1. Policy

The Forensic Anthropology Unit (FAU) responds to consultation requests received from OCME personnel and, on occasion, from external agencies. The FAU shall ensure proper processing, examination, and analysis of remains following acceptable practices within the field of Forensic Anthropology.

2. Scope

The procedures outlined apply to all FAU personnel.

3. Anthropological Laboratory Analyses

There are a multitude of anthropological examinations that the FAU can perform, depending on the completeness, overall condition of the remains, and the type of analysis requested. The following section briefly summarizes the types of anthropological examinations offered by the FAU.

- Determine if remains are osseous, human, and of medicolegal significance.
- Estimate the Minimum Number of Individuals (MNI).
- Estimate the biological profile: sex, ancestry, age at death, and stature.
- Describe and interpret pathological conditions and anatomical variants.
- Describe and interpret trauma to include antemortem, perimortem and dismemberment.
- Describe and interpret taphonomic changes, including postmortem damage.
- Estimate the Postmortem Interval (PMI).

4. Cleaning Remains and Specimen Removal

4.1 **Cleaning/Macerating Remains:** Remains submitted for anthropological analysis are processed based on their overall condition. The following section summarizes some of the appropriate methods that are available. Information about cleaning or macerating remains shall be recorded on the Basic Case Information Form or an Analytical Notes Form.

Note: All current FAU forms can be found on the Anthropology network drive.

- **Skeletal Remains Devoid of Soft Tissue**: The remains may be brushed to remove excess dirt/debris. Skeletal remains that are muddy, but are devoid of soft tissue may be wet brushed. Once the remains are sufficiently cleaned, they should be dried in one of the secure Anthropology Labs.

- **Skeletal Material with Soft Tissue**: Remains with adherent soft tissue may be disarticulated and submerged in warm water with detergents or other appropriate solutions as needed. Prior to putting the remains in water, the Forensic Anthropology (FA) should remove as much soft tissue as appropriate. The remains should be left to soak in a heated pot until the remains are devoid of soft tissue or until the soft tissue can be more easily removed manually. When the remains are sufficiently devoid of soft tissue, they are removed from the pot and rinsed off. Any excess soft tissue adhering to the skeletal elements is removed manually. Once processing is finished the skeletal elements are left in one of the secure Anthropology labs to air dry.

- **Cartilaginous Remains:** Cartilaginous specimens shall be placed in an evidence container filled with formalin. Before attempting to conduct analysis, the specimen should be soaked under running water. See Appendix A: Lab Health and Safety, for the policies and procedures on handling and working with formalin.

4.2 **Specimen Removal:** The medical examiner may request the assistance of the FAU in the removal of specimens. Specimens can be removed for a variety of reasons including but not limited to, adult or sub-adult age determination, trauma, and pathology. All specimens removed shall be submitted to the Evidence Department. See ANTH-001 Evidence Security and Management for the complete procedure for submitting/receiving evidence from the OCME Evidence Department.

4.3 **Health and Safety:** When cleaning and macerating remains, and during specimen removal, FAU personnel are responsible for following the health and safety precautions outlined in Appendix A, including but not limited to, wearing the appropriate level of personal protective equipment (PPE).

5. Examination Methods

Anthropological consultation requests may require various types of examinations. The following section outlines typical techniques used by the FAU:

- <u>Macroscopic Examination:</u> Macroscopic examination refers to a visual (gross) examination of remains.

- <u>Microscopic Examination:</u> Microscopic examination refers to a visual examination using magnification provided by a microscope.

- Metric Analysis: Measurements using calipers, osteometric boards, three-dimensional coordinate measurement machine/system (digitizer), and tape measures are taken using the appropriate method.

- Radiographic Examination: Examination of remains using medical imaging techniques.

  Note: FAU personnel are not responsible for taking radiographs. The OCME Radiography Department is responsible for taking radiographs for casework.

- Examination of digital images: Examination of remains through the review of digital photographs.

6. Anthropological Laboratory Analysis

Based on the completeness of the remains and/or the examination requested, the analyses outlined below may be performed. When referring to the types of analyses, the FAU shall use appropriate and accepted methods and references. See Appendix B for a current list of the most frequently used references by the FAU. There is no authoritative body in Forensic Anthropology, however only validated and published methods shall be used during anthropological laboratory analyses. The FAU does not develop in-house quantitative test procedures nor use non-standard methods for examination of casework.

6.1 **Determining Osseous/Dental versus Non-osseous/Non-dental:** The material shall be examined by macroscopic visual examination, microscopic examination, or evaluation of digital images to assess the presence or absence of features or structures that characterize osseous and dental material to include overall size and morphology, landmarks, cortical or trabecular structures, density and color. The material may be evaluated by radiographic examination or submitted to another unit or agency for other instrument specific procedures.

6.2 **Determining Human versus Non-human:** Osseous material shall be examined by macroscopic visual examination, microscopic examination, or through the evaluation of digital images to assess morphology, looking for features or landmarks that are characteristic of human or non-human species based on the examiner's training and experience in comparative osteology. The osseous material can be compared to information or data from published literature and/or from the FAU comparative non-human skeletal materials.

6.3 **Determining Medicolegal Significance:** Determination of medicolegal significance is based on taphonomic and/or contextual indicators. Human remains may be determined not to be of medicolegal significance when they are from historic/prehistoric

archaeological contexts, disturbed cemeteries, or anatomical teaching collections. The FAU analyst shall assess the evidence and document the features and/or context used in making their determination.

6.4 **Inventory/MNI:** Skeletal, dental, and cartilaginous remains are inventoried for all analyses. An analysis of the minimum number of individuals (MNI) shall be completed to check for commingling. If commingling is found, the MNI may be estimated by counting the most repeated element or portion of an element. Observations concerning condition, articulation, pair-matching, morphology, taphonomy, context, and features of the biological profile of the remains also aid in estimating MNI.

6.5 **Age at Death Estimation:** Analysis of age at death is based on skeletal and dental development for sub-adult aging, and on degenerative skeletal and dental changes for adult aging. Outlined below are some of the most frequently used methods for estimating age at death. The analyst determines the appropriate method and technique based on the material provided and the condition of the remains.

6.5.1 **Developmental Aging Methods:**

- **Dental Development:** Dental development and the timing of tooth eruption are utilized for assessing sub-adult age. Radiographs are taken of the maxilla and mandible to assess unerupted teeth and root morphology. The teeth are typically compared to standard dental development tables and figures. Whenever possible, the appropriate methods and tables for specific ancestral groups may be used.

- **Metric Analysis:** Long bone diaphyses develop and grow at predictable rates until the proximal and distal epiphyses fuse to the diaphysis. There are accepted metric methods that utilize measurements of the long bones to accurately estimate skeletal age in immature remains.

- **Assessing Epiphyseal Appearance and Union:** Appearance and union of epiphyses also occur at predictable rates and is an accurate means of estimating skeletal age in individuals under 25 years. All applicable epiphyses are evaluated to develop a "composite" age estimate. The resulting age estimate may either be reported as terminal (e.g., <18) or as an interval (e.g., 16-20).

- **Medial Clavicles:** The medial clavicles are assessed for the stage of epiphyseal fusion to determine age in teenagers and younger adults.

6.5.2 **Degenerative Aging Methods:**

- **Pubic Symphysis:** Observing the degenerative changes to the pubic symphysis is a common method used in estimating age at death for adults. The analyst will document the condition of the symphyseal surface and any effect it may have on the age estimate.

- **4th Ribs Sternal Ends:** Adult aging using the sternal rib end was designed for use with the 4th rib sternal end, however when both 4th ribs are unavailable or cannot be assessed the 3rd and 5th-9th ribs can be evaluated instead. In cases where an alternate rib is utilized the analyst will document the rib number in the case notes.

6.5.3 **Additional Methods for Age Assessment:** Sections 6.5.1 and 6.5.2 summarize the most frequently used techniques for sub-adult and adult aging; however, the analyst may choose to include other techniques or methods in their age assessment that are viewed by the OCME FAU as reputable and accepted by the scientific community (i.e., published in a accepted journal/book).

6.5.4 **Constructing the Age interval:** Age estimation requires an assessment of developmental and degenerative changes from various age indicators. Certain methods are more reliable for particular periods of life, while others provide a more general indicator of age. The analyst constructs the age interval based on a composite of the available age indicators. The analyst will note which age indicators were used for their assessment. The final age estimate is a matter of expert judgment by synthesizing all available information, including the appropriateness of the reference data, familiarity with the methods, condition of the remains, etc.

6.6 **Ancestry Estimation:** Both cranial and post-cranial non-metric and metric traits are evaluated for ancestry estimation. Results of ancestry estimation may include groups such as, European (White), African (Black), Hispanic, Asian, Native American, or the results may be Indeterminate. Outlined below are some of the most frequently used methods for estimating ancestry; however, the analyst determines the appropriate method and technique based on the material provided and the condition of the remains.

6.6.1 **Non-Metric Assessment of Ancestry**: Non-metric characteristics of the cranium, mandible, and dentition are used when assessing ancestry.

6.6.2 **Metric Assessment of Ancestry**: Statistical software programs, such as Fordisc, are used for metric assessment of ancestry. Bone measurements are taken using an

approved reference (e.g., UT Data Collection Procedures, Howell's definitions). The measurements used for the statistical analysis are up to the discretion of the user. All steps in the statistical software analysis are retained in the associated log files which are kept with the case file (either hardcopy or electronic copy). Any measurement involving trauma, damage, pathologic condition, or anatomical variant is included or excluded at the discretion of the analyst and a comment is made in the analytical notes.

6.7 **Sex Estimation**: Sex estimation is performed by standard non-metric and/or metric assessment procedures that examine sexually dimorphic characteristics of the skeleton. Provided below are standard analyses for sex estimation, however the analyst determines the appropriate method and technique based on the material provided and the condition of the remains.

6.7.1 **Non-metric methods**: Morphological features of the pelvis and skull are typically used to estimate sex. In addition, the skeletal elements present may be evaluated for overall robusticity.

6.7.1 **Metric Analysis**: Estimation of sex may be determined using measurements of the cranial, mandibular, and postcranial elements.

6.8 **Stature Estimation**: Stature can be estimated using mathematical methods (e.g., Fordisc) or anatomical methods (e.g., Fully method). Take measurements as described for the method and select the appropriate demographic categories. At minimum, report the 90% prediction interval. Stature may be reported in centimeters, inches, or feet and inches.

6.9 **Dental examination**: Examine and chart the dentition for inventory purposes. Dental analyses regarding age, sex, ancestry, or trauma will be provided in the relevant sections. Chart the dentition using the Universal Numbering System and document the following:

- Antemortem tooth loss/agenesis.
- Postmortem tooth loss.
- All restorations.

Note: All dental radiographs are taken by the OCME Radiology Department. In most cases, an OCME forensic odontologist will also examine and chart the dentition for identification purposes.

6.10 **Pathological Conditions**: Examine and document characteristics of pathological change. At a minimum the following should be documented (when applicable):

- Affected elements and approximate location.
- Presence of bone remodeling and extent of healing.

- Presence of accompanying features.

6.11 **Anatomical Variants**: Examine the remains for anatomical variants such as abnormal development or notable variations of normal human skeletal anatomy. Describe the anomaly and location.

6.12 **Trauma Analysis:** Remains are examined for trauma in cases where a full skeletal analysis is performed or on specimens removed from autopsy at the request of the medical examiner. Trauma analysis involves examining the remains for antemortem, perimortem, and dismemberment trauma.

The following general information should be recorded when describing and interpreting trauma:

- A determination of the trauma as antemortem, perimortem, or dismemberment, if possible.
- The location of the trauma.
- If antemortem, a description of any healing, signs of medical intervention, and if possible a relative age of injury.
- Description of the type of trauma if possible (e.g., blunt, sharp, high velocity projectile).
- Notes on whether a reconstruction of the specimen is required to perform the analysis.
- Notes on relevant postmortem damage.
- Notes on any relevant pathological conditions that may be associated with the trauma.

6.12.1 **Blunt Force Trauma:** The following is specific information that should be recorded for blunt force trauma analysis:

- Description of the fracture(s) including anatomical location.
- If possible, notes on the direction of force, specific impact site(s), and fracture patterns.
- If possible, a determination of tool class characteristics, minimum number of impacts, and sequence of impacts.

6.12.2 **Sharp Force Trauma:** The following is specific information that should be recorded for sharp force trauma analysis:

- Descriptions and/or drawing of the location of the defect.
- Any relevant measurements.
- Descriptions of specific characteristics of the defect (e.g., incomplete cuts, kerf wall, kerf floor, striation patterns).

- Notes on the progression of the weapon through osseous and cartilaginous structures, when applicable.
- When appropriate, casts of the tool mark (see section 6.12.4).
- If possible, determine tool class characteristics, minimum number of impacts, and sequence of impacts.

Note: In some circumstances, it may be necessary to expose the cut surface (kerf floor and/or walls) by cutting the cartilage or bone to open up the defect for examination. When this occurs the newly cut surface must be noted in the analytical notes so it can be identified as an examination modification.

6.12.3 **High Velocity Projectile Trauma:** The following is specific information that should be recorded for high velocity projectile trauma analysis:

- Descriptions and/or drawing of the overall shape and anatomical location of the defect (wound) with associated fractures.
- Measurements of the size of the defect(s).
- Descriptions of specific characteristics of the defect and notes on the trajectory, if possible.
- Statements of the minimum number of defects and sequence of defects, if possible.

6.12.4 **Tool Mark Casting:** FAU analysts may choose to create cast impressions to aid in examination of tool mark characteristics. A polyvinylsiloxane (e.g., Accutrans) or similar casting material is used to create tool mark casts. All casts should be placed in bags labeled with the unique case number and description of the cast. Tool mark casts created during analysis are considered evidence and the FAU shall follow the policies and procedures documented in Evidence Security and Management (see ANTH-001).

6.13 **Postmortem Interval and Taphonomic Changes:** Examine the remains and record any information from the scene that may aid in the assessment of the postmortem interval and taphonomic processes. Describe the condition of the remains, and if possible, the probable interval between death and discovery.

6.14 **Postmortem Damage:** Postmortem damage refers to any damage to the remains after death and can sometimes be misconstrued as perimortem trauma. The following is specific information that should be recorded for postmortem damage, when possible:

- Documentation of the location of the damage in the analytical notes or, if necessary, in a diagram.
- Description of the extent, pattern, and possible cause of the damage.

- Notes on taphonomic changes to the remains (e.g., color changes, animal activity, water damage).
- Notes on damage resulting from standard autopsy protocol, which are included within the postmortem damage description when applicable.

7. Verifying New Methods

Any newly validated, published methods shall go through a verification process prior to being used on casework. The FAU shall verify that all analysts are competent to use the new method by having the analysts independently perform the method on the same sample(s) and compare their results. Verification is considered complete and the new method can be used in casework when all the analysts' results are in agreement. If there is a disagreement between results then, as a group, the FAU shall review all results, as well as the procedures for the method to ensure all analysts understand how to appropriately use the method. Continued testing of the method will occur until all analysts are in agreement.

Appendix A. Health and Safety

Policy and Scope
FAU personnel, interns and visiting scientists are responsible for following the health and safety policies and procedures outlined by the OCME Health and Safety Department and the safety precautions provided in this appendix.

OCME Health and Safety Department: The OCME Health and Safety Department is responsible for the health and safety of all OCME employees. FAU personnel are responsible for following the health and safety policies and procedures that apply to their duties. OCME health and safety policies and procedures are located on the OCME intranet under Libraries/Health and Safety.

FAU Safety Officer: The FAU Quality Assurance (QA) Specialist is the designated Safety Officer for the unit (see the FAU organization chart in QM-001: Personnel). The QA Specialist is the primary liaison between the OCME Health and Safety Department and the FAU. The QA Specialist is responsible for making sure the FAU follows the OCME health and safety policies and procedures as well as the policies and procedures explicitly stated in this appendix. The QA Specialist is also responsible for chemical hygiene and safety issues.

Note: The duties and tasks associated with maintaining health and safety compliance can be divided among FAU employees.

FAU Personnel: It is the responsibility of FAU personnel to comply with and enforce the health and safety standards created by the OCME Health and Safety Department and outlined in this Appendix.

FAU Laboratory Safety Precautions:
Personal Protective Equipment (PPE): FAU personnel, interns and visiting scientists are responsible for wearing the appropriate level of PPE required when working in the Anthropology Laboratories. The appropriate PPE may vary depending on the task at hand. PPE may include, but is not limited to: lab coats, scrubs, disposable aprons, disposable gloves, shoe covers, eye protection, and respiratory protection. In addition to PPE, FAU personnel shall follow the OCME Laboratory Dress Code policy. Closed toed shoes should be worn when entering the morgue area, working with hazardous materials, or working with sharp instruments. The OCME Laboratory Dress Code policy is located on the OCME intranet under Libraries/Health and Safety.

PPE in Autopsy Suites: At minimum, FAU personnel shall wear appropriate lab attire and an N95 or equivalent face mask upon entering the autopsy suites when autopsies are being performed. The minimum PPE required when working in the autopsy suites may

include but is not limited to, a lab coat, disposable apron, disposable gloves, shoe covers, and an N95 or equivalent face mask. All PPE, except lab coats should promptly be removed when exiting the autopsy suite or morgue area.

PPE for Working in Anthropology Laboratories: When working in the Anthropology laboratories, FAU personnel shall wear PPE appropriate to the task. The type of PPE will vary depending on the task(s) being performed (e.g., maceration may require additional PPE that is not necessary when conducting skeletal analyses).

Note: Let maceration pots cool before handling or use the oven mitts when handling heated pots.

Sharps Safety: FAU personnel using sharp instruments (e.g., scalpels and bone saws) with possible exposure to body fluids are required to wear cut gloves underneath their disposable gloves.

Formaldehyde/Formalin Exposure: When working with formalin fixed specimens FAU personnel shall follow the policies described in the NYC OCME Chemical Safety Plan. The most up-to-date version of the Chemical Safety Plan is located on the OCME intranet under Libraries/Health and Safety.

When working with formalin fixed specimens the following procedure should be adhered to whenever possible:

- Prior to examination the specimen(s) should be soaked under running water.
- At minimum wear a lab coat or disposable apron and disposable nitrile gloves.
- Work under a chemical fume hood or wear a half-face respirator with an organic vapor cartridge when handling formalin fixed specimens.
- To avoid inhalation of formaldehyde fumes all containers filled with formalin should be closed at all times, except when removing or returning specimen(s) to the container.

Chemical Hygiene: Chemical hygiene refers to working with and handling chemicals in a hygienic or clean manner. FAU personnel are responsible for handling and using chemicals properly from initial receipt to final disposal.

All hazardous chemical containers shall be initialed and dated when received and first removed from their shipping containers. A proper notation in the "Chemical Inventory Form" shall be completed for each chemical received. The QA Specialist shall review this form as part of his/her annual audit or when deemed necessary. Additionally, the QA Specialist shall make sure that Safety Data Sheets (SDS) for hazardous chemicals are accessible to all FAU personnel.

Handling Hazardous Chemicals: FAU personnel shall:

- Wear proper PPE to avoid skin/eye contact with hazardous chemicals.
- Wash their hands after handling chemicals.
- Be familiar with the SDSs of any hazardous chemicals used. These sheets are available online and in the FAU Chemical Records Binder.
- Put hazardous chemicals back into the chemical storage cabinet after use (see Chemical Storage).
- Dispose of hazardous chemicals properly (see Chemical Disposal).

Chemical Storage: Hazardous chemicals shall be stored in the FAU chemical storage cabinet. The FAU chemical storage cabinet is located in the Anthropology Laboratory located on the 4th floor (room 424).

Chemical Disposal: Expired or deteriorated chemicals or chemicals no longer utilized shall be disposed of properly. The OCME Health and Safety Department should be consulted prior to chemical waste disposal and the OCME Chemical Waste Removal Tracking Sheet shall be filled out and forwarded to Health and Safety prior to disposal.

Chemical Records: Records related to FAU chemicals such as the Chemical Inventory Form, OCME Chemical Waste Removal Tracking Sheet, and Safety Data Sheets shall be maintained by the QA Specialist. A chemical inventory shall be completed by the QA Specialist during the annual audit.

Incident Reporting: Any accident with injury shall be resolved first and then reported to the Forensic Anthropology Director (Director) and the OCME Health and Safety Department. When reporting an incident, the Director and injured personnel shall follow the steps outlined on the OCME Injury or Illness at Work flow chart. The most current version of the Injury and Illness at Work flow chart is located on the OCME intranet under Libraries, Health and Safety.

Housekeeping: Each FAU employee is responsible for the cleanliness of his/her workspace and jointly responsible for the Anthropology lab/office spaces.

The following procedures apply to the housekeeping standards of the laboratory:

- The Anthropology labs shall be kept clean and orderly. Any spills or messes shall be cleaned immediately.
- All lab equipment shall be kept in their assigned storage areas, except when in use.
- All chemical and biological waste shall be disposed of properly.
- Pathways, doorways, fire-extinguishing equipment and any other emergency equipment shall remain unobstructed.

Appendix B. Current list of References

Al Qahtani, S.J., Hector, M.P., and Liversidge, H.M.
2010 Brief Communication: The London Atlas of Human Tooth Development and Eruption. American Journal of Physical Anthropology 142(3):481-490.

Aufderheide, A.C., and C. Rodríguez-Martín
1998 The Cambridge Encyclopedia of Human Paleopathology. Cambridge: Cambridge University Press.

Barnes, E.
2013 Atlas of developmental field anomalies of the human skeleton: A paleopathology perspective. Hoboken, NJ: John Wiley and Sons.

Bass, W.M.
2005 Human Osteology. Columbia: Missouri Archaeological Society.

Birkby, J.E., Fenton, T.W., and [illegible]E., Anderson
2008 Identifying southwest Hispanics using Nonmetric traits and the cultural profile. Journal of Forensic Sciences 53(1):29-33.

Brooks, S., and Suchey, J.M.
1990 Skeletal age determination based upon the os pubis: a comparison of the Acsadi-Nemeskeri and Suchey-Brooks methods. Human Evolution 5(3):227-238.

Buikstra, J.E., and D.H. Ubelaker, eds.
1994 Standards for Data Collection from Human Skeletal Remains, Proceedings of a Seminar at the Field Museum of Natural History (Arkansas Archaeological Survey Research Series No. 44). Fayetteville: Arkansas Archaeological Survey.

Browner, B.D., Jupiter, J.B., Levine, A.M., and P.G. Trafton, eds.
2003 Skeletal Trauma: Basic Science, Management, and Reconstruction. Philadelphia: Saunders.

Cramer, K.E., and N.E. Green, eds.
2003 Skeletal Trauma in Children. Philadelphia: Saunders.

Crowder, C., C.W. Rainwater, and J.S. Fridie
2013 Microscopic analysis of sharp force trauma in bone and cartilage: A validation study. Journal of Forensic Sciences 58(5):1119-1126.

Edgar, H.J.H.
2005 Prediction of race using characteristics of dental morphology. Journal of Forensic Sciences 50:269-273.

Faz[illegible], and Kósa, K.
1978 Forensic Fetal Osteology. Budapest: Akadémiai Kiadó Publishers

Gallo[illegible]ay, A.
201[illegible] Broken Bones. Springfield, Charles C. Thomas.

Gill, G.W., and [illegible]S. eds.
1990 [illegible]eletal attribution of race: Methods for forensic anthropology. Maxwell Museum Anthropological Papers no. 4. Albuquerque: University of New Mexico.

Haglund, W.D., and M.H. Sorg, eds.
2002 Advances in Forensic Taphonomy. Boca Raton: CRC Press.

Humphrey, J.A. and D.L. Hutchinson
2001 Macroscopic characteristics of hacking trauma. Journal of Forensic Sciences 46(2): 228-233.

Hartnett, K.M.
2010 Analysis of Age-at-Death Estimation Using Data from a New, Modern Autopsy Sample-Part I: Pubic Bone. Journal of Forensic Science 55(5):1145-1151.

2010 Analysis of age-at-death estimation using data from a new, modern autopsy sample—part II: sternal end of the fourth rib. Journal of Forensic Sciences 55(5):1152-1156.

Hefner, J.T.
2009 Cranial nonmetric variation and estimating ancestry. Journal of Forensic Sciences 54:985-995.

Hefner, J.T., Ousley, S.D,
2014 Statistical classification methods for estimating ancestry using morphoscopic traits. Journal of Forensic Sciences 59(4):883-890.

Howells, W.W.
1973 Cranial Variation in Man: A Study by Multivariate Analysis of Patterns of Difference among recent Human populations. Papers of the Peabody Museum 67. Peabody Museum, Harvard University, Cambridge, Mass.

Hurst, C.V.
2012 Morphoscopic trait expressions used to identify Hispanic ancestry. Journal of Forensic Sciences 57(4):859-865.

İşcan, M.Y., and R.K. Wright.
1993 Cast of age phases from the sternal end of the rib for white males and females. Fort Collins, Colorado: France Casting.

İşcan, M.Y., Loth, S.R., and R.K. Wright
1985 Age estimation from the rib by phase analysis: white females. Journal of Forensic Sciences 30(3):853-863.

İşcan, M.Y., Loth, S.R., and R.K. Wright
1984 Metamorphosis at the sternal rib end: a new method to estimate age at death in white males. American Journal of Physical Anthropology 65(2):147-156.

Jantz, R.L., and S.D. Ousley
2005 FORDISC 3: Computerized forensic discriminant functions. Version 3.0.: The University of Tennessee, Knoxville.

Katz, D. and Suchey, J.M.
1986 Age determination of the male os pubis. American Journal of Physical Anthropology 69:427-435.

Klales, A.R., S.D. Ousley, and J.M. Vollner
2012 A revised method of sexing the human innominate using Phenice's nonmetric traits and statistical methods. American Journal of Physical Anthropology 149(1):104-114.

Kleinman, P.K., ed.
2015 Diagnostic Imaging of Child Abuse. 3rd edition. Cambridge: Cambridge University Press.

Komar, D.A.
1998 Decay rates in a cold climate region: a review of cases involving advanced decomposition from the medical examiner's office in Edmonton, Alberta. Journal of Forensic Sciences 43(1):57-61.

Langley, N.R., Jantz, L.M., Ousley, S.D., Jantz, R.L., and G. Milner
2016 Data Collection Procedures for Forensic Skeletal Material. Department of Anthropology, University of Tennessee, Knoxville.

Langley-Shirley, N., and R.L. Jantz
2010 A Bayesian approach to age estimation in modern Americans from the clavicle. Journal of Forensic Sciences 55(3):571-583.

ove, J..., S.M. Derrick, and J. Wiersema
011 Skeletal Atlas of Child Abuse. New York: Humana Press.

Ma..., R.W. antz, R..., Bass, W., and P.S. Willey
1..51 Maxilla... suture obliteration: a visual method for estimating skeletal age. Journal ... nsic Sciences 36(3): 781-791.

Meindl, R.S., a... C.O. Lovejoy
1985 Ectoc...nial suture closure: a revised method for the determination of skeletal age ... death based on the lateral-anterior sutures. American Journal of Physical Anth...pology 68(1): ...-66.

Mincer, H.H., Harris, E.F., and ...rryman, H.E.
1993 The A.B.F.O. study of thi... molar development and its use as estimator of chronological age [published erra... in app...s in Journal Forensic Sciences 1993 Nov; 38(6):1524]. Journal of F...ensic S...ences ...8(2):379-390.

Ortner, D.J.
2003 Identification of pathological condi...ons in h...an skeletal remains. San Diego: Academic Press.

Phenice, T.W.
1969 A newly developed visual method of s...ing the os pubis. American Journal of Physical Anthropology 30(2):297-301.

Pokines, J., and Symes, S.A.
2013 Manual of Forensic Taphonomy. Boca Raton: CRC P...ss.

Reichs, K.J.
1998 Forensic Osteology: Advances in the Identification of Human Remains. Springfield, Charles C. Thomas.

Rowe, L.J., and T.R., Yochum, eds.
2005 Essentials of Skeletal Radiology. 3rd edition. Philadelphia, Lippincott Williams & Wilkins.

Scheuer, L. and S. Black
2004 The Juvenile Skeleton. San Diego, Elsevier Academic Press.

Shirley, N.R., Jantz R.L.
2011 Spheno-Occipital Synchondrosis Fusion in Modern Americans

Sy[illegible] S.A.
1992 [illegible]hology of Saw Marks in Human Bone: Identification of Class Ch[illegible]teristics. Dissertation, Anthropology, University of Tennessee.

Ubelaker, D.H., [illegible]J. Adams
1995 [illegible]fferenti[illegible] of perimortem and postmortem trauma using taphonomic indicat[illegible]s. Jou[illegible]al of Fore[illegible]ic Sciences 40(3): 509-512.

Walker, P.L.
2008 Sexing [illegible]skull using [illegible]criminant analysis of visually assessed traits. American Journa[illegible] Physic[illegible] Anthropology Journal 136(1):39-50.

Yoder, C., Ubelaker, B.A., and Powell, J.[illegible]
2001 Examination of Variation i[illegible] Sterna[illegible]ub End Morphology Relevant to Age assessment. Journal of Forensi[illegible]cience[illegible]46(2)[illegible]23-227.

Revision History

REV.	DATE	SUMMARY OF CHAN[illegible]ES
0	26 January 2018	N[illegible]document[illegible]
1	18 October 2018	Document Control N[illegible] changed from [illegible]NTH-003 to ANTH-002. 6.0- Added the following statement: "There is no authoritative body in Forensic Anthropology, however only validated and published methods shall be used during anthropological laboratory analyses. The FAU does not develop in-house quantitative test procedures nor use non-standard methods for examination of casework. Created Section 7. Verifying New Methods. Only newly validated, published methods shall go through a verification process prior to being used on casework. FAU analysts shall perform verification of a new method by practicing/testing the method on sample(s) and comparing the outcome to the results from one of our already approved analytical methods.