to 1 day at 37°C.

Archival storage:

For archival storage at -20°C, incubate the tissue overnight in the reagent at 2-8°C, and then transfer the tissue in the reagent to -20°C.

For archival storage at -80°C, incubate the tissue overnight in the reagent at 2-8°C, remove the tissue from the reagent and transfer it to -80°C.

NOTE: Homogenization of tissue(s):
Remove tissue(s) from RNA*later* Reagent before disruption (homogenization).

ASSOCIATED DATA

Preparation of labels:

Each study skin and fluid-preserved specimen in the Collection has a MSB specimen tag. Most often, this will be affixed in the field when the specimen is collected. Usually it will be tied with a square knot to the mammal's right leg. If the right leg is damaged or missing, the left may be used. The information on this tag must be printed clearly (cursive writing must not be used.)

When specimens are received in exchanges or as gifts from other institutions, a MSB tag will be sewn on top of the other institution's label. This label may have only the scientific name and the MSB catalog number, assuming that the original label is more reliable than a transcription.

An important distinction in labeling is between data which are transcribed onto labels from another source versus data which are created.

With the few exceptions noted below, all data on the MSB specimen label (Fig. 1) are to be printed in permanent black ink (rapidograph, uniball delux or substitute, **not sharpie**). Uppercase and lowercase letters should be used as appropriate; proper capitalization can be crucial in geographic descriptions. The format for skin labels is roughly of that shown in Hall (1981) on page 1123.

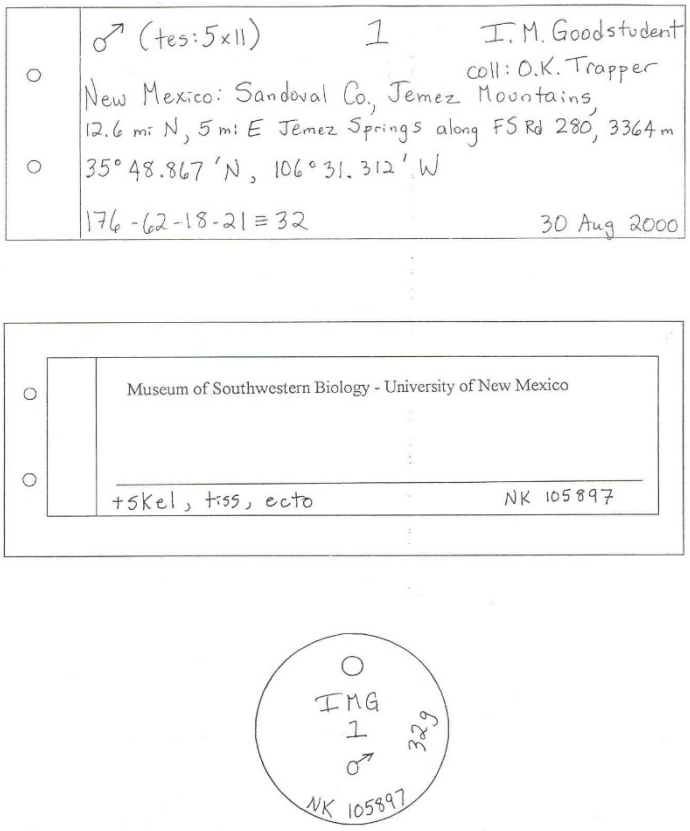


Figure 1 Specimen label and tag.

1. Unlike Hall (1981), **locality** proceeds from broadest category to most specific. Uppercase letters for USA state designations (e.g., "ALASKA: Aleutian Islands, Shemya Island") must be used, and for countries other than the USA, the country name is written out in capital letters (e.g., "BOLIVIA: La Paz, Ciudad Tuco"). Place names in Alaska should conform to those listed by Orth (1967) and/or those found on the USGS maps of Alaska, preferably the USGS 1:250,000 series. Place names whose existence cannot be verified by reference to Orth or to USGS maps are to be written in quotation marks. Or, if you are creating a locality description, restrict yourself to established reference points. In transcribing a variation, it is appropriate to include the established spelling in brackets after the original spelling (e.g., "Sisualik" [=Sheshalik]). If a place name is simply misspelled (e.g., "Ancorage"), just spell it correctly. Note that there are many duplicated place-names in Alaska (e.g., Orth lists 47 Moose Creeks), so it is important that the locality description is unambiguous. Latitude, longitude, and elevation should follow the specific locality
2. **Date** of collection is date of specimen's death; it is to be written day-month-year. Numbers for months must not be used; they must be written out abbreviated using the 3-letter abbreviation (Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec). The year should include all four digits (e.g., "24 Feb 1993"). In cases in which a wild mammal is captured and kept in captivity, remember that the date of its death, not the date of capture is the collection date. The date of capture can be noted in a remark on the label.
3. The Mars/Venus **sex** symbols are used to designate sex. There are limited possibilities: M, F, ?, M? and F?. Only if reproductive organs have been actually identified is the sex

designated. (Reproductively quiescent shrews are not females by default; use a dissecting microscope.) "M?" and "F?" are rarely justified except in transcription.

4. **Collector** is the person who (occasionally, the agency that) is responsible for the veracity of the specimen's original data. Someone who provides secondhand data, even when there are no other data accompanying the specimen, is not the collector. Either the collector's name or the preparator's name should lead us to the correct file in our archive.
5. **Scientific name** is to be written in sharp hard pencil (#3 or #4). This may not be possible until the skull is cleaned and examined. Identification of subspecies is to be done only by an authority. Such identifications should be initialed and dated (year) by the identifying authority at top right of label front. Specimens are not arranged in the Collection by subspecies.
6. **Weight** must be in grams. If weight is not recorded until months after collection date, it is appropriate to append parenthetically the date that the weight is taken. Partial weights or weights from specimens that are obviously desiccated should not be recorded.
7. **Reproductive condition:** Length and width of one testis if specimen is male should be recorded; if it is female, the number and crown/rump length of embryos must be noted. It is valuable to include as much detail for reproductive condition as possible.
8. **Preparator and Field/Prep numbers:** The preparator's name is unnecessary if the collector and preparator are the same. One may refer to the discussion of field numbers in the Data Standards Manual.

Because many specimens that reach MSB do not come from professional mammalogists, original data are sometimes written on a scrap that cannot be attached to the prepared specimen. In such cases, the information is to be transcribed onto a final MSB specimen label and the original is to be carefully proofed against the final by the preparator and by a member of the curatorial staff. Only then can the original "label" be discarded, and only if the label cannot be stored in the permanent accession file.

Original labels that are not too large or unwieldy are to be sewn to and beneath a MSB label.

Field Journal

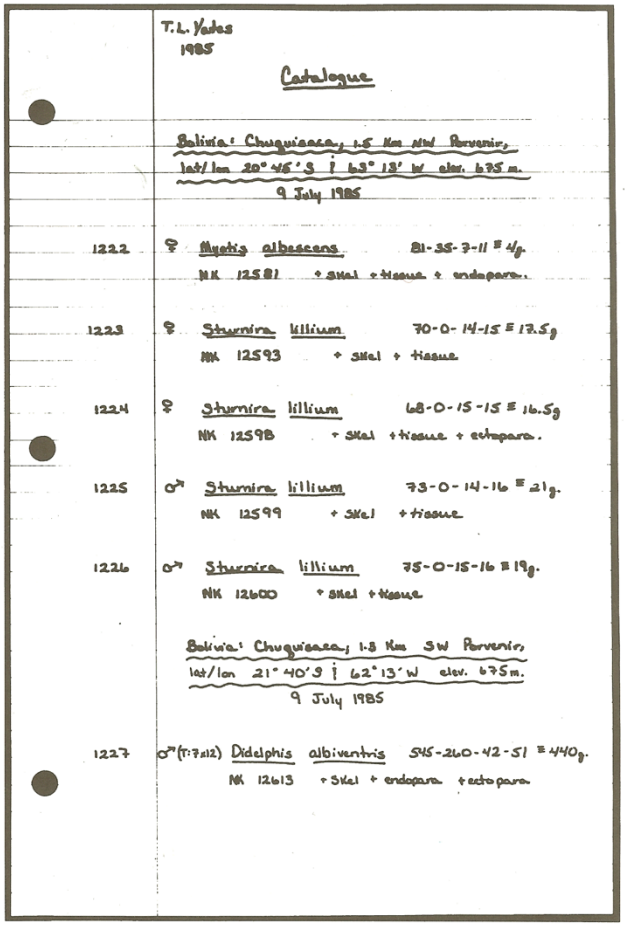
The field journal and catalogue represent the documentation for the voucher specimens you are collecting and provide a record of a point in time and space. They serve as an historical record and will be archived in the Museum along with the voucher specimens in perpetuity.
The following are data which should be included in good field notes:

1. Road log – provides a step by step description of how to get to your collecting locality. Should contain time checks, mileage, and important landmarks.
2. Participant list – should include the full name, 3 letter initials (will be used on skull tags), and signature of all the other people who are on the trip with you.
3. General site description – habitat (i.e. riparian zone, alpine tundra), plant species, % cover, height of under and overstory.
4. Officially designated locality (i.e. USA: NEW MEXICO; Sandoval Co., 3.25 mi N, 10 mi E of Jemez Springs. 35º 48.9'N, 106º 31.3'W, elev. 2610m.)
5. Weather – things that might affect trap success (i.e. rained overnight, extremely windy, snow on ground, etc), average temperature.
6. Trapline information –
   Name your line (i.e. JLD 1).
   Names of other people if you combined on one line (JLD/JAC 1).
   Number and type of traps in your line (i.e. 40 snaptraps, 80 shermans, 10 tomahawks).
   Describe your trapline specifically (i.e. along riparian area, very rocky, overstory of mixed conifers ca. 40' tall, shrub understory 3' high, ground cover ca. 10 cm high and 40% coverage). Include dominant plant species if known.
7. Draw maps of the locality, including your traplines and bat net locations.
8. Each day keep a tally with the number of captures, their trap numbers, species IDs and trap success (i.e. 10 captures / 40 traps = 25%). Even more beneficial if you can also keep records for the group as a whole.
9. Species list for the trip.
10. Any ancillary information that you think is important or interesting to future people who may use your field notes. Foremost, your notes should be clear and informative as the information you collect will be used when cataloging and archiving your specimens and may also be critical in future scientific research. Secondly, your field notes provide a narrative of your field mammalogy experience, continuing a long tradition of great story telling.

Preparation Catalogue

The following data must be recorded in the field catalog (Fig 2.):

1. Unique, consecutive preparators number
2. Gender and reproductive information
3. Standard mammalian measurements (in mm; total length, tail length, hind foot length, ear length, plus tragus and forearm lengths for bats; and (in g) mass)
4. Collection date
5. Locality information from general to specific: country, state, county, specific locality, and geographic coordinates, elevation (i.e. USA: NEW MEXICO; Sandoval Co., 3.25 mi N, 10 mi E of Jemez Springs. 35º 48.9'N, 106º 31.3'W, elev. 2610m.)
6. Collector, preparator and prep number
7. Nature of specimen (skin, skeleton, alcoholic, tissues, endoparasites, ectoparasites, karyotype, blood, baculum, etc.)
8. Unique NK number
9. Accession number
10. An MSB number will be added when the specimen is catalogued.


T. L. Yates
1985

Catalogue

Bolivia: Chuquisaca, 1.5 Km NW Parvenir,
lat/lon 20° 45' S & 63° 13' W elev. 675 m.
9 July 1985

1222 ♀ Myotis albescens 8.1-35-7-11 = 4g.
NK 12581 + skel + tissue + endopara.

1223 ♀ Sturnira lilium 70-0-14-15 = 13.5g
NK 12593 + skel + tissue

1224 ♀ Sturnira lilium 68-0-15-15 = 16.5g
NK 12598 + skel + tissue + ectopara.

1225 ♂ Sturnira lilium 73-0-14-16 = 21g.
NK 12599 + skel + tissue

1226 ♂ Sturnira lilium 75-0-15-16 = 19g.
NK 12600 + skel + tissue

Bolivia: Chuquisaca, 1.8 Km SW Parvenir,
lat/lon 21° 40'S & 62° 13'W elev. 675m.
9 July 1985

1227 ♂ (T:?;12) Didelphis albiventris 545-260-42-51 = 440g.
NK 12613 + skel + endopara + ectopara.

Figure 2. Field catalog page.

MAINTENANCE OF FIELD NOTE COLLECTION

BACKGROUND

Field notes may take several different forms. Notes that are taken in the field about the collecting trip, habitat notes, notes on behavior of the animals being studied, methods of capture, location specifics, mileage, and lists of co-workers compose field notes. Our MSB collection also requires that a specimen catalog accompany these field notes.

The specimen catalog is an integral part of the field notes. It is a record of the specimens collected by the collector and includes the collector number, date, sex, location, and field measurements of the specimen (total length, tail length, right hind foot length, right ear height, weight (in g)). The New Mexico Karyotype (or NK) number is also added to the field catalog if tissue was taken for later analysis.

Field notes also include the NK catalogs and the xeroxed NK pages that are sometimes taken into the field. Anything that has original data and was prepared at the time the specimen was prepared must be treated as original data and must be kept as long as the specimens exist. This even includes xerox copies that were taken into the field and used to enter original data at the time of preparation (such as the xeroxed NK pages).

The field catalog is then used at the time of final identification and cataloging into the museum. Finally, the MSB catalog number is written on the original field catalog pages for cross reference.

FIELD NOTE MAINTENANCE

When a collector brings field notes into the museum several steps ought to follow. First, the notes are checked for completeness and accuracy. Then, copies are made of the original field catalog and accompanying notes: one copy for the author of the notes, another for the "working" copy of the field notes that are available for general use, and perhaps a third copy for a conglomerate working copy that includes several authors of an expedition (i.e., "Bolivia, 1986"). Copies are to be distributed appropriately with the working copy put in a binder, labeled, and put alphabetically by author in the library with the other working copies of field notes.

The original notes are as important as the specimens themselves because they contain much of the valuable background data about the specimens. These notes should be stored in a locked case and only available to the Collections Manager, Curator, or Graduate Assistant Curator. The notes are filed alphabetically in manilla envelopes until they are of sufficient number and completeness to be bound for a more permanent and secure storage.

NK Books

1. Fill out NK page with a permanent (uniball) ink pen (see example NK page in Appendices). Minimally include the following information.
    a. Collector: Project name/person (e.g. Beringian Coevolution Project / S. O. Macdonald)
    b. Species: (e.g. *Ovis canadensis*)
    c. Sex:
    d. Locality data: State, County, Specific locality, Lat/Long, elevation
    e. Date of collection
    f. Nature of Voucher: check all that apply (i.e. skin, skull, tissues)
    g. # of tubes of each tissue type and preservation method (e.g. 2 tubes fz (frozen)).
    h. Include any identification numbers (Mexican wolf studbook #, NMGF #s) associated with the animal in remarks (especially if it is a mark release animal).
2. If whole animals are collected to be brought to the museum be sure to include full data with the animal (Collector, collector contact info, locality data with lat/long if possible, date of collection). If samples have been taken already be sure to include the NK number on the carcass so tissue or blood samples can be cross referenced with the voucher specimen.

PROCESSING SKELETAL MATERIAL

Small and medium sized skeletons are placed in the dermestid beetle colony (see below) for further processing to more thoroughly remove muscle and tendons. Processing large skeletons (mountain lion and larger), however, requires additional work. Large skeletons are prepared more quickly and efficiently by simmering at low heat to soften muscle to the point that it literally “falls off the bone”. The skulls of large mammals are **never** simmered and are always processed in the dermestid beetle colony. Brain cases of large mammals (fox, marten or larger)

should be emptied of grey matter using pressurized water and forceps, allowed to dry, then sent to the dermestarium.

Simmering

Dry or frozen specimens should be soaked in water for a day before simmering. This helps to remove blood and results in less discoloration of the postcranial skeleton. The kettle is filled with water and heated to 180 ^{o} F. After this temperature is reached, the postcranial skeleton is placed in the kettle and simmered from 4-48 hours depending on the size. After this time the kettle is turned off and the water allowed to slowly cool to room temperature (minimum 24 hours). The hot water should not be drained from the kettle as this leads to increased cracking of long bones and other elements. The water should then be drained, the bones removed, and any remaining tissues removed from the bones by hand. A second immersion, simmering and scraping may be necessary if connective tissue is still substantial. Occasionally, it may be necessary to "blow out" marrow or vessels still remaining in the long bones. This is done with compressed air. Long bones are opened proximally and distally with a 1/8" to 1/4" drill bit perpendicular to axis of bone, below the condyle, to allow the escape of marrow and cavity fluids.

Maceration

Specimens should be placed in fine nylon mesh bags with the NK number on an aluminum tag attached to the specimen and the outside of the bag. If possible, skulls should not be macerated as teeth may loosen. Bags can then be placed in large 55 gal plastic drums and covered to keep flies out. Do not seal the tops as oxygen must be able to get in. The drums should be kept away from public areas as the smell is quite strong. Specimens should be checked every couple weeks. Once ready the flesh should fall off the bones. Bones should then be rinsed and may need to be simmered to remove excess fats.

DERMESTID BEETLE (*DERMESTES MACULATUS* AND *D. FRISCHII*) COLONY

1. Previously dried carcasses are removed from the freezer and allowed to reach room temperature before going into the bugroom.
2. All specimens should already be individually tagged with a thermally printed plastic NK tag or aluminum tag.
3. Place each specimen in its own tray or box (n**o exceptions)**; ideally with sides that are higher than the specimen itself. Also be sure that no parts extend from the tray; this prevents the possibility of bones getting mixed with other specimens. Specimens should be placed in boxes and trays in a single layer in the bottom of each bugbox. But if additional specimens must be added, be sure to use larger trays in which to consolidate many smaller trays or boxes. This adds stability and makes it easier to remove the top trays in order to check the condition of the specimens on the bottom.
4. Cover each layer of specimens with several long pieces of paper toweling that are folded over to form 2-3 layers. Thoroughly spray the paper towel with water using a mister. The extra thick layers of paper towel help maintain high humidity in the bugbox. Although the beetle colony is maintained between 80 º and 90 º F and humidity is high (40% or greater, but not tropical), it can dry out fast. Bugboxes should be sprayed at least

2-3 times per week, or more or less depending on the ambient temperature. Be careful when lifting towels to spray carcasses. Skeletal parts may stick to toweling or boxes below and become lost.

5. If dermestids appear not to be feeding on the muscle, it may be necessary to either (1) remove the carcass and soak it in a concentrated bouillon (beef or chicken) solution for a few hour before returning to the bugroom or (2) spray with bouillon or apply bacon grease directly to the carcass.
6. **Bugboxes should be monitored very regularly**, when active, dermestids can clean a small skeleton in a couple of days. Leaving skeletons in too long will result in complete disarticulation and can even result in the bones themselves being eaten. Carcasses are ready to be removed from the bugbox when all noticeable muscle and connective tissue are gone. Be sure that no brain matter remains in the inside of the skull and that the forefeet and hindfeet are free of connective tissue.
7. Use forceps or gloved hands to lift loose bones from each container and place in either a plastic vial, glass jar, or plastic bag. While removing bones, brush off adult and larval dermestids. Check carefully in the bottom of the tray to avoid leaving behind bones in the bug frass that can pile up. It is also helpful to empty the container into a specimen tray and carefully inspect for residual bones. Empty excess frass into bottom of bugbox.
8. After thoroughly and carefully removing all components of a specimen, make sure that each specimen has a tag.
9. Place specimens in plastic bags labeled with the date and put in a "post dermestids" freezer for a minimum of three weeks to ensure that all dermestids are dead.

Precautions:

Extreme care should be taken when returning to the museum after working in the dermestid colony. If showering is not possible, shake out your hair, wash hands thoroughly, and change clothes and footwear if possible before returning to the museum. Do not work in the Collection after working in the bug room unless all precautionary measures are met.

DERMESTIDS CAN CAUSE ALLERGIC REACTIONS.

1. Wear a lab coat.
2. Wear gloves to avoid skin contact.
3. Wear a dust mask to prevent inhalation of particulate matter.
4. Wash hands after working with the dermestid colony.

Post-dermestid Cleaning

The specimen is removed from the freezer and allowed to dry, in its container, at room temperature, for an hour. Although dermestids are efficient at removing the majority of the soft tissue, sometimes even in the smaller specimens some connective tissue can remain. In larger specimens, grease from the marrow cavities of the long bones usually remains behind, and our conservative approach is to remove some but not all of the grease.

In general, the procedure for both situations is to soak the specimen in H2O (or 70% ethyl alcohol for greasy specimens) from 20 min to several hours, depending on the size or greasiness of the specimen, and then manually remove any remaining soft tissue. Smaller specimens, such as shrews or bats, should be soaked for the minimum time (20 min), but larger specimens may require being soaked overnight. When soaking a large specimen, usually only

the long bones are greasy, therefore it is recommended to soak these bones separately from the rest of the specimen. This way all other bones that are not very greasy, for example ribs and vertebra, can be soaked for shorter periods of time. Because bones are hygroscopic and can absorb water, minimizing the time they spend in alcohol minimizes the destructive nature of a liquid environment (Williams 1999). For particularly greasy long bones, it may be necessary to replace the ethyl alcohol with a fresh solution on more than one occasion.

After bones have been removed from the alcohol solution they are briefly rinsed in water to remove any remaining alcohol. Any remaining soft tissue is removed manually using forceps and a scraping tool. While running water over the skull and gently scraping with the dull blade, one can easily remove the soft layer of tissue (peritoneum) that covers the skull. Any thread or wire used in attaching the label to the specimen should be removed and discarded. Once complete the specimen is placed on a flat tray to dry safely on shelves in the prep room.

Specimens should be allowed to dry from two to five days depending on size. Dried specimens should be placed in an appropriately sized container (i.e. plastic vial, cardboard box). The specimen number (i.e. MSB, NK, preparator) should be written in Sharpie pen on the vial top or in pencil in the upper left corner of the box.

The specimen should be checked in Arctos to see if it has an MSB number already assigned. If it is already catalogued, it should be placed in the "Catalogued, awaiting matching and installation" case. If it has not been catalogues yet, it should be transferred to the hold-up cases and placed in NK order and matched with their respective skins to await cataloging.

Tanneries:

Skins sent out for tanning should go to tanneries that do work for taxidermists, as opposed to furriers. (A furrier tan will be scraped thinner for better "drape" and unfashionable parts, such as foot pads and noses, may be removed.) Explicit instructions are a must, particularly when sending out more than one specimen of the same species. For example, if claws come off in processing, the tannery may reattach them randomly. The skins will have to be punch marked with unique codes indicating the field number or accession number. The holes must be cut with a three-edged punch, or else they will shrink and/or close in the tanning process. A common punch code is demonstrated here:

```
   .      .
  . .     .   .
 . . .    . . ...
. . . .   ... ...
1 2 3 4   thus, 412, 223, etc.  (Careful with zeroes!)
```

The tannery that we have been using most recently is: American Wildlife Taxidermy, 4410 Central SE, Albuquerque, NM 505 268-1615.

Numbering bones

Once a specimen has been catalogued the catalog number is written on the skull and postcranial skeleton using archival black ink. Several brands of technical writing pens are recommended, for example Rapidograph® or Pigma Micron. Otherwise the most "basic" of equipment always works -- a crowquill pen point dipped in a bottle of ink. Make sure that the

bones are clean and non-greasy before numbering-- this prevents the ink from smearing and helps ensure a clean line. Numbers should be written clearly, without any extra loops, lines, or whorls.

Skull (Fig 3.): With the nasals pointing to the left, write "MSB" followed by the catalog number on the skull in the middle of the braincase, just above the suture line (sagittal crest?) that roughly divides the cranium in half. Below the number (and below the suture line) record the animal's sex using one of the following symbols: ♂ ♀ U. The "U" symbol stands for unknown. On the mandible ("lower jar"), write the catalog number only on each dentary of the lower jaw. When possible write the number along the flattest and largest part of the bone. If the skull is fragmented and in several pieces or sections are beginning to come loose, record the catalog number on as many of the loose pieces of bone as possible. Delicate bones, particularly those of bats, shrews, and small heteromyids, are easily punctured in numbering. Be cautious in handling and in applying pressure with the pen.

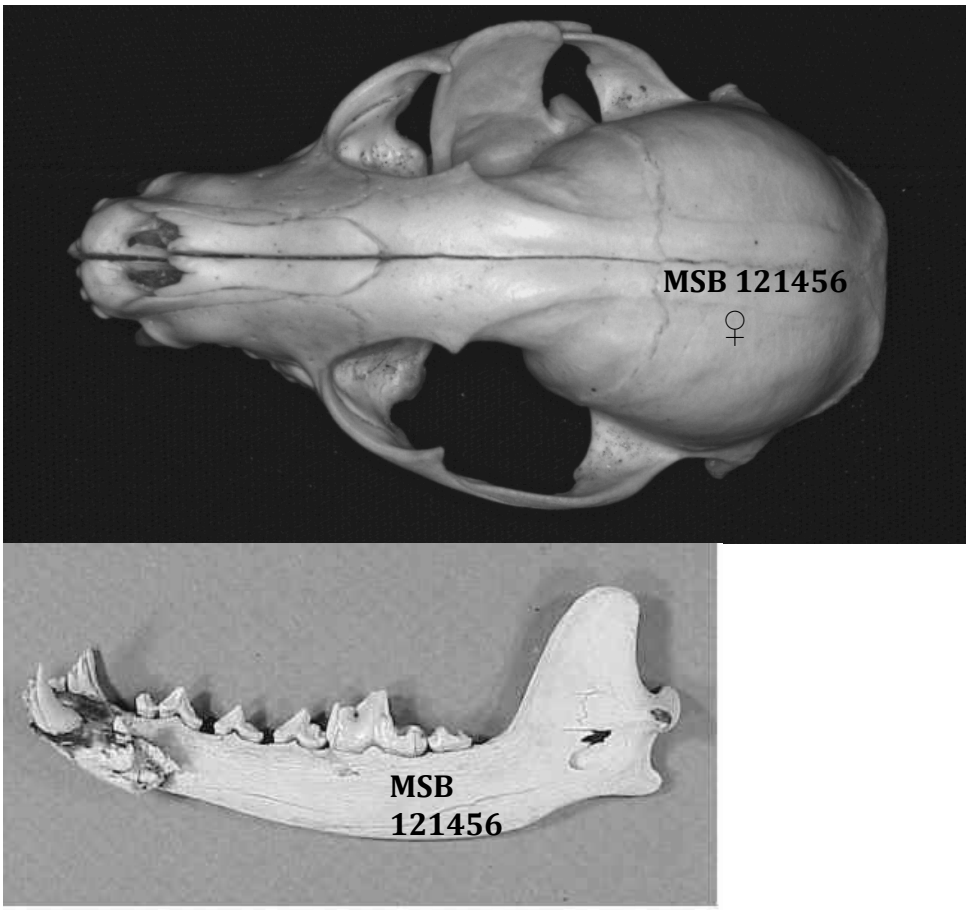


Figure 3. Correct location for MSB catalog number on skull and mandible.

Skeletons: We no longer number every post cranial bone due to time constraints associated with this large of a collection. Number once on the pelvic girdle, and two other large bones (e/g. femur, scapula). Smears and mistakes can be gently removed with 95% ETOH.

Photographic specimens

Increasingly, photo documentation (slide, print/negative, video, scanned image) of a mammal might be the only documentation. Photo documentation is the documented presence of a mammal in a location at a particular time. Photos should be taken in a fashion whereby determining characters are clearly visible and the locality is documented with some sign or Global Positioning screen visible as part of the photo. After cataloging and labeling, photos should be copied with one copy placed in the museum cabinet among other vouchers of the species and the other copy electronically scanned and linked to the specimen record in the ARCTOS database. Loans and other uses of a photo documented specimen are at the discretion of the curator.

Documentation and the ARCTOS database

Specimens in the mammal collection at the MSB are managed within the ARCTOS (Oracle-based management with a Cold Fusion web interface) system (Fig 4.), a database that integrates specimens, scientific results, and extensive collection-management tools to facilitate the use of biological collections. ARCTOS integrates with BerkeleyMapper, GenBank, and GoogleEarth. A DiGIR provider supplies various federated portals (e.g., GBIF). Over 100 collections from >20 institutions including UC Berkeley, University of Alaska Museum of the North, the MSB, and Western New Mexico University share a multi-hosting version of ARCTOS. An independent clone is in use at the Harvard Museum of Comparative Zoology. ARCTOS is largely based on the Collections Information System at the Museum of Vertebrate Zoology.

Additional information on ARCTOS can be found at http://arctosdb.wordpress.com and https://arctosdb.org/.

Curatorial procedures in Arctos are undergoing changes with updates uploaded regularly. Please refer to the site to get the latest procedures.
Help with database management issues can be obtained at https://arctosdb.org/documentation/

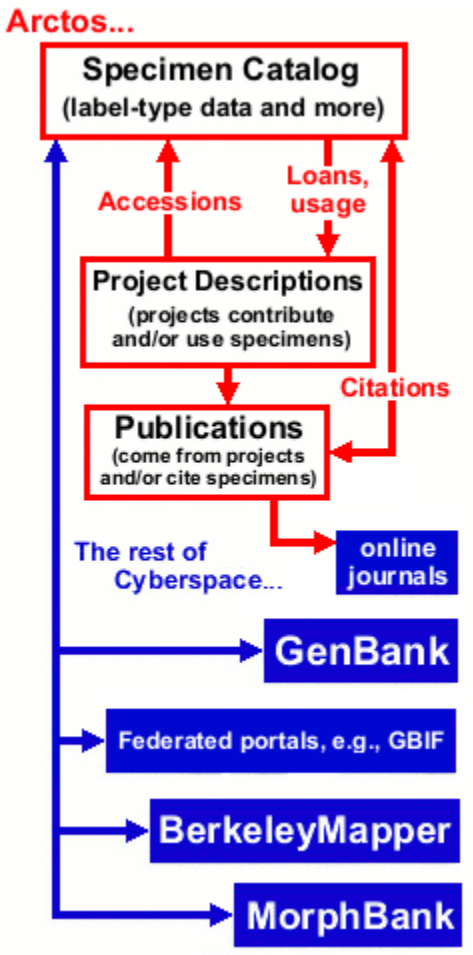


Figure 4. Arctos database system schematic.

Entering a new accession into ARCTOS:
All the information included in the accession ledgerbook needs to be electronically captured as well.

1. Log in

2. Click on the "Transactions" tab
3. Go to "Create" Accessions
4. Fill in all yellow fields
5. Be sure you use correct institution
6. Accession number must be in correct format (e.g. 2007.060.Mamm)
7. Use full written date for received date (e.g. 5 September 2007)
8. "Received from" is linked to Agent tables, so type part of name and tab out to find correct agent.
9. Same as above for "From Agency" field
10. "How obtained" field will usually be "gift" if it was material brought in, or "expedition" if it was material collected on an MSB field trip.

Cataloging in ARCTOS

The purpose of cataloging is to assign a single institutional number to each specimen and to record all pertinent specimen information into a catalog book. Prior to 2006 all mammal specimens were catalogued by hand and the specimen data were manually entered in various hand ledgers or catalogs. Accessions were considered ready to be catalogued only once all parts of all specimens in the accession were physically present. Accessions were prepared for cataloguing by physically arranging all the specimens in an orderly sequence, usually by taxon or locality. This groups similar types of data together and minimizes the amount of different information that needs to be entered in the database. Since the arrival of Arctos at MSB, the importance of cataloguing an entire accession at one time has lessened and individual specimens can be catalogued electronically and associated with the rest of the accession at the push of a button.

Data entry

Specimen data is now entered directly into ARCTOS from the NK pages or other original data. To enter specimen data a user must be listed as a member of the data entry group.

1. Log in to ARCTOS.
2. Go to the "Specimens" drop down on the main page, select "Enter data", then "data entry"
3. Select "Enter a new MSB Mammal record".
4. Data entry fields are linked to the relational database background tables, thus fields such as Collector, higher geography, species, etc. need to be in the system ahead of time. Fill in all or part of the data in a field and then use the tab key to bring up matches from the database (i.e. typing "Dunnum" in the collector field will bring up any collectors with Dunnum as part of their name; "New Mexico" in the Higher Geography field will bring up all matches containing the words New Mexico).
5. At a minimum, all yellow fields must contain data. However, normally we have data for more than just those minimum fields.
6. When all data have been entered select "Save this entry as a new record" from the bottom of the page. If there are no errors the record will go to the bulk loader and await verification before being loaded and assigned a catalog number.
7. Entry screens are color coded:
    a. Green Screen = You are entering data to a new record.
    b. Blue Screen = you are editing an unloaded record that you've previously entered.

c. Yellow Screen = A record has been saved but has errors that must be corrected. Fix and save to continue.

Data verification

The data is held in staging tables until it can be verified by a Curator, Collection Manager or Graduate Assistant Curator. Once verified the records are uploaded and (unless a particular catalogue number has been specified) the next consecutive catalogue number is automatically generated and assigned.

COLLECTION STORAGE AND MAINTENANCE

Labels and Storage Containers

Specimen labels for skeletal material stored in boxes and vials are generated electronically from ARCTOS.

1. Select specimens that need labels through the normal specimen search method.
2. Select "Print any report" in the "Manage" dropdown.
3. Hit go.
4. Select label needed (i.e. MSB_vial_label; MSB_box_label)
5. Hit "Print report", this will show you what will be printed. Check to see it is correct.
6. Print the report, use the 100% cotton rag label paper.

Labels for fluid-preserved specimen jars are either hand written in Uniball on wet specimen labels or printed using a Datamax thermal printer.

The mammal collection uses several standard sizes of boxes and plastic vials for skeletal material (see Appendix 4). Specimens should be placed in the smallest yet safest container, allowing sufficient room so that the specimen can be easily removed and replaced without damage. When using vials, first place the specimen tag in the bottom, with the catalog number facing downward. If a skin tag is also used, be sure to install it prior to adding the skull, as well as all other original tags. For skulls only, next add the cranium with the incisors pointing upward. The mandible can be installed while articulating with the cranium or it can be added after the cranium, with the incisors pointing downward. When placing skeletons in vials, be sure to add the skull last. Before placing the cap on the vial, check to see that the cap is not touching the specimen. If it does, use a larger vial and cap or use a box. For boxes, place the larger or heavier bones in the bottom of the container, then continue adding the smaller components. Place the specimen tag and skull in the container last. If using self-adhesive box labels, attach the labels on the box lids after the appropriate container size is confirmed.

Installation of specimens

Following the taxonomic arrangement (Appendix 2) specimens are stored in drawers in standard museum cases. The skins and skeletal components of mammals are usually stored together but in separate trays. The use of trays facilitates removing a series of skins or skulls all at once. A series of vials can be stored in trays that either fit within the skin tray (but not on top of specimens) or just outside the tray. In drawers where specimens are too large to fit on standard museum trays, the drawers are lined with unbuffered cotton blotter paper and the specimens placed directly on the paper. This reduces movement of specimens when the drawer is pulled out and helps to absorb any grease remaining on the underside of the skin.

Within a particular drawer, the arrangement of trays is front to back, then left to right (Fig. 5). The name side of the specimen label faces up on the first specimen of each tray and on the first and last specimens of each species. Specimens not identified to species are placed at the end of the series for the genus. Unidentified genera are placed at the end of the family.

1. ORDER (Phylogenetic order: following Wilson and Reeder 2005)
2. SUBORDER (Phylogenetic order: following Wilson and Reeder 2005)
3. FAMILY (Alphabetical, following Wilson and Reeder, 2005)
4. SUBFAMILY (Alphabetical, following Wilson and Reeder, 2005)
5. GENUS (Alphabetical)
6. SPECIES (Alphabetical)
7. COUNTRY (Alphabetical)
8. STATE (Alphabetical)
9. COUNTY (Alphabetical)
10. MSB CATALOG NUMBER (Numerical: lowest to highest)

Cases are arranged sequentially from top to bottom. Within a shelf or tray, specimens are arranged in order (starting from left front) from front to back and left to right, as in the following example.

P. boylii NM: Socorro co. MSB 55476	*P. leucopus* NM: Taos Co. MSB 20585	*P. maniculatus* Mexico: Sonora	*P. maniculatus* No data	*Peromyscus* sp. No data
P. boylii USA: Arizona; Apache Co. MSB 34027	*P. leucopus* USA: NM Sandoval Co. MSB 67993	*P. maniculatus* Mexico:Chihuahua	*P. maniculatus* Wyoming: Park Co. MSB 77468	*Peromyscus* sp. Arizona
Peromyscus boylii Mexico: Sonora MSB 59006	*P. boylii* Utah MSB 69470	*P. maniculatus* Canada	*P. maniculatus* Wyoming: Park Co. MSB 69432	*P. truei* NM *P. truei* California
Peromyscus attwateri USA: Georgia MSB 64112	*P. boylii* NM: Socorro Co. MSB 71105	*P. leucopus* NM: no other data MSB 45567	*P. maniculatus* USA: Arkansas MSB 78825	*P. truei* Arizona

FRONT OF TRAY OR SHELF

Figure 5. Installation schematic

When space permits, extra space is left in the collection between taxonomic or geographic breaks to allow of future expansion.

Specimens with NO DATA or incomplete id's go at the end of their respective category:
Peromyscus sp., "No data" should go at the end of all *Peromyscus* sp. from all countries, states, and counties, in MSB order.

CARCASSES AND BACULA:
At present these are stored similarly to no data specimens, at the end of their respective taxon in country, state, county, and MSB # order. This system may need to be changed in the future.

VERIFY ALPHEBETICAL AND NUMERICAL ORDER ON ALL INSTALLATIONS. DO NOT INSTALL SOMETHING YOU HAVE ANY DOUBTS ABOUT. AN INCORRECTLY INSTALLED SPECIMEN IS A LOST SPECIMEN.

Currently two different arrangements are used in the collection. The Order Chiroptera is housed within USNM style cases and arranged left to right and front to back, horizontally within the drawers (Fig. 6). The second arrangement id front to back and left to right (Fig. 7) in the Lane style cases.

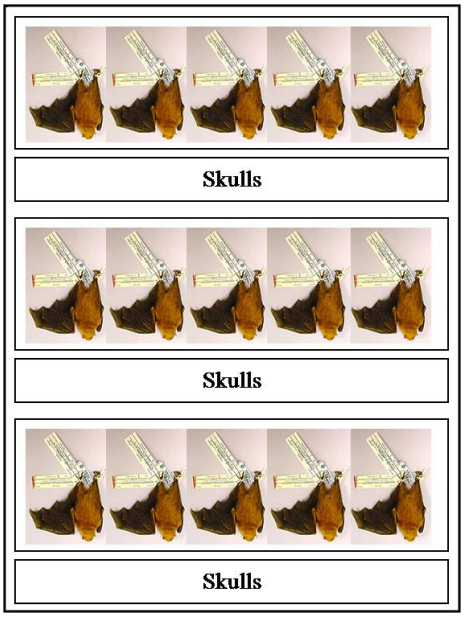


Figure. 6. Arrangement of Chiroptera skin and skull trays within a drawer.

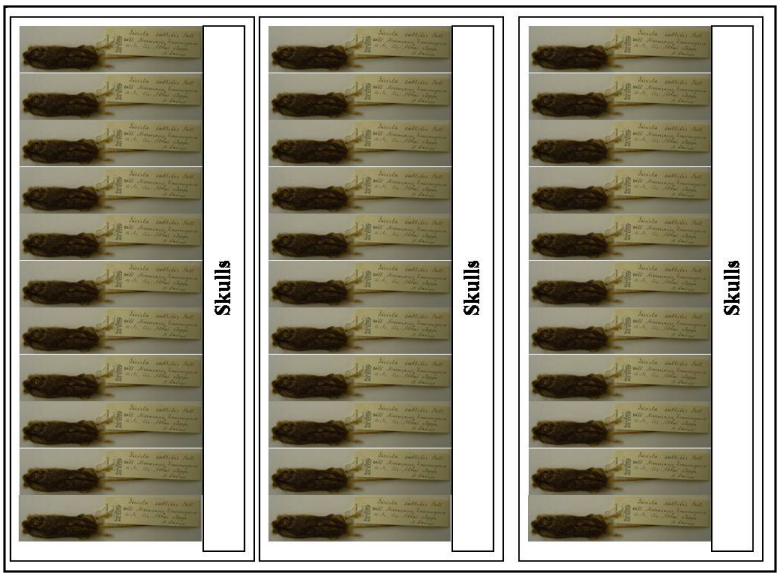


Fig 7. Specimen arrangement within lane style case.

The skulls and skeletal elements of large mammals should be stored in boxes or trays or on padded shelves. The cranium and mandible of the skull should not be stored with the teeth in direct contact because this can cause breakage of the teeth. It is preferable to store the skull and mandibles with the teeth facing up; if stored so that the teeth occlude, separate them with a padded layer of polyethylene foam. When space permits, extra space is left in the collection between taxonomic or geographic breaks to allow for future expansion. Specimens with NO DATA or incompletely identified are placed at the end of their respective category.

COLLECTION MAINTENANCE

Museum collections are vulnerable to destruction from pests such as insects, rodents, birds and mold. This type of deterioration to collections is not always addressed because the damage is often gradual, obscured from general view, and therefore, unnoticed. However, over time this persistent activity can have devastating effects on the collections. In the past, chemical applications were widely used in museums to eradicate pests. Recent changes in public attitudes and government regulations have increased the pressure to minimize the use of pesticides, and have encouraged the use of preventative measures and less toxic materials and methods.

Integrated pest management

Integrated Pest Management (IPM) is the general term used for pest management programs in many museums today. IPM focuses on preventive techniques to minimize food, moisture and environmental conditions required for pest survival. Activities include building inspection and maintenance; climate control; restriction of food and plants; regular cleaning;

proper storage; control over incoming collections to avoid infestation of existing collections; and routine monitoring for pests. While issues of building maintenance and climate control fall directly under the control of the University, the Division of Mammals staff have the most influence over activities that directly affect the collection space. By reducing clutter and dirt, establishing procedures to control how incoming collections are maintained, and conducting regular inspections of the collection, the staff has the most direct impact on the collections. Monitoring activities include regularly checking sticky traps, using pheromone and light traps to target pest species, and actively inspecting at-risk parts of the collections.

Sticky trap inspections

Areas of concern that are routinely monitored with sticky traps include all museum cases and cabinets in the collection room; the collection room perimeter; nearby offices of curators and collection staff; and all laboratories and hallways in the area (Appendix 7). Sticky trap inspections are conducted bimonthly by trained museum staff. Because the bird collection is located in the same room as the mammal collection, staff within the Division of Birds conduct inspections during the same week The contents of each sticky trap are recorded manually on a datasheet and later entered into an electronic software program, ZAKS Pest Tracking Standard© by a collection manager. If a sticky trap contains suspicious material, a collection manager confirms the identification through direct examination or by consulting with an expert in the Division of Arthropods. If a museum pest is identified, staff conducts a more rigorous inspection to understand the extent of the infestation. This is done by carefully lifting each specimen and looking beneath it for the pest or signs of the pest, for example frass or clipped fur. If an active infestation is found, the entire contents of the case are bagged and frozen for a minimum of 15 days at -24°C. See Appendix 5 for the protocol used when freezing specimens.

Cases kept sealed, gaskets monitored and replaced when needed

Specimens are not left out in light

Temperature and humidity are kept within the recommended levels for storage of natural history collections.

Wet Collections

COLLECTION USE

Access to the Mammal collections is permitted for research and educational purposes by both student and professional mammalogists, and other interested individuals. Use of the collections is by approval of the Mammal Curator, Curator Emeritus, or Collection Manager. Users from other disciplines are also welcome to use the collections and collection related data contingent upon the Curator's satisfaction that they are bona fide researchers. We encourage all visitors to wash their hands both prior to and after handling specimens. The Division and the Museum are to be acknowledged in all publications that make use of MSB material, and at least two reprints should be sent to the Mammal Division Library. Specimens from the research collections are generally not available for teaching or class use, but may be used in special instances with written permission from the Curator. A separate

Mammal Teaching Collection (MTC) exists primarily for class use. Contact the Collection Manager if you are interested in using that collection.

Security

All research collections, including the mammal collection, are located behind locked doors and accessed with the use of key cards. Please arrive at the MSB office located in CERIA 240 so that the museum administrator can contact a staff member for you. He or she will meet you there and escort you to the Division of Mammals. Visitors will receive an access card from the administrator that allows them to enter and reenter the collection for the days they will be visiting. The collection is unlocked during business areas but once you leave the secured entrance to the Division of Mammals you will need to use the access card to reenter the area. The card must be returned at the end of the visit.

Handling specimens

Handle mammal skins one at a time by placing your hand around the main part of the body. Do not grasp the extremities or other fragile parts of the body. Use both hands for larger or heavy specimens. Some rabbits and other long-legged mammals are made into study skins with a wooden dowel between the legs to help support the legs. Grasp the dowel to pick up the specimen and support the rest of the specimen with the other hand. Never handle specimens by the tags or labels. Handle hides with care and do not allow them to dragged on the floor. Groups of specimens on trays can be carried to work surfaces rather than removing an entire drawer. But be sure that work surfaces are clean before setting down specimens or trays of specimens. When returning a drawer to the case, slide the drawer gently and be sure there is enough space between the top of the specimen and the bottom of the drawer above before sliding in the drawer. Tips of ears of some rodents are prone to sticking up and ears of lagomorphs (rabbits and hares) are especially high and can be easily broken when sliding in a drawer with inadequate clearance.

MAMMAL TEACHING COLLECTION / CLASS USE

Specimens from the research collections are ordinarily not available for teaching or class use, but may be used in special instances with permission from the Curator or Collections Manager. A Mammal Teaching Collection (MTC) exists primarily for class use. This use is subject to the following regulations:

1. A Mammal Teaching Collection (MTC) is created for instructors to use when teaching vertebrate biology and systematic classes (such as mammalogy, Biology 489). These specimens are all cataloged into an MTC catalog and maintained in museum cases in Castetter Room 53. Such specimens must be protected from damage and loss. These specimens are not considered replaceable, although their research use is considered impaired. Rigid adherence to proper use (including loan procedures) must therefore be enforced.
2. Borrowers must request an official loan of specimens in order to use this collection. This controls use of the collection and documents how specimens are being utilized.
3. Research or rare specimens may be used as demonstration material only by the class instructors, and not by students or members of an audience. Such material is not to be

placed out on laboratory tables or to be removed for more than the period of the lecture or demonstration. Material designated as MTC (Mammal Teaching Collection) may be handled by students in specialty classes (such as mammalogy) under the direction of the instructor.

4. Specimens removed from the research collections for teaching use are to be covered by yellow withdrawal slips (following loan procedures) and a specimen invoice if removed from the department (as a loan approved by the Curator). No person can remove specimens without prior divisional approval.
5. Specimens (except fluid-preserved) removed from the museum for use in lecture or laboratory for more than half a day should be returned to collection staff for fumigation (see fumigation below).
6. Specimens checked out for use under provision (1) above must not be left out in the laboratory beyond class hours, and if not immediately returned to the museum, must be housed in the laboratory in closed specimen cases marked as "Mammal Teaching Collection." MTC cases must be closed and locked when not in use. Fluid-preserved specimens must be promptly replaced in specimen jars with adequate and proper fluid preservative.
7. No smoking or eating while handling or in the proximity of the collections or specimens.
8. Collection staff and instructors are responsible for observance of these rules. Teaching assistants and graduate students should be instructed on the observance of the rules by the curatorial staff.

INSTRUCTIONS TO USERS OF COLLECTION SPECIMENS

I) DRY COLLECTIONS

Investigators will be provided with a brief orientation tour, space in which to work, the specimen(s) s/he wishes to examine, or an explanation of the location of those specimens in the museum. The following general instructions will alert the visitor to the procedures followed here:

1. Wash hands before handling specimens.
2. Specimens are to be picked up only by the body, and only one at a time. Do not pick up specimens by legs, tails, wings, or other protruding appendages. Handle hides with care, not allowing them to drag on the floor. Do not pick up specimens by their labels. Do not stack animals on top of one another. Groups of specimens are to be carried on specimen trays to the work counter. Additional layout space can be arranged if your present quarters are limiting. If it is not necessary to look at the skins, do not remove the whole tray; take out only the skulls. Minimal handling of specimen skins will prolong their existence!
3. Do not set specimens or trays down on dusty or otherwise dirty surfaces. Clean your work surface.
4. Slide drawers in and out of cases gently to avoid sliding and pileup of specimens rubbing on adjacent drawers. Please report specimens that do rub on the underside of the drawer above. Do not attempt to return such ill-fitting drawers! Report improperly fitted drawers immediately.
5. Investigators should note that the specimens are arranged in a special order that has been explained or depicted to you (also explained Page 4 in this Manual). This order should be restored when the investigator has completed specimen examination. Additionally,

labels should be straight, data (locality) side up, except for the first specimen of a taxon. Aid in restoring proper order can be obtained from curatorial staff. Please report apparent mis-identifications, errors, or incorrect order to the curatorial staff. Leave all notes concerning re-identifications, loans, etc., in specimen trays, being sure to specify the MSB number(s). Provide a list of corrections to the Collections Manager.

6. Cases should not be left standing open. They should be opened only for removal or replacement of specimens. Please report instances when cases are inadvertently left open to the curatorial staff for inspection.
7. NEVER detach a label from a specimen or specimen container. These tags are the exclusive link between specimens and collateral data that we maintain in catalogs, field notes, and published accounts. If you notice a loose tag or label in the collection, please bring it to the attention of curatorial staff.
8. No materials of any sort should be installed in the collections unless approved by the Curator or Collections Manager and until properly curated (identified, labeled, cataloged, numbered, etc.). Please report any discrepancies to the curatorial staff.
9. Please report any malfunctions of the physical plant (light bulbs out, leaky sprinkler heads, leaking water, broken windows, faulty latches, broken locks, loose gaskets, inoperable specimen doors or carriages, lack of power outlets, etc.) to curatorial staff.
10. Please also report any case where insects or signs of insects are noticed; immediately report any signs of insects in a case to the Curator or Collections Manager.

Visits

The Mammal collection is open by appointment Monday - Friday, 8:00 am - 5:00 pm. To avoid scheduling conflicts and assure that adequate assistance and supervision are available, researchers should submit a visitation request to the Curator or Collection Manager prior to their proposed visit. Pending prior confirmation by divisional staff, please arrive at the MSB office, located in CERIA 240, so that the museum administrator can contact a staff member to escort you into the collection. Visitors should sign, date, and provide the purpose of their visit in the Division's Visitor Book. All first time users of the collection will be given an orientation tour of the collection, instructed on the handling of specimens, and assigned appropriate working space. Researchers will be carefully supervised initially to ensure that they comply. The researcher may return specimens, singly or entire trays of specimens, to museum cases, but if there are any questions as to the proper location then museum staff will return the specimens. No smoking is permitted in the Museum and no food or drink is to be taken into the collection.

Tours

Educational tours of the collection may be provided by the Curator, Collection Manager (s) or other designated staff as staff time allows. Please contact the Museum Administrator to request a tour.

USE FEES

The Museum of Southwestern Biology in general is free to use for all public not-for-profit agencies and research professionals. Agencies, consultants, or individuals gleaning a profit from use of the collections, use of the primary database, derivation of a secondary

database, or data otherwise derived from museum-cataloged specimens (such as field notes, catalogs, cryovouchers) will be billed as follows:

Unassisted use of collections *	$50 per hour
Assisted use of collections **	$75- $150 per hour
Data inquiries ***	$100 per hour
Requested reports prepared by curation staff ****	$200 per report page
Contracting or subcontracting	Fee determined by job

* All visitors in this category must have a minimum of one hour of training by MSB staff regarding the proper use and care of museum specimens before they can be left unassisted.

** Assisted use varies depending on the assisting staff member. For graduate assistants and graduate students in the field of specialty (e.g., mammalogy), $75 per hour; for Collection Manager assistance, $100 per hour; for Curator assistance, $125 per hour; for Director's assistance $150 per hour.

*** All data inquiries are performed by the Collections Manager. The charges for this service is $100 per hour; one hour minimum.

**** Examples of the types of reports that may be requested include: an accurate listing of the mammals of Hidalgo Co., NM.; verified holdings of *Peromyscus eremicus*; plant associations of Socorro Co., NM.

All fees that are collected will be deposited into that division's endowment account through the University Foundation. These funds are used to enhance the operation and curation of the division (for instance, to buy more museum cases or specimen boxes). All fees will be determined by the divisional Curator (or her/his designee) before initiation of the work by the user. Payment will be due upon receipt of bill for services rendered.

The intention of this policy is not to impede science or the distribution of data, rather it is the proprietary right of the MSB to glean benefits from profit-making entities (whether they be grants, industry, or private agencies) to help maintain and conserve the irreplaceable specimens placed under the care of the Museum of Southwestern Biology by the Regents of the University of New Mexico. Each Curator, as the hired agent of the Regents, reserves the right to refuse services to anyone as well as judge the appropriate fee rate of each individual user. A Statement of Proprietary Rights must be signed by the user, Curator, MSB Director, user's agency director, and chair of the UNM Department of Biology stating the intended use and control of <u>any</u> data extraction initiated from voucher specimens or their collateral materials. Improper use or profit from theses specimens may result in legal action.

Specimen Loan Policy:

The MSB-DOM collections are, first and foremost, research collections. They are available to legitimate users from the national and international scientific community. Specimens may be used for research, exhibit, and educational purposes. Owing to their manner of preservation, specimens generally are not suitable for display in exhibits; nonetheless, scientific specimens are used in exhibits when appropriate. Similarly, selected examples may be used in teaching and as

models for preparing illustrations for publication. The governing consideration in any use of Museum specimens is the conservation of specimens in particular and the collections as a whole.

The Museum of Southwestern Biology, Division of Mammals (MSB, DOM) provides loans of skins, skeletons, and fluid-preserved specimens from its collections for scientific research. Type specimens are not loaned. Researchers interested in tissues or destructive sampling should read those policies carefully before making a request.

- Specimen loans are made only to faculty, curators, and permanent research staff at recognized institutions with facilities to properly house and care for specimens. Individuals who are not affiliated with such an institution may request a loan of material only if they have made prior arrangements with an appropriate institution for housing of specimens, and if that institution agrees in writing to receive the specimens on the researcher's behalf.
- Loans are generally made for a period of **six months**. Requests for loan extensions, and for permission to transfer specimens from one institution to another, must be made in writing.
- No more than half of our holdings of a taxon from one locality are loaned at the same time. In most cases, a request for all holdings will be divided in half with the second shipment being sent after the first has been returned. Some shipments may be further divided depending on the size and condition of specimens requested. The requestor may stipulate groupings of specimens in partial shipments within the confines of this policy.
- For foreign loans, the borrower also is responsible for providing copies of all relevant import and export permits. If permits are not necessary, that should be stated in writing at the time of the request. Loans to countries where commercial delivery services are unreliable will be granted only when specimens can be hand-carried in both directions.

Information on our holdings may be found by querying our electronic database (http://arctos.database.museum/SpecimenSearch.cfm), if further information is needed please contact the Collection Manager (s) via e-mail.

Loan Requests:

All requests for specimen loans must be in writing and addressed to the Curator of Mammals. One electronic copy of the request containing the information below should be sent to the Curator at the address listed on the website. In addition, one hardcopy letter should be submitted on institutional letterhead; requests from students must be co-signed by the faculty advisor.

Requests for loans should contain:

- A cover letter outlining the request, signed by both Faculty borrower and student researcher.

- A brief summary paragraph of the research, including other sources of material and a justification for why samples are needed from the MSB collections. This statement should specifically address the following:
    1) Objectives of the project and its potential scientific value.
    2) Feasibility and time frame of the study.
    3) Method(s) of analysis.
    4) Qualifications of the investigator(s) to perform the laboratory work
    5) Availability of funding to complete the project.
- List containing information on the nature of material needed:
    1) Specific specimens requested with their MSB, DOM catalogue numbers.
    2) Or, if specific specimens are not needed, the number of specimens from a given taxon and geographic location.
    3) Nature of material (i.e. skin, skull, postcranial skeleton, etc.) needed.

Review of Requests:

Requests will be reviewed on a case-by-case basis according to the following criteria:

- The kind and extent of request, including whether it duplicates previous efforts.
- Availability of material from wild or captive sources, and efforts by the investigator(s) to obtain such material.
- Amount of material in the MSB, DOM and DGR collections.
- Rarity and replaceability of the samples (i.e., distribution and abundance of the taxon relative to the location of the user).
- Demonstrated ability of the investigator(s) to perform the work and complete the project.
- Financial support for the project.

Should the loan be approved, a Federal Express recharge number must be provided to cover shipping charges. Unless otherwise requested, all loans will be shipped via FedEX.

Upon Receipt of Loan:

- The borrower must contact the DOM Collection Manager via email to acknowledge safe receipt of the specimens.
- Check number and condition of specimens, noting any discrepancies or damage incurred during transit on appropriate copy of loan invoice. Specimen damage that occurs during transit should be reported immediately. **Sign and return one copy of the loan invoice** to the DOM Collection Manager. The borrower is liable for damage that occurs while the specimens are in their possession.
- All skins and skeletal material must be safely stored in cases and protected against light, insects, dust, and excessive moisture; wet specimens are to be stored in 70% ethanol and away from light.

- Some specimens that pre-date 1970 may have been treated with arsenic. Therefore, all users are advised to take proper precautions when handling specimens.
- **Invasive procedures are not permitted without expressed written permission.** Removal of hair or skin samples for molecular analyses are considered invasive procedures and written permission must be obtained in advance (**see policies for Destructive Sampling and Tissue/DNA loans**).

Return of Loan:

- Prior to or at the time of return, please email the Collection Manager with the date of shipment and a tracking number.
- Return the loan in the same wooden box(es) in which it was received and via the same carrier.
- Specimens must be packed in such a manner as to protect them from shock, moisture, or excessive heat. Skins should be wrapped in material similar to that used in shipment to borrower.
- Use only toilet paper or similar soft paper as packing for skulls. Do not use cotton batting or polyester packing in contact with skulls.
- Place address labels on inside as well as outside of package.
- Shipment must be insured for the same value indicated on the original loan invoice.
- If specimens were fumigated while in your care, please state what pesticide was used.

In the case of re-identification of specimens, the new designations should be provided to MSB, DOM curatorial staff when specimens are returned to the Museum. These data can be provided on a copy of the original loan invoice, or in a separate list that contains the MSB, DOM catalog numbers and respective new identifications (either in text or spreadsheet format).

Tissue Loan Policy:

The Museum of Southwestern Biology, Division of Genomic Resources (DGR) houses a collection of over 500,000 samples of mammal tissue, blood, and protein extracts from >170,000 individual specimens housed in the Division of Mammals (DOM). Although most tissues are frozen, the MSB also maintains a growing collection of ethanol-preserved tissues.

Unlike traditional specimens, tissue samples are eventually depleted with use. Thus, MSB Curators have formulated the following guidelines to ensure that destructive sampling does not exhaust these limited resources. These guidelines also apply to destructive sampling of traditional museum specimens (e.g., skin and skeletal material) for biochemical, isotope, or other kinds of analyses. For additional information on requests for destructive sampling of museum specimens, see our **Destructive Sampling Policy**.

In developing these guidelines, consideration was given to policies instituted by other major tissue collections. Our overall goal is to preserve the value of the collections for present and future use.

General Philosophy:

The MSB will provide limited loans of tissue from its collections to qualified researchers. Such loans are intended to supplement material from wild or captive animals obtained independently by users of the collections. Implicit in the loan agreement is the understanding that users will abide by certain requirements. In turn, the MSB will absorb the high cost of obtaining, housing, cataloguing, and maintaining these samples.

Requests for sampling of MSB tissues or specimens is an explicit acknowledgment that the researcher supports legitimate scientific collecting, and that he/she values the time and effort that goes into collecting, preparing, and maintaining museum collections. In exchange for granting these samples for scientific study, we may occasionally ask researchers to provide verbal or written support of scientific collecting and our collections.

How to request a tissue loan:

All requests for loans of genetic material must be in writing and addressed to the Curator of Mammals (see DGR site for requests directly through that division). One electronic copy of the request containing the information below should be sent to the Curator at the address listed on the website. In addition, one hardcopy letter should be submitted on institutional letterhead; those from students must be co-signed by the faculty advisor.

Information on our holdings may be found by querying our electronic database (http://arctos.database.museum/SpecimenSearch.cfm), if further information is needed please contact the Collection Manager (s) via e-mail.

Requests for tissue loans should contain:

- A cover letter outlining the request, signed by both Faculty borrower and student researcher.
- A brief summary paragraph of the research, including other sources of material and a justification for why samples are needed from the MSB collections. This statement should specifically address the following:
    1) Objectives of the project and its potential scientific value.
    2) Feasibility and time frame of the study.
    3) Availability of material from wild populations or captive sources, including the researcher's own efforts to collect samples for the project.
    4) Method(s) of analysis.
    5) Qualifications of the investigator(s) to perform the laboratory work
    6) Availability of funding to complete the project.

- List containing information on the nature of material needed:
    1) Specific specimens needed and their MSB, DOM catalogue numbers.
    2) Or, if specific specimens are not needed, the number of samples from a given taxon and geographic location.
    3) Desired method of transport (e.g., frozen, 95% ethanol). Tissues will be sent in ethanol if method of transport is not specified.

Should the loan be approved, a Federal Express recharge number should be provided to cover shipping charges.

Review of Requests:

Requests will be reviewed on a case-by-case basis according to the following criteria:

- The kind and extent of request, including whether it duplicates previous efforts.
- Availability of material from wild or captive sources, and efforts by the investigator(s) to obtain such material.
- Amount of material in the MSB, DOM and DGR collections.
- Rarity and replaceability of the samples (i.e., distribution and abundance of the taxon relative to the location of the user).
- Demonstrated ability of the investigator(s) to perform the work and complete the project.
- Financial support for the project.

Permits:

Requests for tissues must be accompanied by copies of all requisite permits.

- For foreign researchers, this includes a copy of any import permit required by the foreign government. If no permit is needed, the researcher must state such in writing at the time that the tissue request is submitted.
- Requests from foreign researchers for tissue of species regulated by the U.S. Fish and Wildlife Service (e.g., CITES-species, endangered species, marine mammals, migratory birds) will not be processed without the proper U.S. export permits; species listed only under CITES may be exported under a Certificate of Scientific Exchange if the receiving institution possesses such a certificate.
- Requests from U.S. researchers for tissue of species regulated by the U.S. Department of Agriculture must be accompanied by a copy of a USDA transport permit, issued to the recipient or his/her institution.

Loan Receipt and Conditions:

- It is the borrowers responsibility to immediately report specimen damage and/or discrepancies in the invoice.
- Loans that are made to other institutions by the MSB, DOM are subject to the condition that, should MSB desire to recall any item for its own purposes, it may do so with 30 days notice to the borrower.
- Frozen tissue must be maintained in an ultra-cold facility (- 80^{o}c freezer or liquid nitrogen) until used.
- Patenting of products discovered in these specimens (or ancillary materials) is not allowed without the written consent of the Director of the Museum of Southwestern Biology.

Return or exchange of material:

- Tissues received from the MSB, DOM and DGR collections, or DNA extracted from these samples, cannot be transferred to a third party without express written permission by the MSB Curator.
- The Curator may request tissues in exchange for those received from the MSB collections. These may include vouchered samples for permanent disposition in the MSB, or exchanges of loans of tissues from other institutions.
- Tissues deposited in MSB should be well-labeled and contain complete data. In addition, voucher specimen information (including institution acronym and catalog number) must be provided, along with copies of relevant collecting permits or other documentation.
- Sequences obtained from MSB tissues or traditional specimens should be entered into GenBank (http://www.ncbi.nlm.nih.gov/) so that they are accessible to other researchers. These sequences must be referenced to the MSB, DOM specimen catalog number. **Format should be as follows: "MSB:Mamm:12656". For GenBank submissions, the catalogue number should appear in both the Definition and Voucher fields.**

- Material is non-transferable and unused portions of tissues and resulting products must be returned promptly (on or before the end of the loan period) to:

  Mariel Campbell
  Museum of Southwestern Biology
  Division of Genomic Resources
  MSC03 2020, Department of Biology
  University of New Mexico
  Albuquerque, N.M. 87131

Great care should be taken in packing specimens for shipment. Use the following information as a guideline for shipping:

- Frozen tissue: Use a minimum of 10lbs of dry ice for overnight shipments. Tissues should be double bagged in plastic to prevent leakage.
- Alcohol preserved tissues may be shipped in a secure container at room temperature (following current regulations for the shipment of hazardous materials).
- DNA may be shipped in a secure container at room temperature.
- Place a copy of the loan invoice in an envelope attached to the outside of the shipping container. Insure loan and shipment for the maximum amount allowable.

Destructive Sampling Request Policy:

Researchers may request samples of skin, hair, feathers, toe pads, or bone from traditional specimens for DNA, isotope, or other analyses. However, because our collections are finite resources, one of our primary responsibilities is to protect the MSB, DOM holdings to insure that they are available for use by future generations of researchers.

Requests for destructive sampling of museum specimens should follow the same general guidelines as for tissues. While we do approve such requests, they are evaluated more stringently than other requests.

As the number of destructive sampling requests has grown, it has become necessary to implement the following guidelines regarding destructive use of museum specimens:

- Requests for destructive sampling will be considered on a case by case basis by the Curator.
- Requests for destructive sampling must contain compelling reasons why the project cannot be completed without the use of museum specimens. This includes evidence that (a) the research question being addressed is explicitly historical and thus requires the use of museum specimens, or (b) the taxa of interest cannot be sampled directly from the field.
- Requests for destructive sampling should provide evidence that the investigators have experience with associated analytical procedures (e.g., PCR amplification and sequencing of DNA from museum skins), and that the proposed studies are likely to generate useable data.
- If permission is granted to remove specimen parts (e.g., skin clips, reproductive organs, stomach contents), those parts must be labeled with the MSB catalogue number by the researcher and returned with the specimens. Any slide preparations (e.g., SEM stubs, histological, karyological), are to be returned properly labeled.
- The actual destructive sampling will normally be performed by DOM staff at MSB unless other arrangements have been formally made.

We emphasize that destructive samples are intended to supplement research materials obtained from other sources, not replace primary data collection efforts such as field sampling of extant

taxa. While we strongly encourage collections-based research, our obligation to protect the MSB's holdings may require that some requests for destructive samples be denied.

Use of Photographs, Fieldnotes, and Correspondence:

- Photographs (including photographs of specimens), field notebook pages, correspondence, and other archival materials may not be reproduced, distributed, publicly displayed or otherwise used, in whole or in part, without written permission from the MSB. No materials may be used for commercial or financial gain.
- When permission is given, materials may be used, downloaded, reproduced, publicly displayed, distributed or reprinted by persons affiliated with academic and/or non-profit organizations for scientific and scholarly purposes only, provided that the following attribution appears in all published use: "With the permission of The Museum of Southwestern Biology, University of New Mexico."
- Use of photographs or other MSB, DOM materials on personal or academic web sites must be authorized by the Museum. Images must be credited to the "MSB, University of New Mexico."
- Publication permission is given for ONE TIME USE only.

  Physical copies of MSB, DOM written materials and photographs are charged at cost. There is no charge for the use of online/electronic materials.

For further information or to submit a request, contact the Curator or Collection Manager.

Specimens Examined / Acknowledging MSB:

Specimens used in publications, reports, or presentations should be included in a "Specimens Examined" section and listed in the following format "MSB:Mamm:123456".
The Museum should be acknowledged in any publications that result from the use of its specimens. Acknowledgement should be given as "Museum of Southwestern Biology, University of New Mexico." One electronic PDF file of each publication should be sent to the Museum c/o:

Dr. Joseph Cook, Curator of Mammals - cookjose@unm.edu
or
Dr. Jon Dunnum, Senior Collection Manager - jldunnum@unm.edu

Museum of Southwestern Biology
CERIA Building, MSC03 2020
1 University of New Mexico
Albuquerque, NM USA 87131-0001.

Outgoing Loans

Packing

TO PACK TRADITIONAL SKIN AND SKELETON LOANS

Specimens to be sent on loan are to be packed in a wooden box of suitable size. If none are available, one should be made.

1. Line the box with tissue paper, leaving the ends hanging out. Later, these ends will be folded over the top layer of packing cotton. Line the box with packing cotton (or synthetic dacron; ethafoam can also be used).
2. Skulls and other skeletal material should form the bottom layer(s) of packed material unless fluid materials are being shipped at the same time.
3. Pack individual items as follows:

   Small Skulls: These should be removed from their vials one at a time and individually wrapped in toilet paper or Kimwipes and gently replaced in the vial. Do not use cotton to wrap skulls as cotton fibers stick to bones and are difficult to remove. If space still remains at the top of the vial, a small wad of toilet paper may be placed in the vial. Be careful to avoid crushing the skull when placing the wad in the vial. If skull fits too tightly use a larger vial. Place vials in vial trays, packed with cotton to prevent rolling around, and then wrap the tray and its contents tightly with tissue paper and tape to vial tray (avoid actually taping the vials themselves). The wrapped vials should be placed in the box adjacent to each other in as many rows as can fit while maintaining sufficient padding. If more than one layer is necessary, place a layer of packing cotton between layers.

   Small Skeletons: Wrap skeletons in toilet paper as with skulls (see above). Place specimen tags in vials first such that they are visible even after the skeletal elements have been packed. Wrap post-cranial material first and place in vial. Next wrap dentary and skull together, but separate with one wrap of tissue so that bones do not abrade. Carefully place into vial. After a snug fit and the cap is safely on, shake contents for rattles. If bones rattle, re-pack vial contents. Pack the boxes securely in the cotton-lined wooden box.

   Large Skulls: Skulls normally housed in boxes should be wrapped in tissue paper with crumpled tissue paper wads used to protect projecting bones, horns, antlers, and delicate parts. Space not occupied by skull and wrapping should be padded with crumpled tissue paper, packing cotton, or pieces of ethafoam (for large skulls). Close box and shake gently to check for shifting or rattling of the specimen. Secure the top of the box with one or more rubber bands. Place in wooden box snugly so shifting is prevented.

   Skins: Skins should be placed in a lined wooden box (as described above) so they lie snugly together, not touching the walls of the box. Whiskers, tails, wings, and

the like should not be bent in packing. Tissue paper should be below and on top of the layer of specimens. On top of the tissue paper place packing cotton between the layers of skins. Skins should be individually wrapped in tissue paper with the ends taped before placing them in a layer in the shipping box. Layers of skins should not be placed so tightly that they crackle when the lid is placed on the box.

Large Skeletons: Use common sense for larger specimens. It may be necessary to use a large amount of ethafoam or other such padding material to keep bones from knocking next to one another or insulated against movement during shipping. Avoid placing small specimens in with larger, heavy ones. Send specimen(s) in more than one wooden box if necessary. Check on postal regulations with regard to dimension or weight limitations.

Fluid-Preserved: Wet specimens should be removed from their jars and wrapped carefully in several layers of cheesecloth that have been dipped in 70% ethanol. The wrapped specimens should then be triple-bagged in ziplock baggies. Place enough absorbent paper towels or other material in the third bag to prevent leakage. Be sure to clearly indicate both on invoice and with specimens, "Specimens currently stored in 70% ethanol, please store and return to MSB in same." The plastic bags are then arranged snugly in a cotton-lined, wooden shipping box. If the animals are small, several may be bound together in cheesecloth before bagging.

4. All specimens should be placed snugly, but not tightly, against each other to prevent shifting. They should not lie against the wall of the box, but should always be padded with cotton. If necessary, small wads of cotton should be placed between specimens.
5. A top layer of cotton should be placed between the specimens and the box lid. The ends of the packing tissue should be neatly and snugly folded over the top layer of cotton and secured with transparent tape.
6. Loan instructions should be placed on top of the packed specimens along with the loan invoice, contained in an envelope.
7. Be sure both the invoices and the MSB-DOM address are inside the box before closing. The lid of the box ideally should be fastened with screws. However, if this is not possible, galvanized nails may be used, which should be hammered in at a slight angle.
8. Strapping tape should be wrapped around the box twice lengthwise and/or breadthwise, especially if repeated use of the box has weakened the wood or the grasp of the nails.
9. A MSB label bearing the following should be affixed to the side on the outside of the box and covered with transparent tape:

SCIENTIFIC RESEARCH SPECIMENS –
NO ENDANGERED SPECIES, NO COMMERCIAL VALUE

IF LOST PLEASE RETURN TO:
Dr. Jonathan Dunnum
Senior Collection Manager, Division of Mammals
Museum of Southwestern Biology, MSC03 2020
1 University of New Mexico
Albuquerque, NM, USA 87131-0001
(505) 277-1360, (505) 514-9025
jldunnum@unm.edu

10. Insure shipment for at least $100. Add insurance at a rate of $100 per 25 specimens (if small mammals), more for large, rare, or special specimen loan shipments.

RETURNING BORROWED SPECIMENS

1. Obtain a copy of the loan invoice from divisional files or from the borrower. Check to see that all specimens to be returned are included in the lot you were given. Check the condition of the material against the invoice (see condition reporting below).

2. Attach original/photo-copies of the borrower's invoice to a MSB specimen invoice. The MSB invoice should indicate that the material is being returned, the borrower's name, address, and department. In the space provided for specimen details should be the following message:

3. Give all correspondence materials to the Collections Manager who will write a cover letter. Copies of all correspondence should be then filed.

4. The loaning institution should be contacted prior to returning the loan to be sure there is someone to receive it. Once shipped an email should be requested from the loan institution verifying that they received it in good condition.

LOANS TO MSB RESEARCHERS FROM OTHER INSTITUTIONS

Individuals borrowing specimens from other institutions must get Curator's approval for the collection staff to receive, store, and return borrowed specimens. All correspondence, permits, and invoices pertaining to specimens on loan from another institution should be given to the Collections Manager for loan processing.

1. Record loan information in the divisional "Incoming Loans" catalog.

2. Open loan container and visually inspect for shipping damage or insects.

3. Unpack specimens and check them against the invoice. Damaged, missing, or extra specimens should be noted on the invoice. One copy of the invoice with all notations should be mailed to the lending institution soon after the loan is received by MSB. If the specimens cannot be checked immediately, a letter stating that the loan shipment has arrived and will be inspected should be sent to the lending institution so they will know that MSB has received it.

4. File the division's copy of the invoice, permits, and correspondence in the file cabinet under the institution's name.

5. Borrowed specimens, packing materials, and shipping container should be placed in a freezer for fumigation immediately after unpacking. Any packing material that shows any sign of insects should be discarded.

6. Place borrowed material in a designated research case. Include a copy of the loan invoice with the specimens. Label drawer and case well to prevent specimen misplacement.

7. Specimens should be maintained in the condition specified by the lending institution. Fluid-preserved specimens should be kept in the preservative in which they were sent.

Specimen loan return procedures should follow the same steps used to send an MSB loan. Check specimens to be shipped against loan invoice while packing loan in box in which it was shipped (supply a wooden box if loan was improperly shipped to MSB). File return invoices in the institution file. Also file acknowledgment of the returned loan when received from the loaning institution.

WHEN MSB LOANS ARE RETURNED TO US

1. Unpack the loan. Check-in all specimens using the invoice from the loan file cabinet. If the returned list represents part of a loan, mark this clearly, indicating which specimens have been returned and the date of return.

2. Update the ARCTOS database by changing loan status to "closed" and specimen disposition back to "in collection".

3. If an invoice written by the loanee is included with the specimens, this should be signed by a Curator and returned to the loanee. If no invoice is enclosed, an MSB postcard may be sent acknowledging the safe return of the specimens.

4. Specimens, their shipping box and packing material should then be placed in the fumigation freezer with a note indicating the date received and the initials of the person handling them. If only part of the loan has been returned, mark the loan invoice accordingly.

5. File the signed paperwork in the loan files.

CONDITION REPORTING

When specimens are sent out for loan or are received back from a loan, a condition report should be considered. Condition reports document the structural integrity or uniqueness of loaned material. Follow categories listed in Appendix. The use of condition reporting enhances MSB's ability to use electronic data to assess research value of specimens, maintain information important to record for loans, and monitor stability of specimens through time. Ultimately the application of this category can be used to assess the physical condition of the collection as a whole.

ANIMAL WASTE (NON-HAZARDOUS)

Non-hazardous animal waste is any unwanted animal, whole or part, that has *not* been contaminated with chemicals such as formalin, chloroform, paint thinner, gasoline, acetone. Animal waste should be placed in a clear (non-red) plastic bag and stored in the "Burn" freezer in the loading dock (red bags indicate "biohazardous" waste which is stored separately; see below). Everything in this freezer is automatically considered waste so to avoid the possible incineration of valuable research specimens, please store these specimens elsewhere. Once a month on a Friday the freezer is emptied and the contents taken for incineration.
NOTE: When the "burn freezer" reaches half-full capacity, please notify the Collection Manager so that arrangements can be made to dispose of the waste.

HAZARDOUS WASTE

Hazardous waste is any material that is a byproduct of museum preparation or curation that may pose a hazard to staff or specimens. Those that are chemical hazards are disposed of by the Safety and Health Environmental Assessment (SHEA) department of the University. Biological waste that has been contaminated with chemicals such as formalin, chloroform, paint thinner, gasoline, or acetone; or known to be potentially infected waste generated by special projects such as the *Hantavirus* research project should be bagged in red biohazard bags and disposed of properly.

CHEMICAL INVENTORY

A chemical inventory must be completed for each area of the division and associated labs. A chemical inventory was completed in 1997 that resulted in approximately 100 chemicals in use in the division. SHEA conducts and maintains an inventory list and provides proper labeling and Material Safety Data Sheets for each chemical. The division is responsible to ensure labeling is followed and that new employees are aware of the presence of chemicals in their work areas. The Right-to-know law urges employees to read and review MSDS sheets and to know safety procedures and exits in the place of work.

Biosafety in the Museum of Southwestern Biology:

Standard Operating Procedures

A. BIOSAFETY LEVEL 2

Certain labs within the Museum of Southwestern Biology are designated as Biosafety Level 2 (BSL2) facilities to provide an environment for safely handling and processing *potentially* biohazardous materials. The BSL2 lab designation means that we must follow guidelines to ensure the safety of personnel working in the lab, and to keep any pathogens that might be associated with the animals we are working on contained in these facilities. These guidelines are critical for ensuring both the health of the human public and the protection of the poultry and livestock industry. BSL2 guidelines are published in the CDC/NIH *Biosafety in Microbiological and Biomedical Laboratories* 5th Edition and available on the web at http://www.cdc.gov/biosafety/publications/bmbl5.

The Museum of Southwestern Biology holds many state, provincial and federal regulatory permits for wildlife including permits issued from the U.S. Department of Agriculture (USDA) and the Centers for Diseases Control and Prevention (CDC) Etiologic Agent and Vector Import Program for import and transport of restricted or potentially infectious products which require BSL2 facilities.

The vast majority of specimens prepared in MSB facilities are species from the United States and most are not associated with zoonotic disease investigations. The USDA and CDC regulations are primarily concerned with imported specimens of species that may have potential as carriers of zoonotic diseases or diseases that would negatively affect the poultry or livestock industries. These species make up a very small portion of the total MSB material. Most specimens that are imported from other countries have been processed into museum specimens prior to importation and thus are not prepared in our labs. Those specimens are directly cataloged and archived in the collections.

As our default protocol, MSB requires BSL2 procedures for all specimens processed in our BSL2 labs regardless of place of origin. Heightened awareness to zoonotic disease is a precautionary step and one that MSB has played a leadership role in developing guidelines and educating other professionals, health care professionals and the general public about zoonotic diseases (e.g., Mills et al. 1995; Yates, et al. 2002; Glass et al. 2005; Kelt et al. 2010).

B. BSL2 LABS IN THE MSB

The following labs associated with the MSB are designated as BSL2 because they are facilities where materials that may present a biohazard are handled.

CERIA 237 – Mammal and Bird Specimen Preparation Lab
CERIA 324A – Division of Genomic Resources Tissue Processing Lab
CERIA 121 – Parasite Specimen Preparation Lab

C. RISK LEVELS

Risk will vary depending on the animal species, its region of origin, and conditions at time of collection. Precautions should be taken when working with any animal material in this facility. Consult with HSC BioHazard Compliance Office when conducting risk assessments.

D. GENERAL PROCEDURES FOR BSL2 LABS

1. Handling animal materials:

-A biohazard sign will be posted on the entry door.
-As a rule, MSB does not prepare known or suspected infectious specimens, but never assume any animal material is safe.
-Always wear gloves and lab coats. Other personal protective equipment (PPE) is to be worn as needed (see Section E2). PPE is changed when contaminated or when the integrity is compromised.

-Remove all PPE before exiting the BSL2 laboratory; do not bring lab coats and gloves into non-laboratory work areas.
-Dispose of sharps in a sharps disposal container. Never reuse sharps. Containers shall not be more than 2/3's full.
-Clean all utensils and spaces after each use. Use diluted bleach (10%) or another high powered disinfectant (e.g. Cavicide) to clean utensils and counters that have been in contact with potentially biohazardous materials.
- DO NOT touch faucets, door knobs, telephones, light switches, etc. while wearing gloves.
-Always thoroughly wash your hands with soap and water before leaving the room.
-Avoid handling animal carcasses in a manner that creates splashes or aerosols.
-Be aware of others working around you and avoid contaminating them.

2. Biohazard Disposal:

All materials related to the processing and cleanup of specimens or tissues should be considered potential biohazards (this includes all animal materials, gloves and paper towels used during preparation). Biohazards must be bagged in specially designated red biohazard bags and placed within biohazard bins or in dedicated crematorium freezers. These materials MUST NOT be put in the regular garbage.
Known infectious or potentially infectious animals/materials requiring USDA or CDC permits should be double red-bagged and frozen until a biohazard bin pickup is scheduled. Place infectious animal material in bin just prior to pickup to avoid rotting.

3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption is not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.

4. Animal and plants not associated with the work being performed are not permitted in the laboratory.

5. If accidental exposure occurs through a cut or spray/aerosol:

Treat all exposures seriously.
Employees need to report without delay to EOHS during normal business hours or UNMH Emergency Department (evenings, weekends and holidays) after exposures.

1. Wash exposed skin thoroughly with warm water and soap for at least 10 minutes. Flush eyes and/or mucous membranes with water for 15 minutes.
2. Apply first aid as needed.
3. Notify your supervisor or other staff member that an incident has occurred and convey the following information:
    1. (**Employees**) Notify the Employee Occupational Health Services clinic at 272-8043 of the exposure while the employee proceeds to the clinic.
        1. During standard university business hours (M-F, 8-4:30) visit the UNM EOHS Clinic (272-8043) located in the Family Practice Center, 2400 Tucker (Bldg. 248).
    2. (**Students**) Notify UNM Student Health & Counseling (SHAC) at 277-3136 of the exposure incident while the student proceeds to the clinic.

1. During hours of operation (M-F) visit SHAC located in the Student Health Center and Undergraduate Studies building (Bldg. 73).

3. If EOHS or SHSC are closed, report to the Emergency Department at UNMH, located in the Barbara and Bill Richardson Pavilion – 1st floor (272-2411), 2211 Lomas Blvd (Bldg. 286),for evaluation.

1. During university holidays, weekends or afterhours visit the UNMH Emergency Department.

4. If no medical attention is expected to be sought (If there is a biological exposure the employee needs to go to EOHS or UNMH ED).
   A Notice of Accident form (Form NOA-1-W) must be filled out and turned in to UNM Safety & Risk Services Claims Specialist (currently Joel Jackson jjackson9@unm.edu)
   http://www.workerscomp.state.nm.us/pdf/noa.pdf.
5. If medical attention is needed, a First Report of Accident from (Form E1.1) must be filled out and faxed to the number on the form.
   http://srs.unm.edu/risk-services/media/docs/e1www.pdf.
   For medical attention go to the Employee Occupational Health Services 2400 Tucker NE Family Practice Center Room 232 (272-8043; or if after hours, University Hospital Emergency Department).

E. CERIA 237 AND CERIA 121: DIVISION OF BIRDS AND MAMMALS AND DIVISION OF PARASITES - SPECIMEN PREPARATION LAB

1. Access:

Access to the lab is at the discretion of the Collection Staff in charge (Collection Managers for Birds (Andy Johnson), Mammals (Jon Dunnum), Parasites (Sara Brant), and DGR (Mariel Campbell). Outside doors that provide access to the lab must be kept closed. While work is underway in the lab, access is restricted to authorized and trained personnel. Authorized personnel are those that have completed Basic Annual Safety Training, Biosafety Training for BSL-1 and BSL-2 Labs, Biosafety Cabinet Training and lab specific training on the Standard Operating Procedures (SOP) from a museum collection staff person. Failure to follow the SOP will result in restriction of access. Tour groups, contractors, volunteers not employed by or enrolled at UNM, and other untrained visitors may not enter the lab while work is being conducted.

2. Protection:

When working in the BSL2 prep labs for the Divisions of Mammals, Birds, and Parasites, standard BSL-2 PPE is required to protect against exposure to potential pathogens.

- All workers should wear lab gloves (either latex or nitrile) and a lab coat.
- Wear face protection (safety glasses and masks) or work in a Biosafety Cabinet (BSC) when splashes or aerosols are a risk.
- Wear face protection when dry carnivore fecal matter is present.

- Wear booties as appropriate, specifically when working with large animals such as wolves.

- When working with knives, wear metal mesh gloves over latex/nitrile gloves.

- When working with animals potentially carrying zoonoses, work must be conducted in the Biological Safety Cabinet. Wear double gloves in addition to standard PPE.

- *Peromyscus maniculatus* are not to be prepared in the lab. Previously prepared fluid preserved specimens may be handled in the lab as 70% ETOH deactivates hantaviruses.

- Other *Peromyscus* spp*., Sigmodon hispidus*, *Oryzomys palustris* and bats should be prepared in the Biological Safety Cabinet.

- Carnivore GI tracts and feces must be handled carefully and disposed of promptly. All carnivore GI tracts and feces should be frozen at – 70C prior to handling to deactivate potential Echinococcus.

- After work is complete, disinfect work area with 10% bleach solution.

- Remove all PPE before leaving the lab.

- Wash hands thoroughly with antibacterial soap before leaving the lab.

- Keep lab clean and tidy.

- If an injury occurs, report it to your supervisor (see section D5 above).

3. Biohazard Disposal:

All materials related to the processing and cleanup of specimens should be considered potential biohazards (this includes all animal materials, gloves and paper towels). Take special care when washing/flushing specimens with water; catch as much material as possible in a strainer, bag it, and dispose of it in the crematorium freezer. Contaminated products such as paper towels and gloves should be deposited in the Biohazard Waste (red) bin. Solid animal materials must be bagged and deposited in the crematorium freezer. Animal materials are disposed of in the campus crematorium. Crematorium burns will be scheduled by division collection managers as needed.

Known infectious or potentially infectious animals/materials requiring USDA or CDC permits should be double red-bagged and frozen until a biohazard bin pickup is scheduled. Place infectious animal material in bin just prior to pickup to avoid rotting.
Note: use Biohazard Waste bins to dispose of soiled gloves and bags and other inorganic material that has biological residue on it. This is to reduce the amount of emissions from the crematorium. DO NOT put anything that will rot directly in this bin, freeze until scheduled pickup.
Red biohazard bin is picked up for incineration by *Estrategymedwaste.com* when requested.

4. Biological Safety Cabinet:

The MSB Prep Lab contains a Class 2 biosafety cabinet. All work with potentially infectious animals/materials requiring USDA or CDC permits should be done in the BSC following accepted safety protocols.

F. CERIA 324: DIVISION OF GENOMIC RESOURCES - TISSUE COLLECTION STORAGE FACILITY

This room is designated Biosafety Level I and is a long-term Frozen Archive.

1. **Access:**

Access to the facility is at the discretion of DGR Curator Joseph Cook and Collection Manager Mariel Campbell.

Outside doors that provide access to the facility must be kept closed at all times. Anyone working in the facility must receive clearance from the DGR Collection Manager prior to starting work.

2. **Hygiene:**

- Under no circumstances are containers containing specimens to be opened in this room.
- Food and drink is not permitted in the collection space.
- Lab coats, latex or nitrile gloves should be worn when accessing the ultralow freezers and handling cryovials.

- Long hair should be tied back or head covering used when accessing the freezer collection.

3. **Liquid Nitrogen (LN2) Handling:**

- Be aware that liquid nitrogen is extremely cold (-196C or -320F) and expands up to 700 times its volume during vaporization. Nitrogen gas displaces oxygen; excessive nitrogen gas build-up can lead to death by asphyxiation.
- If the Oxygen Sensor alarm sounds, leave the premises immediately. Do not enter the room if the alarm is activated.
- Safety training, eye protection, cryogenic gloves, laboratory coat, long pants and closed-toed shoes are required for handling liquid nitrogen.
- Smoking or use of any source of flame or combustion is prohibited in CERIA 324.
- Liquid nitrogen tanks and dewars should not be sealed to prevent pressure buildup.

G. CERIA 324A: DIVISION OF GENOMIC RESOURCES – BSL2 TISSUE COLLECTION PROCESSING LAB

1. Access:

Access to the facility is at the discretion of the DGR Curator Joseph Cook and Collection Manager Mariel Campbell.
Outside doors that provide access to the facility must be kept closed. Anyone working in the facility must receive all appropriate safety training and be approved by the DGR Collection Manager prior to starting work.

2. Protection:

All workers should wear lab coats and lab gloves (either latex or nitrile) when handling tissue samples. Tubes containing samples are only to be opened and handled inside the HEPA-

filtered Biosafety Cabinet (BSC), following standard operating procedures for the operation of the BSC.

- The cabinet fan should be turned on 5 minutes prior to operation and kept running during use with no obstruction to airflow.
- Keep all materials within the BSC to a minimum to avoid airflow obstructions. Work in the direction of clean to contaminated towards the rear of the BSC.

--The safety glass should remain lowered below the alarm threshold at all times.

-After use the cabinet and its contents should be decontaminated with freshly prepared bleach (.5% Hypochlorite) 10% bleach solution or another high powered disinfectant (e.g. Cavicide) followed by 70% ethanol.. -Used utensils should be decontaminated in a solution of 10% bleach for 20 minutes, and rinsed for 20 min in distilled water.

3. Biohazard Disposal

Biohazards must be disposed of in biohazard bags inside the BSC then sealed, surface decontaminated and transferred to larger biohazard container in the lab. Sharps must be disposed of in a sharps container located inside the BSC. The container shall not be more than 2/3's full. Biohazard waste MUST NOT be put in the regular garbage or down the sink. Red biohazard bin is picked up for incineration by *Estrategymedwaste.com* when requested.

Appendix I. MSB Guide to Zoonoses

A zoonosis is an infectious disease transmittable between animals and humans. Zoonoses with a wildlife reservoir are typically caused by various bacteria, viruses, parasites, and perhaps fungi.

Here are some zoonoses to become familiar with. See the following pages for fact sheets from CDC, USGS or USDA for each of these diseases.

Arenaviruses	Leptospirosis
Avian Botulism	Plague
Avian Cholera	Q Fever
Cryptococcosis	Rabies
Hantaviruses	Salmonella
Herpes B	Tularemia
Histoplasmosis	West Nile Virus
Influenza viruses	

Higher risk animals:

Only specimens from foreign countries (birds and mammals) are considered high risk from the standpoint of USDA BSL2 procedures. As a general rule, the MSB considers the following groups to be higher risk based on potential to carry important pathogens.

-Carnivores
-Birds – especially corvids, waterfowl, and other water birds
-Rodents - especially Cricetids
-Bats
-Primates
-Ruminants, Swine, Equines

-Specimens from foreign countries and fresh specimens that have never been frozen

References

Glass, G. E., T. M. Shields, R. R. Parmenter, D. Goade, J. N. Mills, J. Cheek, J. Cook, and T. L. Yates. 2006. Hantavirus risk in 2006 for U. S. Southwest. Occasional Papers, Texas Tech University 255:1-16.

Kelt, D.A., Hafner, M.S., ASM Ad Hoc Committee for Guidelines on Handling Rodents in the Field. 2010. Updated guidelines for protection of mammalogists and wildlife researchers from hantavirus pulmonary syndrome (HPS). *Journal of Mammalogy*, *91*(6), pp.1524-1527.

Mills, James N., Yates, Terry L., Childs, James E., Parmenter, Robert R., Ksiazek, Thomas G., Rollin, Pierre E., and Peters, C.J. 1995. Guidelines for Working with Rodents Potentially Infected with Hantavirus. Journal of Mammalogy, 76: 716-722

Yates, Terry L., James N. Mills, Cheryl A. Parmenter, Thomas G. Ksiazek, Robert R. Parmenter, John R. Vande Castle, Charles H. Calisher et al. 2002. The Ecology and Evolutionary History of an Emergent Disease: Hantavirus Pulmonary Syndrome. Bioscience, 52(11):989-998.

CERTIFICATION

I certify that I have read and understand the Standard Operating Procedures of the Museum of Southwestern Biology's Biosafety Level 2 facilities. I understand that I should never assume that any animal material is 'safe' and that all animal materials in this facility may be a threat to my health or to others working around me.

I certify that I have read and understand the Appendix (MSB Guide to Zoonoses). I understand that if I follow the Standard Operating Procedures when working in the MSB, the risk to my health and to others working around me will be minimized.

_____ _____

Signature Date

_____

Printed name

Laboratory

Trainer

EMERGENCY PROCEDURES

See museum wide procedures

APPENDICES

1. Map of the collection space for (a) dry collections, CERIA 231 and (b) wet collections, CERIA xx.
2. Taxonomic arrangement of the collections
3. Sample of a completed page in the Accession logbook
4. Guide to container size
5. Protocol for Freezing Specimens in the Divisions of Birds and Mammals
6. IPM Protocol for Incoming Bird and Mammal Specimens
7. Flow chart for incoming bird and mammal specimens
8. Map of sticky trap locations in the Mammal collection, and nearby offices and labs
9. Instructions for collecting and shipping of carcasses to the MSB
10. Policy on Consumptive (Destructive) Sampling of Non-traditional Tissues
11. Loan enclosure document
12. Museum Staff Position descriptions
13. MSB mammals vial label schematic

Appendix 1. Map of the collection space for (a) dry collections, CERIA 231 and (b) wet collections, CERIA XX.

Appendix 2. Taxonomic arrangement of the collections

MUSEUM OF SOUTHWESTERN BIOLOGY DIVISION OF MAMMALS COLLECTION ARRANGEMENT

The collection of the Division of Mammals follows the taxonomy of Wilson and Reeder (2005). Major arrangement deviations in the DOM dry collection are: Primates and Lagomorpha follow Chiroptera; Rodentia follow Lagomorpha. Some taxa containing large skeletal material and tanned hides will be located in both the standard specimen cases and the upright locker style cabinets. The DOM wet collection follows Wilson and Reeder (2005) without the above deviations.

The collection is arranged phylogenetically by Order and Suborder. Within Suborder, Families are arranged alphabetically; within Family, subfamilies are arranged alphabetically; within Subfamily, specimens are arranged alphabetically by Genus, then Species. Within Species, specimens are arranged geographically in alphabetic order by Country, State, and then County. Within County specimens are ordered numerically by MSB catalog number.

Key: A - upper case; B - lower case; S – skeletal cabinets.

MONOTREMATA:	Tachyglossidae	1A
DIDELPHIMORPHIA:	Didelphidae	1A, 2A, 3A, 4A
PAUCITUBERCULATA:	Caenolestidae	4A
MICROBIOTHERIA:	Microbiotheriidae	4A
DIPROTODONTIA:	Petauridae	1B
	Macropodidae	1B
AFROSORICIDA:	Tenrecidae	1B
	Chrysochloridae	1B
MACROSCELIDEA:	Macroscelididae	1B
HYRACOIDEA:	Procaviidae	3B
PROBOSCIDAE:	Elephantidae	3B
SIRENIA:	Trichechidae	16S-19S
CINGULATA:	Dasypodidae	3B
PILOSA:	Bradypodidae	3B
	Megalonychidae	3B
	Cyclopedidae	3B
	Myrmecophagidae	3B
SCANDENTIA:	Tupaiidae	5A

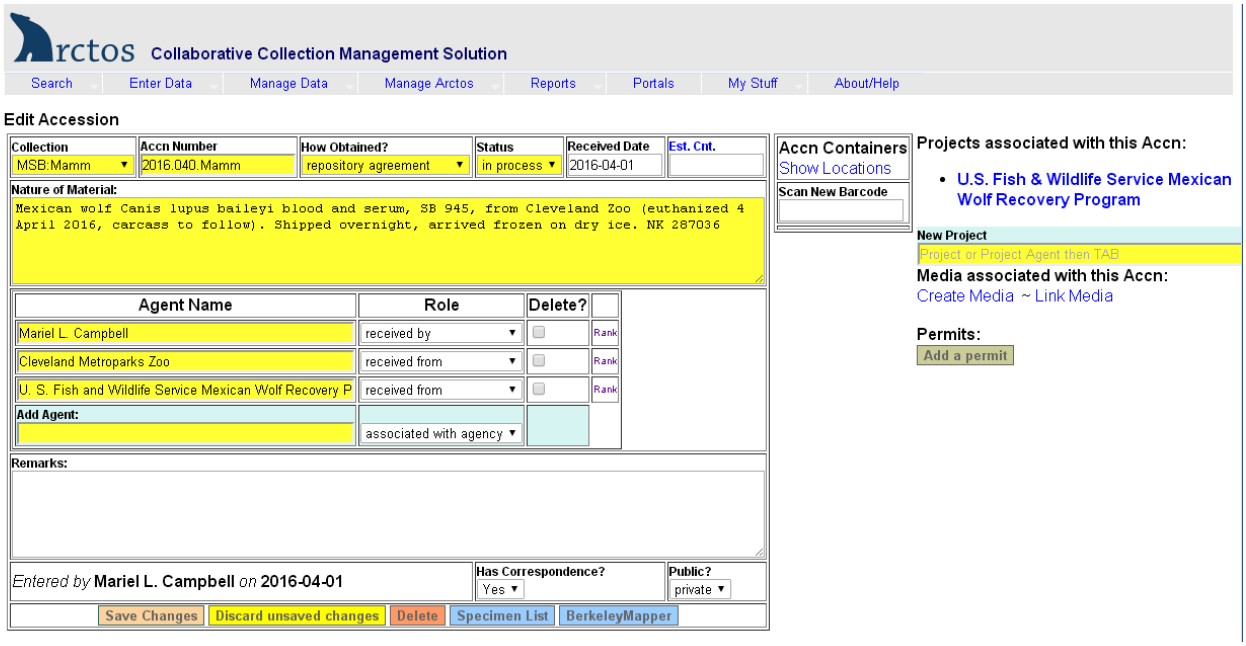
DERMOPTERA:	Cynocephalidae	5A
ERINACEOMORPHA:	Erinaceidae	5A
SORICOMORPHA:	Soricidae	5A-6B
	Talpidae	8A, 8B
CHIROPTERA:	Pteropodidae	9B
	Emballonuridae	9B
	Molossidae	9B-10B
	Mormoopidae	11B
	Natalidae	11B
	Noctilionidae	11B
	Phyllostomidae	12B-14B
	Rhinolophidae	14B
	Thyropteridae	14B
	Vespertilionidae	15B-26A
PRIMATES:		
STREPSIRRHINI	Galagidae	27A
	Lemuridae	27A
	Lorisidae	27A
HAPLORRHINI	Atelidae	27A
	Cebidae	27A
	Pitheciidae	27A
	Cercopithecidae	27B
	Hylobatidae	28A
	Hominidae	28A
PHOLIDOTA:	Manidae	28A
LAGOMORPHA:	Ochotonidae	29B
	Leporidae	29B-31B, 33B, 35B-38B
RODENTIA:		
SCIUROMORPHA	Aplodontidae	39B
	Sciuridae	
	Sciurinae	39B-44B
	Xerinae	45A-46B, 48B-57B
	Gliridae	57B
CASTORIMORPHA	Castoridae	59B, 60B
	Geomyidae	64B-68B
	Heteromyidae	
	Dipodomyinae	71B-75B, 77B-83B, 85B, 86B
	Heteromyinae	88A
	Perognathinae	88A-91B

MYOMORPHA	Cricetidae	
	Arvicolinae	94B-100B, 107B, 108B
	Cricetinae	108B
	Neotominae	111B-118B, 120B, 122B-125B, 127B, 129B, 130B, 132B, 133B, 135B, 136B, 138B, 139B, 141B, 144B
	Sigmodontinae	145B-151B
	Tylomyinae	151B
	Dipodidae	159B
	Muridae	
	Deomyinae	163B
	Gerbillinae	163B
	Murinae	163B, 164B
	Nesomyidae	164B
	Spalacidae	164B
ANOMALUROMORPHA		
	Anomaluridae	165B
	Pedetidae	165B
HYSTRICOMORPHA		
	Abrocomidae	166B
	Bathyergidae	166B
	Caviidae	
	Caviinae	166B
	Hydrochoerinae	166B
	Chinchillidae	166B
	Ctenomyidae	167B-169B
	Cuniculidae	170B
	Dasyproctidae	170B
	Dinomyidae	170B
	Echimyidae	170B
	Erethizontidae	170B, 171B
	Hystricidae	172A
	Myocastoridae	172A
	Octodontidae	172A

CARNIVORA:		
CANIFORMIA	Ailuridae	187B
	Canidae	175B-183B, 186A-187B, 1S, 58S
	Otariidae	188A
	Phocidae	188A
	Procyonidae	188B-190B

	Mephitidae	190B, 191B
	Mustelidae	192B-194B
	Ursidae	187B, 2S-5S, 58S
FELIFORMIA	Herpestidae	194B
	Hyaenidae	194B
	Felidae	195B-199B, 6S-12S, 22S, 55S
PERISSODACTYLA:	Equidae	200A, 23S-27S
	Rhinoceratidae	27S
	Tapiridae	200A, 27S
ARTIODACTYLA:	Antilocapridae	200B, 44S, 45S
	Bovidae	200A, 201A, 46S-53S, 56S, 57S, 59S-61S
	Camelidae	201A, 31S, 32S
	Cervidae	201A, 201B, 33S-43S
	Giraffidae	201A, 32S, 33S
	Suidae	28S, 29S
	Tayassuidae	201B, 29S, 30S
CETACEA:	Delphinidae	14S, 15S
	Phocoenidae	15S
	Balaenidae	13S

3. Sample of a completed Accession page in the Arctos database.



Appendix 4. Guide to Container Size (measurements in inches)

GENUS	SKULLS	SKELETONS
Sorex	1.5 dram plastic vial	7 dram plastic vial
Peromyscus	7 dram plastic vial	7 dram plastic vial
Microtus	7 dram plastic vial	7 dram plastic vial
Eutamias	7 dram plastic vial	12 dram plastic vial
Tamiasciurus	12 dram plastic vial	4.5 X 2.5 X 2 box
Cynomys	20 dram plastic vial	4.5 X 2.5 X 2 box
Spermophilus	20 dram plastic vial	4.5 X 2.5 X 2 box
Lepus	4.5 X 2.5 X 2 box	8 X 2.5 X 3 box
Erethizon	4.5 X 2.5 X 2 box	8.5 X 4.5 X 3.5 box
Ctenomys	20 dram plastic vial	8 X 2.5 X 3 box
Castor	8 X 2.5 X 3 box	12 X 5.5 X 2.5 box
Urocyon	8 X 2.5 X 3 box	12 X 5.5 X 2.5 box
Vulpes	8 X 2.5 X 3 box	12 X 5.5 X 2.5 box
Canis lupus	8.5 X 4.5 X 3.5 box	8.5 X 10.5 X 13 box
Canis latrans	8.5 X 4.5 X 3.5 box	8 X 8 X 5 box
Felis	8 X 8 X 5 box	8.5 X 10.5 X 13 box
Felis concolor	8 X 8 X 5 box	8.5 X 10.5 X 13 box
Ursus	8 X 8 X 5 box (open)	8.5 X 10.5 X 13 box
Antilocapra	8 X 8 X 5 box (open)	8.5 X 10.5 X 13 box
Bison bison	8.5 X 10.5 X 13 box	42 X 12 X 20 box

Appendix 5. Protocol for Freezing Specimens in the Divisions of Birds and Mammals

1. When pest activity is evident or suspected study skins should be bagged in an airtight clear polyethylene bag. Evacuate as much air as possible, fold the open end of the bag around the tray, and seal with clear plastic tape. Always support specimens on a specimen tray or piece of cardboard before bagging.

2. Fill out the "Freezer label" with the date and your initials and tape to the outside of the bag using clear plastic tape.

3. Place trays in a single layer in one of the three IPM-dedicated freezers in the Treatment Room. If you need to add additional trays be sure that you do not stack the trays directly on top of each other. Instead use some type of spacer e.g., narrow trays or boxes, that will provide sufficient space between specimens so that their ears and bodies are not crushed. The spacer also allows for good air circulation around the specimen to assist in rapid cooling

NOTE: If adding specimens to an empty freezer **never** completely load the freezer at one time. Rather, fill the freezer halfway, wait 1-2 hrs, then finish loading the freezer. This ensures that specimens freeze quickly.

4. Freeze the bagged specimens for a minimum of **15 days.**

5. Minimize length of time the freezer doors are open to maintain a low temperature.

6. After the required length of time, remove specimens from freezer and place on a flat surface. **DO NOT REMOVE SPECIMENS FROM THE BAG UNTIL ROOM TEMPERATURE HAS BEEN REACHED AND THERE IS NO CONDENSED WATER ON THE INSIDE OF THE BAG**. This can take up to 24 hrs. Handle specimens very carefully when removing them from the freezers as they are subject to breakage.

7. Once specimens have thawed they should be removed from the bag and placed in a holdup case. Remove all tape and labels from the bag and return it to a cabinet in the Collection or to the Storage Room. Do not leave it on a casetop.

Appendix 6. IPM Protocol for Incoming Bird and Mammal Specimens

This protocol provides instruction for managing dry specimens of birds and mammals from the moment they enter the Museum building, CERIA. All new specimens are presumed to be "potentially contaminated" and as such will be treated as though they are infested. Incoming specimens can consist of study skins, skeletal material, or taxidermy mounts, and may result from a loan returned to the MSB, a loan requested by the MSB, or a new acquisition generated from a fieldtrip, gift, etc. Fluid-preserved specimens and frozen animals are not covered here because they are processed in the Wet Collection Prep Lab and the Treatment Room, respectively. Refer to Figure 1 for a graphical representation of the protocol.

Arrival: All new accessions or shipments should enter CERIA at the Loading Dock rather than the side or front entrances. This action avoids potentially contaminating the hallways that lead to the bird and mammal collection should a specimen or container be contaminated. If specimens must be transported via this route they should be either tightly sealed in plastic or in a suitable storage container. Specimens that are brought into the building specifically to be frozen for IPM purposes must enter the building through the loading dock—there are NO EXCEPTIONS. Once in the building all specimens must be taken into the Treatment Room.

Treatment Room All specimens are unpacked and carefully inspected for signs of active or recent insect infestation. Packing material is also inspected. If an active infestation is found the specimen (skin and/or skeletal material) must be bagged and frozen for a minimum of 15 days in one of the 3 dedicated IPM freezers. If other specimens are packed with the contaminated specimens they must also be frozen. Refer to "Protocol for Freezing Specimens in the Divisions of Birds and Mammals" for specific instructions.

Freeze or Quarantine? In general skins of birds and mammals are frozen whereas skeletal material is quarantined. The difference in the procedure relates to the more susceptible nature of osseus material. Whereas the action of freezing bird and mammal skins has not been shown to directly damage the skins, sudden changes in temperature and humidity resulting from freezing have been shown to negatively affect bone by causing teeth to crack and long bones to fracture. When the value of the specimen is high, the nature of the specimen is sensitive, or permission to freeze is uncertain or denied, then conservative action (e.g., quarantine) is required. Refer to "Protocol for Quarantining Specimens" for specific instructions.

Specific cases:

Incoming loan requests (specimens sent on loan to the MSB): Before specimens are sent to the MSB from another museum, MSB staff should notify the other museum that all incoming specimens are routinely frozen for IPM purposes. If permission is denied the specimens must be bagged and quarantined and then installed in a holdup case in Clean Prep. Under no circumstances can specimens be moved into Clean Prep without having been previously frozen or bagged for quarantine. All packing material is bagged and frozen and the shipping container should be labeled and placed on a shelf in the Treatment Room. If specimens have been frozen they can be moved into a holdup case in the Collection for examination.

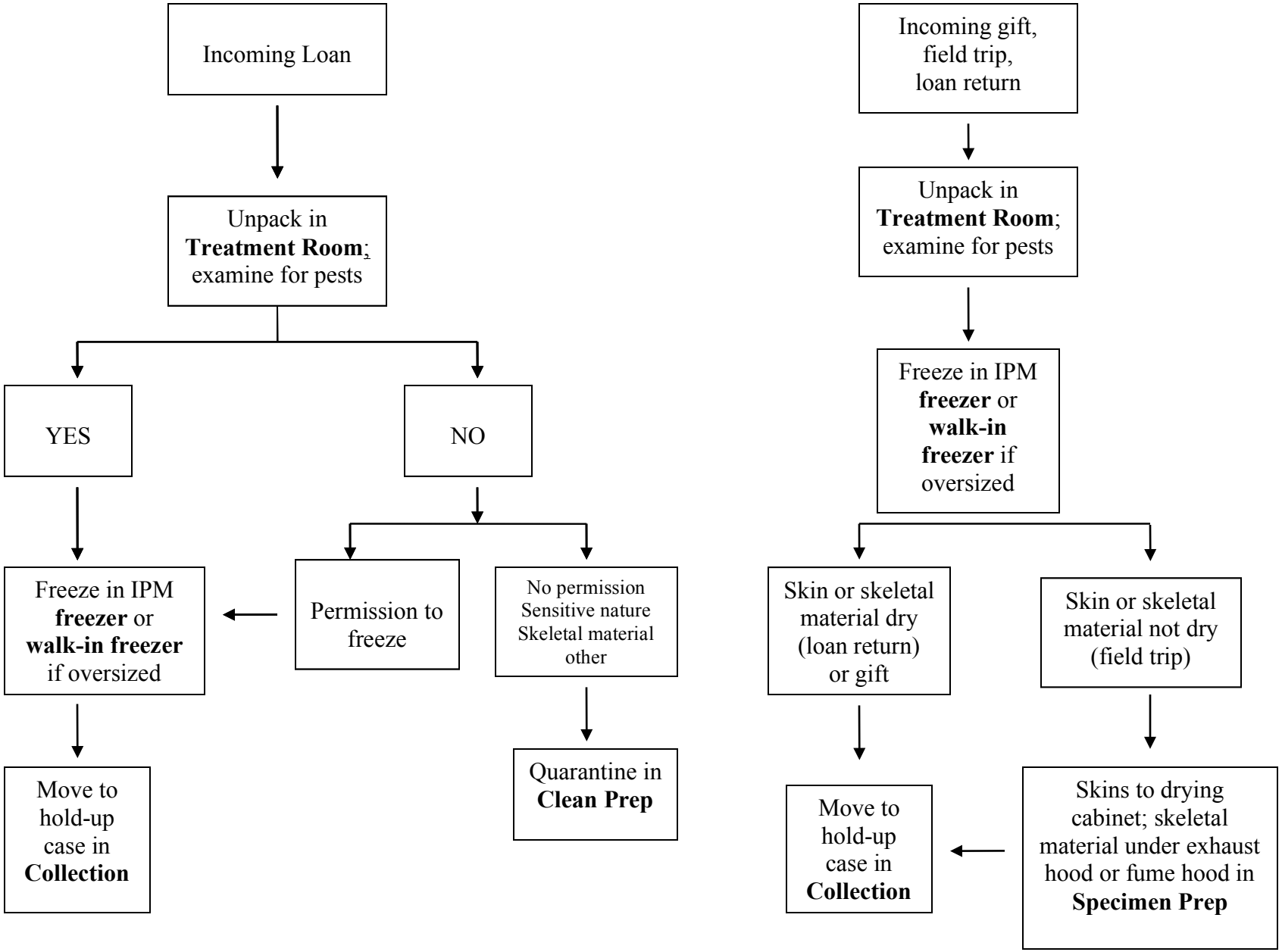
Loan return: Before specimens are treated either via freezing or quarantine, their condition should be assessed and compared with the condition on the original loan slip. Packing material must be bagged and frozen especially if it will be reused. If not then discard it.

Specimens from field trips: New accessions from field trips generally consist of dry or partially dry skins and unbugged skeletal material. Due to the high risk of infestation, skins and skeletal material should be bagged and frozen as soon as they are accessioned rather than allowing them to dry completely. Once they are frozen the skins can be transferred to pinning boards and placed in the drying cabinet in Specimen Prep. Skeletal material that has not completely dried should be suspended by hooks beneath the exhaust hood or placed on trays under the fume hood in Specimen Prep. After drying skin specimens should be relocated to a holdup case in the Collection and unbugged skeletal material should proceed to the dermesterium.

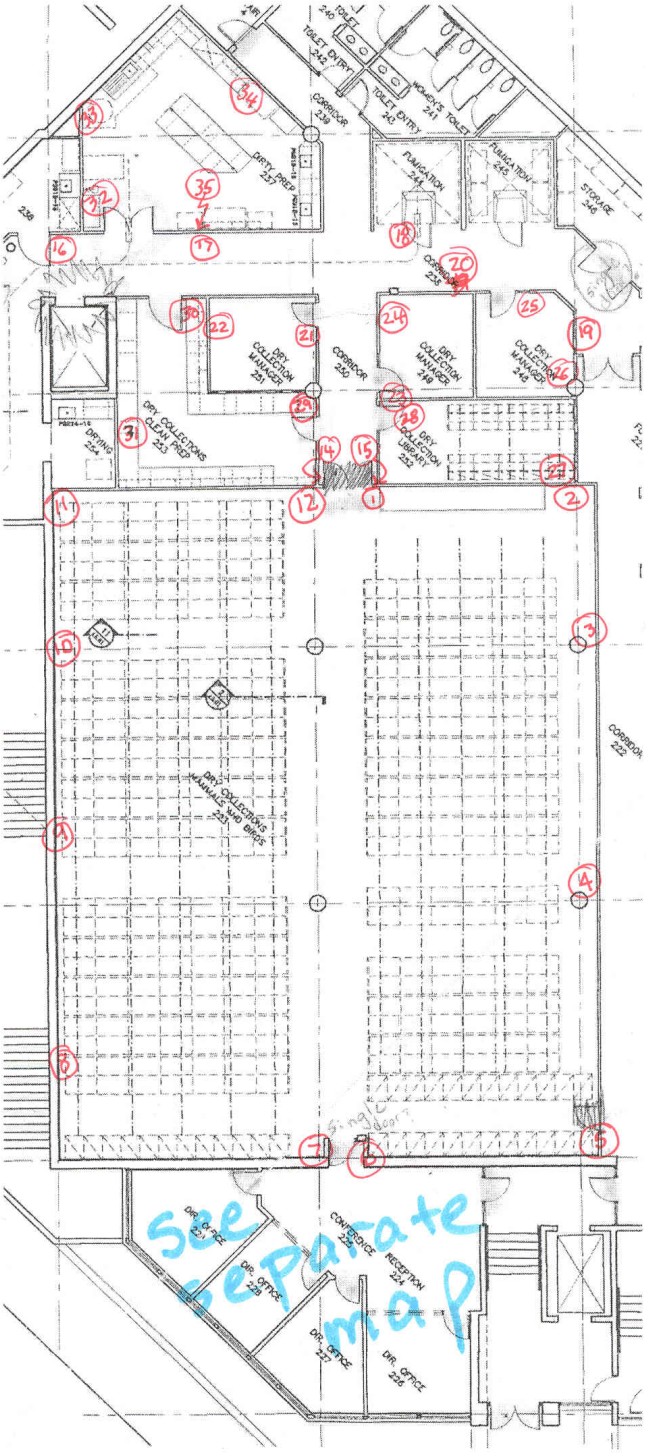
Taxidermy mounts or oversized specimens: Oversized specimens that will not fit in one of the three dedicated IPM freezers in the Treatment Room should be bagged and moved into the walk-in freezer. Because of the colder temperature here (-20 °C) specimens need only be frozen for a minimum of 10 days. The Specimen Inventory should be updated each time specimens are placed in, or removed from, the walk-in freezer.

Teaching Collections: These specimens are often used by students throughout a semester and therefore can be frozen when the course has ended or when there is no further use for the specimens. The specimens, however, should NOT be brought into the Collection unless they have been frozen first.

Appendix 7. The flow of incoming bird and mammal specimens into the Museum building CERIA.



Appendix 8. IPM sticky trap locations.



Appendix 9. Instructions for collection and shipping of mammalian carcasses to MSB.

Museum of Southwestern Biology
Division of Mammals
University of New Mexico

INSTRUCTIONS FOR COLLECTION AND SHIPMENT OF MAMMALIAN CARCASSES

Joe Cook, Curator of Mammals: cookjose@unm.edu 505 277-1358
Jon Dunnum, Collection Manager, Division of Mammals: jldunnum@unm.edu 505 277-9262
Mariel Campbell, Collection Manager, Division of Genomic Resources: campbell@carachupa.org 505 277-7808

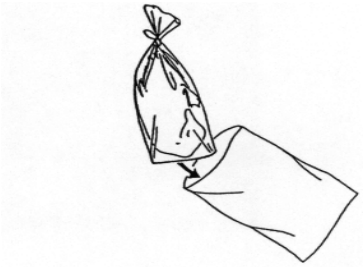
The MSB complies with the standards set forth by CDC and IATA for shipping and handling of specimens potentially contaminated with etiological agents. Carcasses are received in one of three ways; dried, fixed, or frozen. In all cases carcasses are contained in multiple sealed containers and handled and processed according to currently accepted protocols. Dried carcasses are initially immersed in ETOH and then dried; fixed are preserved in formalin or ETOH; frozen are kept frozen prior to and during import and then stored in Biosafety level 2 freezer facilities until final processing by dermestid beetles.

The following instructions should be used for collecting and shipping wildlife carcasses, carcass parts, and samples extracted from animals to the Museum of Southwestern Biology (MSB) to insure adequate and well preserved specimens.

MSB prefers frozen specimens unless tissue samples have been extracted prior to shipment of carcasses. Freezing/thawing impedes isolation of some pathogens and damages tissues thus every effort should be made to avoid thawing.

- ☐ Contact MSB to get shipping approval and discuss shipping arrangements. Typically, ship specimens by 1-day (overnight) service, Monday through Wednesday, to guarantee arrival before the weekend.
- ☐ Email history and tracking number to MSB. Packages will not be opened if history does not arrive first!
- ☐ Use rubber, vinyl, or nitrile gloves when handling animal specimens. If you do not have gloves, insert your hand into a plastic bag.
- ☐ Collect specimens that are representative of all species and geographic areas.
- ☐ Collect the freshest specimens. Decomposed or scavenged carcasses are usually of limited value. If you plan to collect animals in the field, take along a cooler containing blue or dry ice to immediately chill carcasses.
- ☐ Contact MSB for assistance if collecting samples from animals that are too large to ship.

MSB Mammals Procedure Manual – Dunnum et al. 2016.



☐ Collect animals under the assumption that an infectious disease or toxin is involved and other animals may be at risk. Protect yourself as some diseases and toxins are hazardous to humans.

☐ Immediately attach a leg tag to each animal with the following information in pencil or waterproof ink:

- Date collected
- Location (specific site, town, county, state, Lat/ long)
- Collector (name/address/phone)
- Species
- Found dead or euthanized
- Your reference #

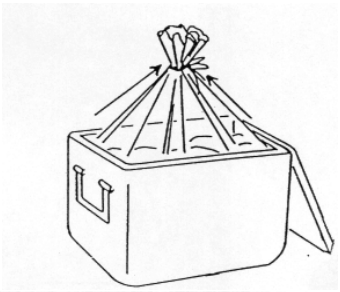
☐ Place each animal in a plastic bag, close, and seal the bag. Cover zipper bag closure with strapping or duct tape after sealing zipper.
Twist non-zipper bags closed, fold over on itself, and secure with package strapping or duct tape.

☐ Place 1st bag inside a 2nd bag, release air, close and seal. More than one individually bagged animal can be placed in the 2nd bag. This prevents cross-contamination of individual specimens and leaking shipping containers.

☐ Tag the outside of 2nd bag with number of animals and type, date collected, location, and name of collector. Reminder order: TAG, BAG, BAG, TAG.

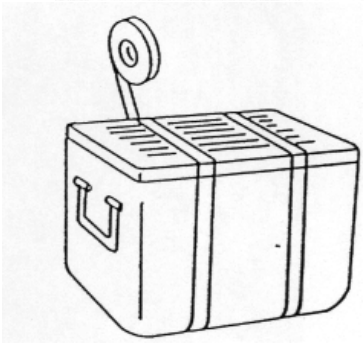
☐ Use a hard-sided ultra cooler in good condition for shipment. Close the drain plug of cooler and tape over inside. Line cooler with a thick bag (1 mil thickness, 3rd layer of bags).

☐ Place absorbent material in the 3rd plastic bag to absorb any liquids that might leak during shipping. See appendix for examples of bags and absorbent materials.



☐ Pack the individually bagged animal(s) that are contained within the 2nd sealed bag into the 3rd bag with enough ULTRA FROZEN BLUE ICE PACKS or similar coolant to keep carcasses cold. Use enough coolant to keep samples chilled if there is a delay in delivery.

- Blue ice (unfrozen) can be obtained at hardware, sporting goods, or grocery stores.
- Wet ice can be used if frozen in a sealed plastic container (i.e., soda or water bottle).
- If using dry ice a designated shipper (i.e. FEDEX) must be used and proper labeling must be on container.



☐ Seal the 3rd bag with methods described for 1st bag.

☐ Place the completed specimen history and return shipping label in a ziplock bag and tape to the inside lid of the cooler (if you want the cooler returned).

☐ Using packing or duct tape, tape the cooler shut around the lid and at each end using a continuous wrap around the cooler.

☐ Attach the shipping document (airbill) with the DOT information below to the outside of each cooler in a resealable pouch:

Address:

Collection Manager
Museum of Southwestern Biology
Division of Mammals
University of New Mexico
CERIA Bldg 83, Room 204
Albuquerque, NM 87131

Supplementary Labels**:**

Keep Cold/frozen

☐ Mark the cooler with the appropriate information:
(See Pg. 4 for printable marking labels)

- Carcasses of animals:
  BIOLOGICAL SUBSTANCE, CATEGORY B and **UN 3373.**
- Blood and tissue samples
  EXEMPT ANIMAL SPECIMENS.

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☐ Note the tracking number in case packages are delayed.

☐ These instructions cover federal shipping regulations for commercial carriers.

Appendix:

Example of bags available at large supermarkets (list not all inclusive):

Inner and second layer bags:

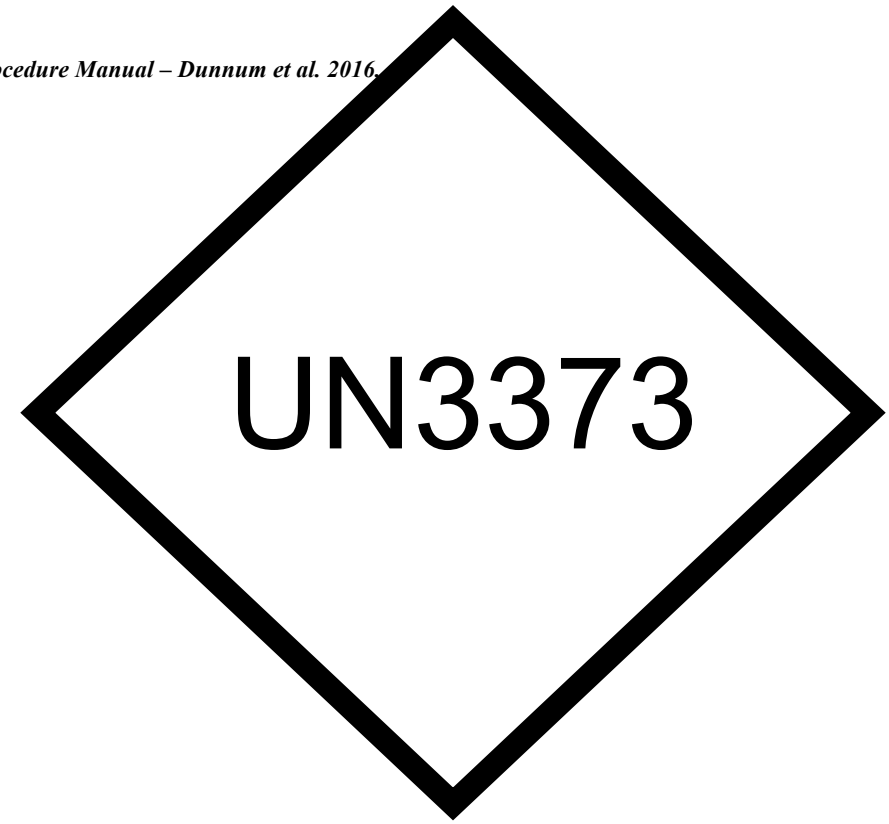
Hefty Big Bag – 22 gal	Ziplock Freezer – 1 gallon
Hefty Freezer – 1 gal	Ziplock Big Bag – 20 gallon
Hefty Jumbo – 2.5 gal	Glad Freezer – 1 qt, 2 qt, 1 gal

Third layer for cooler liner:

Hefty Cinch Sak (1.1 mil) – 33 and 39 gal	Glad Force Flex (1.05 mil) – 25 gal
Hefty Lawn and Leaf (1.1 mil) – 33 and 39 gal	Hefty Ultra Flex (1.3 mil) – 30 gal
House brand large trash (1.1 mil) – 30 gal	House Lawn - Leaf (1.2 mil) – 39 gal

Absorbent material:

Super absorbent packet or pads for water	Cellulose wadding
Paper towels	Cotton batting or cotton balls
Do not use packing peanuts or shredded paper.	



BIOLOGICAL SUBSTANCES, CATEGORY B

EXEMPT ANIMAL SPECIMENS

Appendix 10. Policy on Consumptive (Destructive) Sampling of Non-traditional Tissues

Traditional tissues are tissues collected for purposes of genetic or molecular studies and typically include (but are not restricted to) portions of heart, liver, kidney, and muscle that are often stored in liquid nitrogen or an ultracold freezer. Guidelines for consumptive sampling of these tissues are found in the Division of Genomic Resources. **Non-traditional tissues** are tissues that are extracted from voucher specimens (dry or fluid-preserved) for established and novel applications. These tissues can include portions of dry skin (including ear and wing punches, toe pads, nails, and hair), bone (including os bacula), and fluid-preserved specimens (including embryos and internal organs).

This document has been developed to assist users in making requests for these limited biological resources and to ensure that consumptive sampling helps to preserve, rather than exhaust, the value of these collections for present and future use. The guidelines have been developed in conjunction with policies and procedures from other research collections.

Procedures for Requesting Non-Traditional Tissues

An initial request of the Division's holdings can be made by phone, email or regular mail to the Collection Manager or Curator of the Division of Mammals. A formal request for specific tissues must be made in writing on institutional letterhead from the researcher and addressed to: Curator, Division of Mammals, Museum of Southwestern Biology, Department of Biology, University of New Mexico, Albuquerque, NM 87131. Requests originating from a student (undergraduate or graduate) must be co-signed by the student's advisor, who will assume responsibility for use of the samples. If the tissue loan is approved, the letter represents a contract between the researcher and the MSB.

The formal request should provide the following information:

1. A brief summary of the goals, methods, and time-frame of the project, and the qualifications of the researcher to perform the laboratory work. Include the availability of funding to complete the project. Include the total number of tissues to be used in the project, in addition to MSB's contribution. To justify the use of the samples explain why samples are needed from the MSB versus the availability from other sources. Please specify the number of tissues that will be collected by the researcher and the number requested from other institutions.

2. A list of the MSB specimens by taxa and catalog number. Please specify the amount of tissue/extract required and the preferred method of delivery (e.g., on dry ice, in 95% EtOH, etc). Currently tissues must be extracted at MSB.

3. A Federal Express charge number must be provided to cover shipping and dry ice charges. Provide a complete shipping address.

Copies of permits:

- For foreign researchers, this includes a copy of any import permit required by the foreign government. If no permit is needed, the researcher must state such in writing at the time that the tissue request is submitted.
- Requests from foreign researchers for tissue of species regulated by the U.S. Fish and Wildlife Service (e.g., CITES-species, endangered species, marine mammals, migratory birds) will not be processed without the proper U.S. export permits; species listed only under CITES may be exported under a Certificate of Scientific Exchange if the receiving institution possesses such a certificate.
- Requests from U.S. researchers for tissue of species regulated by the U.S. Department of Agriculture must be accompanied by a copy of a USDA transport permit, issued to the recipient or his/her institution.

Criteria for Approval

Each request will be evaluated by Curators associated with the Division of Mammals and approval will be evaluated on the following criteria:

1. The scientific value and feasibility of the project. Preference is given to projects of high-quality research and those that will likely be published. Evidence of sufficient lab facilities and funding.

2. Proportion of samples being collected by applicants. Preference is given to researchers who can provide their own material. MSB will not provide the majority of tissues for a project; we expect researchers to collect most of their specimens.

3. Evidence of reciprocal benefit to MSB. Examples of reciprocal benefit include: tissues offered in exchange for MSB tissues; access for MSB researchers to substantial tissue holdings; help organizing collecting expeditions; funding for collecting expeditions. Reciprocal benefit is assumed for any foreign researcher requesting tissues of organisms from his/her own country.

4. Qualifications of the investigator(s). Loans will be denied to researchers who have not made good use of samples in the past or who have not fulfilled loan requirements.

5. Rarity and replaceability of the samples requested. Loans of specimens may depend upon volume of tissue and rarity of taxon.

Terms

1. Sampling is to be conducted in the museum either by MSB personnel or by investigators under the supervision of MSB personnel.

2. Pre-existing or new NK numbers will be used to identify the samples and extracts throughout the process but an MSB catalog number is required when the work is published. The museum acronym MSB is considered part of the catalog number.

4. All material loaned by the MSB for consumptive use, as well as any materials derived therefrom (e.g., purified DNA, amplified genes, extracts) remain property of MSB.

5. Tissues or extracts may not be given to third parties without the permission of MSB. This rule ensures maximal use of tissues, prevents loss, prevents legal infractions, and provides a paper trail.

6. Unused portions must be returned to MSB upon completion of the study. Researchers must agree to deposit DNA sequence results in an appropriate international database (such as GenBank) and must be accompanied by the museum catalog number and MSB acronym

7. In addition to extracts MSB may request exchanges of vouchered tissues or specimens. Such material should be well-labeled and include complete locality data, and appropriate permits.

8. Two copies of reprints of publications resulting from the loan must be provided to the MSB Division of Mammals and "The Museum of Southwestern Biology" must be acknowledged.

9. Length of loan. The loan will remain open until unused portions are returned. Time frame for returning extracts is two years although extensions may be granted if requests are made in writing (with a brief summary of the status of the project).

Appendix 11: Specimen loan enclosure document.

NATURAL HISTORY SPECIMENS - NO COMMERCIAL VALUE

IF LOST PLEASE RETURN TO:
Division of Mammals
Museum of Southwestern Biology
MSC03 2020
1 University of New Mexico
Albuquerque, NM, USA 87131-0001
(505) 277-1360

To Borrower and Students of Borrower:

1. Please check specimens, then **sign and return one copy of enclosed invoice**.
2. Specimens should not be taken away from place listed on shipping label without notifying the MSB Division of Mammals.
3. Specimens must be kept in suitable storage facilities protected from light, dust, and pests.
4. Do not remove, alter or annotate specimen tags or labels; any changes including re-identifications should be listed separately.
5. Fluid preserved specimens should be kept moist with 70% ETOH unless otherwise specified.
6. Please return specimens in original containers.
7. Loans retained over the listed loan period are subject to renewal or recall.

Kindly report to the MSB Division of Mammals the title, journal, and expected date of publication (or the complete citation if already published) of any material that results from use of the collection. **We also require one electronic copy of the reprint.**

Repeatability and testability of a given study are central tenants of the scientific method. To achieve each of these, it is essential that others can track the sources on which your conclusions rest (i.e. the specimens examined). To make this as easy as possible, we ask that you acknowledge the material that you are borrowing from us in all resulting publications, reports, presentations, or GenBank submission; using the following format: **"MSB:Mamm:12656". For GenBank submissions, the catalogue number should appear in both the Definition and Voucher fields.** Whenever possible, museum catalogue numbers should be included in the print version of published journal articles; borrowers are strongly encouraged to work with editors to ensure that this happens. In cases where this is not possible, museum catalogue numbers should be made available as supplemental material available online and archived on the journal's website. Your signature on the invoice signifies your willingness to follow these guidelines.

On behalf of both the MSB and future researchers, thanks for your cooperation!

Appendix 12: Museum Staff Position Descriptions.

I.) MUSEUM ASSOCIATES

The Museum Associates program is designed to recognize scientists whose work brings them into especially close contact with one of the divisions of the MSB, in a relationship that is beneficial to them as well as to the Museum, its curators, staff, and students. Two equal classes have been established, Curatorial Associate for individuals who contribute time and expertise in the day-to-day curation of the collections, and Research Associate for those whose research importantly involves ongoing use of the collections, and whose presence thereby contributes to the intellectual atmosphere in the Museum and Biology Department. Curator Emeritus is hereby established for those who have retired from the MSB, but who are active contributors to the Museum or Department. Associates are nominated by a member of the Museum staff and approved by the Board of Curators. A current curriculum vitae is filed with the Director. Appointments are for three years and are renewable.

II.) CURATOR

A full-time (1.0 FTE) faculty member in the Department of Biology whose responsibility is to curate a MSB division; these duties may be designated with the approval of the Director. The USGS-BRD collections are the responsibility of the BRD curator (a Federal employee). Usually, the Curator has a systematic, taxonomic, evolutionary research interest in one or more of the taxonomic groups held in his/her division. Ultimately, the Curator is responsible for ensuring a division's success. The Curator sets and enforces policy, oversees specimen acquisition and collection growth, procures funding for the division, supervises the division's Collection Manager, and reports to the Director and Chair of the Department of Biology.

III.) COLLECTIONS MANAGER

A professional staff member, whose main duties are collection management, is responsible for fostering the preservation, accessibility, and utility of the collections and associated data. In consultation with the Curator, Collection Managers are responsible for policy development and implementation, specimen acquisition and collection growth; planning and establishing collection priorities; obtaining, allocating, and managing resources; oversees student workers, and coordinating collection processes with the needs of curation, preservation, and specimen use. These responsibilities may be shared by Collection Managers, subject specialists, and other institutional administrators.

IV.) GRADUATE ASSISTANT CURATOR

In the MSB, each division is assigned a graduate student to assist the Curator and Collection Manager in specimen cataloging, taxa-specific curating, and loan preparation. These 0.5 FTE assistantships are part of the usual support offered to Biology graduate students and are part of graduate Teaching Assistant assignments. These curatorial assistantships were added to the TA pool in the mid-1970's to support the museum and to supplement graduate support. Curatorial assistants are selected by curators annually.

V.) MUSEUM ASSISTANT

Usually an undergraduate student paid as a work-study or student employee to learn and conduct the daily maintenance of a natural history research collection. Duties include maintenance and operation of the dermestarium, osteoscribing, matching material, processing skeletons, and many other routine duties.

VI.) PREPARATOR

Unfortunately we have no preparator position, but it is most closely filled by a combination of the Collections Manager and a senior-level undergraduate student assistant called the Prep Room Supervisor. The Prep Room Supervisor should be an undergraduate student who has two years of museum and prep room experience, and can communicate well with the Collections Manager and student staff. This person should be well acquainted with the workings of a prep room, that is: know how the bug room operates, check for accession number on new-to-prep material, ask for notes, permits, or other data associated with prep material, know the chemicals that are being used and of their proper disposal, know the proportions of preservatives/fixatives, know general specimen preparation techniques: i.e., boiling, fluid-preserving, skin/skeleton preps, communicate frequently with the collections manager, alert the Collections Manager of materials in short supply, alert the Collections Manager of abuses or improper techniques in the prep room, monitor overall quality of work among other prep room people, alert the Collection Manager of personnel problems, keep materials moving through the preparation process, alert the Collections Manager of "clogs" in the preparation process, be flexible in work schedule to cover times when other personnel will be working, remind workers to keep the area clean and safe, among other duties.

VI.) RESEARCH STAFF

Conduct independent research projects that enhance collection. Assist with specimen processing, cataloging, museum operations, etc.

VII.) MUSEUM ASSISTANT

VIII.) VOLUNTEER

Appendix 13. Sample vial label.

MSB Vial Labels

- Arial, 6-point font except where noted
- 1.5" x 2.25" box with thin black border
- 1/16" white space around box with light dashed line for cutting

Museum name – centered, bold

collection – centered, not bold

MSB # and sex – five spaces (or so) between sex and number, centered, MSB # bolded and without a dash, sex not bolded, "U" for unknown sex

scientific name – Times New Roman, italicized, left justified, shrink font as needed to fit name on **one line**

location – do not include North America, use USA, not Unites States, use semi colon and colon as shown, abbreviate county as shown, limit to five lines (use ellipsis if necessary to indicate cut off info), left justified.

date – day month (spelled out) year, no dashes, left justified

NK – no dash, left justified

collector name – first name, middle initial, last name, left justified, shrink font if needed to fit name & number on **one line**

collector number – on same line with collector name, right justified

preparator name – first name, middle initial, last name, left justified, shrink font if needed to fit name & number on **one line**

preparator number – on same line with preparator name, right justified

parts – parts only, no preservation methods, limit to five lines (use ellipsis if necessary to indicate cut off info), if possible list dry parts first, left justified

Museum of Southwestern Biology
Biological Surveys Collection

MSB 122441 ♀

Peromyscus maniculatus maniculatus

USA: New Mexico; Rio Arriba Co., Española

15 March 2004

NK 103623

coll: Keith Geluso

prep: Cindy A. Ramotnik CAR 234

skin, skull, postcranial skeleton, liver, heart, kidney, lung, spleen, embryo, blood

Museum of Southwestern Biology
Biological Surveys Collection

MSB 120041 ♂

Canis latrans

USA: New Mexico; Valencia Co., Los Chavez, on side of road in front of Dennis Chavez Elementary School

2 August 2007

NK 100283

coll: Adrienne L. Raniszewski ALR 101

prep: Ernest W. Valdez

skull

Museum of Southwestern Biology
Division of Mammals

MSB 25000 U

Microtus oeconomus macfarlani

USA: New Mexico; Bernalillo Co., Albuquerque, Rio Grande Nature Center, under large cottonwood tree at east end of parking lot

23 January 1972

NK 100001

coll: Kathleen Stewart S95-247

prep: Kathleen Stewart

whole organism, liver, heart, kidney

Museum of Southwestern Biology
Division of Mammals

MSB 257 ♂

Reithrodontomys megalotis zacatacae

USA: New Mexico; Torrance Co., Salinas Pueblo Missions National Monument, 2.5 mi E and 1.25 mi S of such and such landmark, Quarai Unit

12 July 1996

NK 189953

coll: Garth Brooks

prep: Dolly Crawford 263

skull, postcranial skeleton, embryo