Forensic Anthropology

A Comprehensive Introduction

Second Edition

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3. Recount the events that began and ended each of the three historical periods in forensic anthropology.
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5. Discuss the importance of documented modern skeletal collections for forensic anthropology research, practice, and education.
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The discipline of **anthropology** seeks to understand the many intricate aspects of what it means to be human. Derived from the Greek word *anthropos,* meaning "human," and *logia,* referring to the "study of," anthropology seeks to shed light on human behavior, biology, language, and culture in past and present contexts. Anthropology is a holistic discipline that encompasses multiple subdisciplines. The four most common subdisciplines are archaeology, sociocultural anthropology, linguistic anthropology, and physical/biological anthropology. These subdisciplines are not mutually exclusive, and each seeks to define and interpret various aspects of the human condition. Archaeology reconstructs the history of past populations through contextual analysis of the artifacts and structures (i.e., material culture) that these populations have left behind. Sociocultural anthropology uses observation and interviews of participants to understand cultural groups or subcultures. Linguistic anthropology investigates the origins and use of language, as well as language changes over time. Physical/biological anthropology studies human biological origins, adaptation, and variation in an evolutionary context, as well as the life histories of our nonhuman primate relatives. Each subdiscipline of anthropology is broken down further into smaller, more specialized subfields or applied areas of study that focus on specific aspects of what it means to be human. Figure 1.1 illustrates several common subfields of archaeology, cultural anthropology, linguistic anthropology, and physical/biological anthropology.

Forensic anthropology is an applied subdiscipline of physical/biological anthropology. Forensic anthropologists use their knowledge of modern human skeletal variation to help law enforcement identify unknown decedents and, if possible, provide information about the circumstances surrounding a death. The American Board of Forensic Anthropology defines forensic anthropology as "the application of the science of physical or biological anthropology to the legal process," adding that "[p]hysical or biological anthropologists who specialize in forensics primarily focus their studies on the human skeleton" (www.theabfa.org).

Forensic anthropologists employ the principles of skeletal growth, development, degeneration, and variation to ascertain biological information about an individual, such as age, sex, ancestry, and stature. These four components are collectively referred to as the **biological profile**. If the remains are human, modern, and of forensic significance, a forensic anthropologist constructs a biological profile to assist law enforcement in identifying the unknown decedent. Forensic anthropologists may also use their understanding of bone biomechanics (i.e., the way in which bone behaves under certain loads or forces) and/or bone healing to evaluate skeletal trauma. (The interpretation of skeletal trauma is discussed in detail in Chapter 13.) Furthermore, forensic anthropologists apply the principles of forensic taphonomy and bone weathering to determine what happened to the remains in a given depositional environment. Forensic taphonomy encompasses animal activity and bone weathering due to environmental factors such as sun, soil, plants, and humidity and is discussed further in Chapter 15.

Nationally, anthropology is recognized as one of the forensic sciences by the **American Academy of Forensic Sciences** (AAFS). The AAFS has 11 sections, each representing a different subdiscipline of forensic science. The AAFS has specific requirements for membership, as do each of the sections within the academy. Requirements have been developed for various levels of membership, from student and trainee affiliate members to associate and full members and fellows. Promotion from one level of membership to the next is contingent on completing the necessary requirements

Figure 1.1 Subfields within the four major subdisciplines of anthropology.

for promotion, which vary by section. Figure 1.2 presents the membership of each AAFS section as a percentage of the total AAFS membership. Figure 1.3 imparts the notion that, although anthropology is not the largest section, it is the section with the highest percentage of student or trainee affiliates. This may represent a significant trend for the future membership of the Anthropology Section of the AAFS.

Of the AAFS-recognized forensic science disciplines, anthropologists work most closely with forensic pathologists and forensic odontologists. Forensic pathologists are medical doctors with specialized training in pathology. Pathologists conduct forensic autopsies and determine cause of death. Forensic pathologists consult forensic anthropologists to examine skeletal, badly decomposed, severely burned, fragmentary, or commingled remains and submit a case report. Forensic odontologists are also referred to as forensic dentists. Forensic anthropologists rely on forensic odontologists to certify a positive identification of human remains by using the dentition. In these instances, the odontologist compares antemortem records (typically radiographs) with postmortem radiographs to make the identification.

Most forensic anthropologists are affiliated with the AAFS, as well as with the **International Association of Forensic Sciences (IAFS)**. Forensic anthropologists also disseminate research at the **American Association of Physical Anthropologists (AAPA's)** annual meetings. In addition, several regional forensic anthropology organizations exist

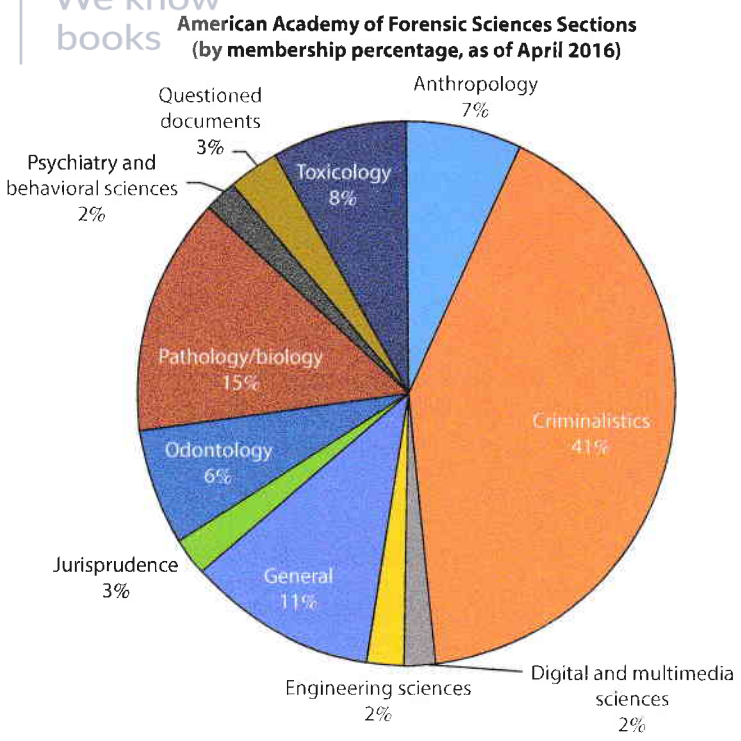

Figure 1.2 Membership in the sections of the American Academy of Forensic Sciences.

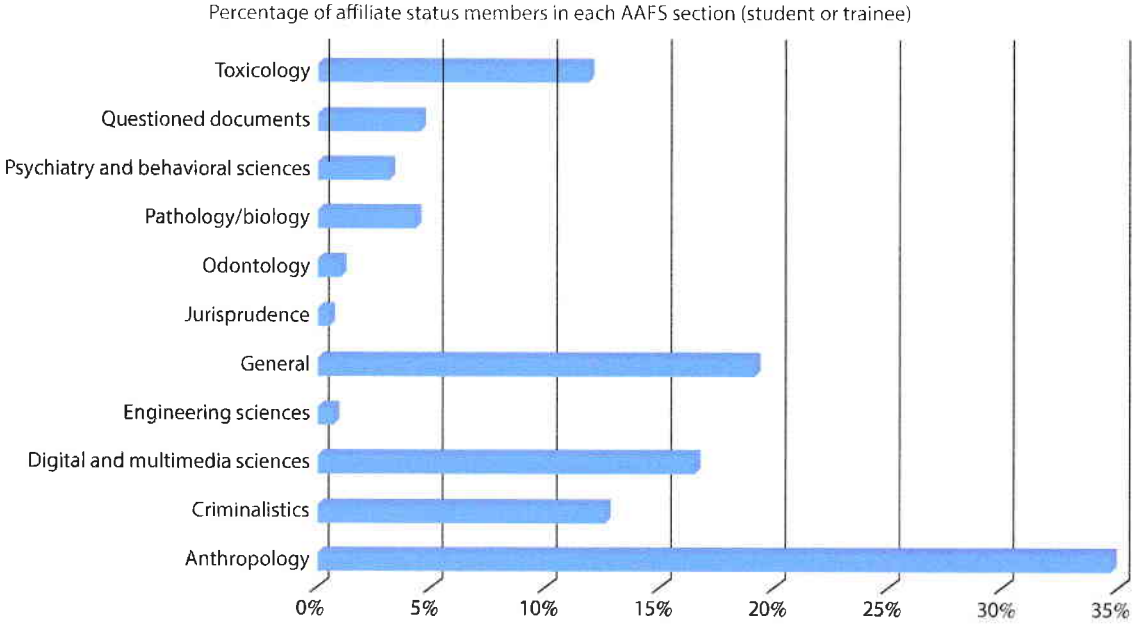

Figure 1.3 Percentage of student and trainee affiliate status members in each of the AAFS sections.

throughout the United States: Mountain, Swamp, and Beach Forensic Anthropologists (MS&B—Southeast United States); Mountain, Desert, and Coastal Forensic Anthropologists (MD&C—Southwest United States); Northeast Forensic Anthropology Association (NEFAA—Northeast United States); and Midwest Bioarchaeology and Forensic Anthropology Association (BARFAA—Midwest United States). The annual meetings of these organizations, though often a slightly less formal affair than the AAFS annual meetings, allow for the presentation of anthropological research and symposium discussions that facilitate the dissemination of research and scholarship in burgeoning areas of physical and forensic anthropology.

FORENSIC ANTHROPOLOGY IN THE PUBLIC EYE

The rising popularity of the forensic sciences as a result of popular crime novels and television (TV) dramas such as *CSI* and *Bones* has led to a misconception about the true nature of forensic anthropology. Forensic cases are not solved in a day, and, unfortunately, many cases go unsolved for years or even decades. Furthermore, although DNA is an excellent way to identify unknown persons, it is expensive and time-consuming, often taking six months or more to get results. Whenever possible, a forensic anthropologist seeks dental records or other radiographs to make a positive identification, because these methods are quick and inexpensive.* This also helps alleviate DNA laboratories of excessive backlogs, so that they can process other pertinent crime scene material. Nonetheless, there are some informative nonfiction texts and TV shows that give an accurate depiction of forensic anthropology. For a list of some of these resources, please see the Additional Information section of this chapter.

WHAT WE ARE "NOT": DEBUNKING HOLLYWOOD MYTHS

Some popular TV dramas give inaccurate depictions of the forensic sciences. In most crime scenes, multidisciplinary collaborations between various branches of the forensic sciences are necessary to solve a crime. For example, criminalists process scene evidence such as fingerprints and blood spatter, toxicologists process evidence from bodily fluids, pathologists conduct a forensic autopsy on the body, and anthropologists assist with skeletal trauma analysis. Each of these tasks is accomplished by trained professionals within each discipline and not by a single person with training in all areas of the forensic sciences. In other words, the forensic sciences are splintered into a number of highly specialized fields. This ensures that all aspects of a crime scene are analyzed by qualified experts and then assembled to give the most complete picture possible. Certainly, fictional TV dramas use their artistic license in order to present a case in a one-hour time slot, using a limited number of actors. Nonetheless, a number of nonfiction programs give more accurate depictions of how forensic scientists work together to solve crimes (e.g., *Forensic Files*, *The New Detectives*, and *FBI Files*).

Another misconception about forensic anthropology involves the educational requirements to practice forensic anthropology. There is no formal degree in "forensic anthropology" in the United States; instead, forensic anthropologists pursue a degree in anthropology, with a concentration in physical or biological anthropology and further specialization in forensic anthropology. Forensic anthropologists are proficient in skeletal biology, anatomy, and modern human variation. In addition, many forensic anthropologists are knowledgeable in bone injury biomechanics, pathology, and taphonomy, as well as statistics and archaeological recovery methods. Anthropologists emphasize a **four-field approach** and receive training in each subfield of anthropology. As a result of this multifaceted educational training, forensic anthropologists bring a unique perspective to understanding human variation in that they consider the biological and sociocultural determinants of human skeletal biology. For example, characteristic skeletal features indicate whether a skeleton is male or female, but other skeletal markers can reveal aspects of an individual's identity, such as socioeconomic status, health history, and occupation. These clues give law enforcement a more complete picture of an unidentified person and assist greatly in the search for identity.

Unfortunately, with the increasing number of TV dramas and movie plots based on the forensic sciences, the line between fiction and reality has become effectively blurred. This has resulted in general public being increasingly

* Methods of positive identification are discussed in Chapter 16.

aware of the forensic sciences but not necessarily well versed on what can actually be achieved through each type of analysis. Consequently, potential jurors and members of the public may have expectations of forensic analyses that are unattainable and unwarranted. Moreover, the fictionalization of forensic practitioners' ability to be able to analyze and report on multiple aspects of a crime (such as the fingerprint analysis, ballistics, and autopsy report) can cause confusion when the data are presented to families or in the courtroom. In sum, while these shows are intended to intrigue the audience and present a plausible (however unlikely) crime scene, it would behoove the curious viewer to perform a critical analysis of what is fact, what is fiction, and what is a stretch with regard to the forensic sciences, or for that matter, any discipline that is represented in a TV drama or movie.

EDUCATIONAL AND EMPLOYMENT OPPORTUNITIES

In order to practice forensic anthropology, a master's or doctorate in physical or biological anthropology with additional training and experience in forensic anthropology methods is recommended. Students interested in this career path should consult the website of **American Board of Forensic Anthropology** (http://www.theabfa.org/) for additional information. The website of **Scientific Working Group for Forensic Anthropology** also offers a list of journal articles and publications concerning forensic anthropology practice and theory that was created by the Society of Forensic Anthropologists (SOFA); this resource can be found at http://www.swganth.org/news-resources.html. Although universities do not offer a formal "forensic anthropology" degree, a number of anthropology programs offer a focus in forensic anthropology. In addition to an anthropology curriculum, students may benefit from coursework in genetics and biomechanics. According to a 2009 survey of the AAFS's Anthropology* section members, nearly half of practicing forensic anthropologists (44.5%) are employed at an academic institution and do forensic casework on a consulting basis (Agostini and Gomez 2009). Within academia, forensic anthropologists are typically employed as physical anthropologists, anatomists, osteologists, and/or skeletal biologists. Other common employment agencies are medical examiner and coroner's offices (19.1%), federal agencies (12.7%), private consulting firms (i.e., self-employed consultants) (5.5%), museums (2.7%), and nonprofit organizations (2.7%). The remaining 12.7% of the members surveyed were retired or students. The survey by (Agostini and Gomez 2009) also revealed that the majority of forensic anthropologists report an annual income of $50,000–$100,000.

It is highly recommended that students interested in pursuing a career in forensic anthropology or any of the forensic sciences, whether applied or research-oriented, read the recent National Academy of Sciences (NAS) report entitled "Strengthening Forensic Science in the United States: A Path Forward" (2009), as this report will likely affect training, policy, and practice in the forensic sciences for years to come (see section on the NAS report later in this chapter).

BRIEF HISTORY OF FORENSIC ANTHROPOLOGY

Forensic anthropology is a relatively young subfield within biological anthropology. The development of forensic anthropology is divided into three periods that are divided by events that arguably changed the path of the field: the formative period (early 1800s–1938), the consolidation period (1939–1971), and the modern period (1972–present).

FORMATIVE PERIOD (EARLY 1800s–1938)

The origin of forensic anthropology is said to lie within the twisted tale of the Parkman murder in 1849. Dr. George Parkman was a physician who donated the land to Harvard, on which the medical school was built. Dr. Parkman was murdered by Harvard's Chemistry Professor John Webster in the medical building. Dr. Webster had purportedly borrowed money from Parkman and killed him to avoid paying back the debt. The local newspapers reported the salacious details of the case, suggesting that Webster mutilated Dr. Parkman's body, put parts of it in the anatomy laboratory and in a septic tank, and burned the head in the furnace. Harvard's anatomy professors Oliver Wendell Holmes and Jeffries Wyman were asked to aid in the investigation of Dr. Parkman's death. Wyman and Holmes were able to put the pieces back together and to suggest that the skeleton belonged to a person whose description was consistent with George Parkman. Webster was eventually convicted of the murder when dentures found in the furnace were shown to match a mold of Parkman's teeth that his dentist had used to make the dentures.

* When the study was published, the Anthropology Section of the AAFS was known as the Physical Anthropology section.

The first avid practitioner of the applied study of forensic anthropology was Thomas Dwight (1843–1911). Dwight was considered the father of forensic anthropology in the United States (Stewart 1979), because he was one of the first Americans to discuss how to identify remains using information obtained from the human skeleton. In 1878, Dwight submitted an essay to the Massachusetts Medical Society entitled, "The Identification of the Human Skeleton. A Medico-Legal Study" (Dwight 1878). Dwight succeeded Oliver Wendell Holmes in the Parkman Professorship of Anatomy position at Harvard. As a trained anatomist, Dwight recognized the need for research on methods to determine age, sex, and stature from the skeleton.

George Dorsey (1839–1931) learned from Dwight's research at Harvard. Dorsey received his doctorate from Harvard in anthropology in 1894 and became curator of the Field Museum of Natural History in Chicago. It was at this museum that Dorsey tested his theory that the articular surfaces of long bones could be used as an indicator of sex; he concluded that humeral head diameter was a better diagnostic tool for sex estimation than the femoral head diameter, a point later confirmed by (Dwight 1905). Dorsey was asked to consult on the case of the Leutgert murder, in which the Chicago sausage maker Adolph Leutgert was accused of killing his wife by placing her in a vat of potash, which effectively dissolved most of the body, except four small pieces of bone and the ring that she normally wore. Dorsey was able to say that the fragments came from a human rib, hand, and foot. Leutgert was later convicted, but Dorsey faced harsh criticism from other anatomists of the time for his testimony and conclusions in this case. This criticism is said to have caused Dorsey to abandon further pursuit of forensics, although (Stewart 1979) believes that Dorsey's assertions about the skeletal remains were correct. At the beginning of World War I, Dorsey removed himself from academe and joined the U.S. Navy.

Harris H. Wilder (1864–1928) was a contemporary of George Dorsey, whose most notable contribution to forensic anthropology dealt with personal identification. Wilder was a European-trained zoologist, who became interested in physical anthropology while teaching at Smith College late in his career. Wilder's physical anthropological focus was on dermatoglyphics (fingerprint analysis) and facial reconstruction by using skulls. Wilder and Bert Wentworth published a book in 1918 entitled *Personal Identification: Methods for the Identification of Individuals, Living or Dead* (Wilder and Wentworth 1918). However, (Stewart 1979) points out that this text has no mention of Dwight's previous research on identification, suggesting that at that point, Dwight's research may not have found its way to other scholars within and outside of the field.

Another American anatomist whose work had implications for forensic anthropology was Paul Stevenson (1890–1971). Stevenson spent a good deal of his career studying in China. He contributed two important publications dealing with age determination based on epiphyseal union (Stevenson 1924) and stature estimation by using long bones in a Chinese population (Stevenson 1929). However, it is unclear if Stevenson was aware of the impact of these contributions on forensic anthropology.

According to (W.M. Krogman 1976), Aleš Hrdlička (1869–1943) was the "founding father of American Physical Anthropology." Hrdlička was born in Bohemia in 1869 and came to New York in 1882, at the age of 13 years, where he worked as a cigar maker and went to school at night. After a bout with typhoid at the age of 19 years, Hrdlička began to study medicine at the Eclectic Medical College of New York City, where he graduated in 1892. He went on to study at the New York Homeopathic College for two years, and he took an internship at the New York Homeopathic Hospital for the Insane, where he published on the somatometry of adult patients with various types of insanity. In 1896, Hrdlička received his training in physical anthropology in Paris under Manouvrier, where he learned how to measure the skeleton quantitatively. In 1897, Hrdlička began to study human skeletons at the College of Physicians and Surgeons in New York City. In 1899, Hrdlička embarked on a series of trips to study the American Indians of the southwestern United States and northern Mexico for the American Museum of Natural History. In 1903, he became a part of the Division of Physical Anthropology at the U.S. National Museum in Washington, DC (now known as the Smithsonian), and became curator in 1910. Hrdlička was a giant in the field of physical anthropology. He founded the *American Journal of Physical Anthropology* (AJPA) in 1918 and the American Association of Physical Anthropologists (AAPA) in 1928, two contributions for which he is often remembered most. Hrdlička was the editor of AJPA from 1918 until 1942.

Another physical anthropologist whose work on human variation shaped the theoretical foundations of biological and forensic anthropology was Earnest A. Hooton (1887–1954). Hooton received his doctorate in liberal arts at the University of Wisconsin in 1911. In 1912, he received his diploma in anthropology from Oxford University, and the following year, he joined the anthropology department at Harvard. Hooton's research focused on human variation

with respect to human origins and adaptation. Under his direction, Harvard became an important center for training physical anthropologists, and his students became prominent practitioners in the field.

T. Wingate Todd (1885–1938) was also a prolific researcher in anatomy and physical anthropology during the latter part of the formative period. Todd's work influences forensic anthropology even today. Todd was interested in skeletal aging methods and growth and development. He was trained in England as an anatomist and moved to the United States in 1912 to take Dr. Carl Hamann's vacated teaching position at Western Reserve University (Dr. Hamann had become Dean of the medical school). A recent change in Ohio state law permitted professors to retain cadavers that the medical students dissected, and Drs. Todd and Hamann had the foresight to begin an anatomical collection that would soon surpass any other in existence in terms of number of specimens and level of documentation (i.e., age, sex, ancestry, stature, weight, cause of death, and case history). In addition, Todd took anthropometric measurements and photographs of most of the cadavers. By the time of his death in 1938, Todd had managed to build a skeletal research collection containing over 3000 documented individuals. He used the specimens in the collection for numerous anatomical and anthropological studies, and the Hamann–Todd Collection continues to be an important resource for skeletal biology research today.

Todd's contributions to anthropology are numerous and include documentation of differences in limb proportions between American Blacks and Whites; establishment of the usefulness of endo- and ectocranial suture closure for age estimation; development of an age estimation method based on the pubic symphysis; establishment of principles of epiphyseal union; and extensive documentation of human postcranial and craniofacial growth, development, and maturation. During his career, Todd authored nearly 200 publications in anatomy and physical anthropology, many of which have significant implications for forensic anthropology. In addition, two of his students, Wilton Krogman and Montague Cobb, went on to make important contributions to physical anthropology. We discuss Krogman in the following sections, but his legacy includes the landmark bulletin *Guide to the Identification of Human Skeletal Material* (Krogman 1939), as well as the close mentoring of William M. Bass. Cobb was the first African-American to earn a Ph.D. in physical anthropology and left behind a legacy reminiscent of his mentor. The W. Montague Cobb Human Skeletal Collection at Howard University contains approximately 700 skeletons and serves many of the same research purposes as the Hamann–Todd Collection in Cleveland.

Robert J. Terry (1871–1966) was also an anatomist who had the foresight to curate a research collection of skeletal remains. Dr. Terry was an anatomy professor and department head at Washington University Medical School in St. Louis, Missouri. In the same manner as Todd, Terry began collecting skeletal remains from medical school cadavers during the 1920s. Terry Collection cadavers have associated morgue records with the individual's name, sex, age, ancestry, date, and cause of death. Terry also took photographs and anthropometric measurements of most of the cadavers, as well as skin and hair samples; however, only the hair samples remain today. In addition, plaster death masks were made of 836 of the cadavers. Terry retired in 1941, and Dr. Mildred Trotter (1899–1991) assumed his anatomy teaching position and continued to build the collection, until she retired 26 years later. Today, the nearly 2000 skeletons of the Terry Anatomical Collection are housed in the Smithsonian Institution in Washington, DC.

CONSOLIDATION PERIOD (1939–1971)

It has long been posited that the end of the initial period of forensic anthropology (here termed the formative period) and the beginning of the consolidation period were marked by the publishing of Wilton Marion Krogman's *Guide to the Identification of Human Skeletal Material* in the Federal Bureau of Investigation's (FBI's) Law Enforcement Bulletin in 1939. This publication summarized all that had been discovered about the identification of skeletal remains until that time. The significance of this publication is that, for the first time, an article pertaining to forensic identification had been written by an anthropologist and was included in a journal focused on forensics, as opposed to anatomy or the broader discipline of physical anthropology.

Wilton Marion Krogman's prestigious career began in the spring of 1925, where he first lectured in physical anthropology at the University of Chicago. Krogman insisted that it was this experience, coupled with a term paper assignment on the anthropology of teeth given by his professor Dr. Fay-Cooper Cole, that focused his entire professional career:

> That did it! Teeth lead to jaws, jaws to face, face to head, head to body: in other words a coordinated whole. But more than that, it led from statics to the dynamics of age progress. Thus launched my life-work in growth and development, comparative and human anatomy (Krogman 1976).

The term paper introduced Krogman to paleontology, orthodontia, and the work of T. Wingate Todd. Krogman submitted a reworked version of this term paper to the First District Dental Society of New York City's Morris L. Chaim Prize, where T. Wingate Todd was one of the judges. Krogman won the prize, and Todd saw promise in the paper and in Krogman. On a stopover in Chicago, Todd sought out Krogman, who indicated that he would like to do graduate work with Todd. In 1928, Krogman was awarded the Cleveland Foundation Fellowship in anatomy, thanks to Todd's arrangements. Krogman wrote his dissertation under Todd's direction. In 1929, Krogman instructed at the University of Chicago, and in 1930, he took a fellowship at the Hunterian Museum at the Royal College of Surgeons in London. In 1931, Krogman became an associate professor of anatomy and physical anthropology at Western Reserve University. Krogman's appointment at his mentor's department put him in contact with the foremost physical anthropologists of the time. As Krogman (1976) explained, "Todd's department was a magnet for the physical anthropologists of the 1930s."

Krogman expanded upon his article in the FBI bulletin and produced the first textbook in Forensic Anthropology, entitled *The Human Skeleton in Forensic Medicine* (Krogman 1962). The textbook focused on the practical application of human osteology to forensics. Krogman's text became the primary reference for physical anthropologists practicing forensic anthropology, much like his 1939 article had been at the time of its publication. The theme of the book was human variation. Krogman emphasized that the methods identified within the text did not present hard and fast rules; instead, they were meant to be guidelines for assessing remains, with the understanding that humans represented a wide range of morphological variability. Krogman's dedication to research helped push forensic anthropology forward. He imparted a great deal of his wisdom on his graduate students. One of these students, William M. Bass, undoubtedly had the greatest impact on the modern era of forensic anthropology. We discuss the influence and legacy of Bass in greater detail in the following sections.

MODERN PERIOD (1972–PRESENT)

The founding of the Physical Anthropology Section of the American Academy of Forensic Sciences (AAFS) in 1972 is often referred to as the beginning of the modern period in forensic anthropology. At this time, the term "forensic anthropologist" began to be used on a regular basis to refer to practitioners in the field. The section founding was thanks in a large part to Ellis R. Kerley (1924–1998). Kerley had joined AAFS in 1968 as part of the pathology/biology section. Through his encouragement, other physical anthropologists also joined the AAFS. By 1972, with 14 anthropologists as members of the academy, Kerley and colleagues had exceeded the minimum number of members required to establish a new section. Thus, the Physical Anthropology Section of AAFS was born, and this formal organization of the field provided an appropriate stage for the presentation of new ideas. In addition, the academy's flagship journal, *Journal of Forensic Sciences*, was well suited for research concerning new methods in the identification of skeletal remains.

Ellis Kerley was also instrumental in establishing the American Board of Forensic Anthropologists (ABFA) in 1977. This board certifies forensic anthropologists in a similar manner to the certification of physicians by their various boards, using a rigorous application and examination process to ensure that each diplomate of the board is qualified and competent to undertake forensic anthropology casework. In 1987, Kerley became the forensic anthropology consultant and scientific director of the United States Army Central Identification Laboratory in Hawaii, where he oversaw the identification of repatriated war remains. He also served as president of the AAFS from 1990 to 1991. In 2000, the Ellis R. Kerley Forensic Sciences Foundation was established in his memory. The foundation is dedicated to furthering the development of forensic anthropology by assisting students in the field of anthropology and continuing the research in forensic identification of the skeleton (http://www.kerleyfoundation.org/). Each year, the foundation issues at least one scholarship to a graduate student who is enrolled in a physical or forensic anthropology program and who is involved with the AAFS or the ABFA. In addition, the foundation hosts a reception at the AAFS annual meetings, where it presents an award to recognize innovative efforts to continue research in human identification.

As mentioned earlier, William M. Bass was Kerley's student who went on to have the most significant impact on forensic anthropology. In the 1960s, Bass established a graduate program in physical anthropology at the University of Kansas and recruited Ellis Kerley and Thomas McKern to be a part of the department. This graduate program produced some of the foremost physical/forensic anthropologists, including Douglas Ubelaker, Walter Birkby, Judy Suchey, Linda Klepinger, and Richard Jantz.

In 1971, Dr. Bass moved from Kansas to Tennessee, and in doing so, he began an anthropology program in the eastern United States that has produced more forensic anthropologists than any other program to date. By the time Dr. Bass retired in 1994, he had trained over 20 practitioners, including Bill Rodriguez, Anthony Falsetti, Hugh Berryman, Steve Symes, Murray Marks, Doug Owsley, Stephen Ousley, Emily Craig, and Walter Birkby (Rhine 1998). In fact, nearly 40% of practicing forensic anthropologists can trace some element of their academic lineage through Bass (Marks 1995). Many of this new generation of graduates went on to change the face of forensic anthropology by taking it from a strictly academic discipline, in which practitioners acted as consultants, to an applied field that became incorporated into the medical examiner setting. Hugh Berryman was the first forensic anthropologist to be employed full-time outside of academia. In 1980, he was hired as morgue director of the Shelby County Medical Examiner and University of Tennessee Hospital Morgue in Memphis. Over three decades, that single position grew to over 20 full-time positions nationwide and continues to grow today (Berryman 2009) (Figure 1.4). While the majority of these positions are filled by PhDs, a little more than one-third of these employees have master's degrees only. Several factors that contributed to the increase in full-time medical examiner/coroner positions over the last 30 years include a favorable economy, the realization that forensic anthropologists' skills include more than just skeletal analysis, and a number of mass disasters that required anthropological expertise (i.e., the Oklahoma City bombing, the 9/11 attacks on the Pentagon and World Trade Center, and the Tri-State Crematorium situation in Noble, Georgia) (Berryman 2009).

Although a number of forensic anthropologists attained full-time positions in coroner's and medical examiner's offices, many maintained academic appointments and continued to train new practitioners. For example, one of Bass' students, Richard Jantz, has mentored a number of forensic anthropologists, including Stephen Ousley, with whom he created the Fordisc program. Fordisc stands for "forensic discrimination" and is currently in its third version. The Fordisc program has made it possible for forensic anthropologists to determine the sex, ancestry, and stature of unknown remains from cranial and/or postcranial measurements with the click of a button. We discuss this program in detail in Chapter 14.

ANTHROPOLOGY RESEARCH FACILITIES

Perhaps, Bass' most notorious accomplishment is the establishment of the first outdoor research facility devoted to the study of human decomposition. The Anthropology Research Facility (ARF) was founded in 1980 in response to Dr. Bass' realization that the forensic community needed information about the postmortem interval that was based on controlled scientific research on human cadavers. The need for this type of research became evident to Dr. Bass in 1977, when he was asked to inspect decomposing remains that were discovered in a disturbed burial (Bass 1984; Bass and Jefferson 2003). Based on his field observations of the state of decomposition, Dr. Bass estimated that the remains had been in the grave for approximately 1 year. However, after exhuming the remains and bringing them back to his laboratory for closer inspection, he noticed aspects of the clothing that indicated that they belonged to a Civil War colonel. To his dismay, Bass had underestimated the time since death (TSD) by 113 years! To Bass' credit, Colonel Shy's remains had been uncharacteristically well preserved for that era owing to embalming and a high-quality iron casket. Nonetheless, a survey of the literature exposed a dearth of research on decomposition changes, so Dr. Bass resolved to remedy the situation. Fortunately, he had the full support of an open-minded UT administration and an available plot of land on which to establish the unconventional research facility.

The first ARF consisted of a 16-square-foot concrete slab enclosed on all sides and above by a chain-link fence. The first donation arrived in 1981, and three more followed that year. Many of the early donations were unclaimed bodies from the State of Tennessee Medical Examiner, but as the donation program grew in popularity with increasing publicity, the donor population also grew in diversity. In 2009, the ARF received its 1000th donation and has received nearly 1800 donations since inception. Over 3500 individuals have filed paperwork to donate their bodies to the ARF for scientific research. The pre-registered donor paperwork requests information about donors, such as birth date, sex, ancestry, height, weight, number of children, medical and dental history, occupation, habitual activities, handedness, shoe size, education level, childhood socioeconomic status, and photographs. In addition, hair and blood samples are taken as donations arrive, and fingerprints and laser scans are soon to be added to that protocol. As a result of the increase in body donations, the ARF has expanded its initial 16-foot plot to a 1.3-acre tract of land. Today, the ARF is part of a larger establishment within the UT Anthropology Department—the Forensic Anthropology Center (FAC). The FAC oversees all activities at the ARF, including donor relations, law

1980s

• 1980	Hugh Berryman, PhD, D-ABFA	Shelby County ME & UT Chattanooga, Morgue Director
• 1981	Donna Fontana, MS	New Jersey State Police, Forensic Anthropologist
• 1982	David Wolf, PhD	Kentucky ME (first State Forensic Anthropologist)
• 1983	Craig Lahren, MA	Shelby County ME, Assistant Morgue Director
• 1984	William Rodriguez, PhD, D-ABFA	Caddo & Bossier Parish, LA, Deputy Chief Coroner
• 1986	William Rodriguez, PhD, D-ABFA	Onondaga, NY ME , Forensic Anthropologist & Chief of Operations
• 1986	Craig Lahren, MA	Hamilton County, TN ME, Coordinator of Forensic Services
• 1986	Robert Mann, PhD, D-AFBA	Shelby County ME, Assistant Morgue Director
• 1987	Steve Symes, PhD, D-AFBA	Shelby County ME, Assistant Morgue Director
• 1988	William Haglund, PhD	King County, WA ME , Chief Medical Investigator
• 1989	William Rodriguez, PhD, D-ABFA	Office of the Armed Forces Medical Examiner, Chief Forensic Anthropologist and Deputy Chief ME

1990s

• 1994	Emily Craig, PhD, D-AFBA	Kentucky State Forensic Anthropologist
• 1994	Gwen Haugen, MA	St. Louis County MEO, Forensic Investigator/Forensic Anthropologist (1994-97; 2007-present)
• 1990s	Deborah Gray	Riverside County, CA Sheriff's Department, Forensic Anthropologist/Archaeologist/CoronerSergeant
• 1995	Charles Cecil, PhD	San Francisco OCME, Medical Investigator II/Forensic Anthropologist
• 1995	Nici Vance, PhD	Oregon State Police Forensic Laboratory, Forensic Anthropologist; OSME, State Forensic Anthropologist (since 2006)
• 1996	Dana Austin, PhD, D-AFBA	Tarrant County, TX ME, Forensic Anthropologist
• 1996	Ann Marie Mires , PhD	Massachusetts State OCME, Forensic Anthropologist
• 1997	Craig Lahren, MA	North Dakota State Forensic Examiner's Office, Administrator and Forensic Anthropologist
• 1997	Tom Bodkin, MA	Hamilton County, TN ME, Coordinator of Forensic Services
• 1997	Laura Fulginiti, PhD, D-ABFA	Maricopa County, AZ ME, Forensic Anthropologist
• 1997	Fran Wheatley, MA	Metropolitan Nashville/Davidson County ME, Death Investigator/Forensic Anthropologist
• 1998	Clyde Gibbs, BS, AS	North Carolina OCME, Chapel Hill, Medical Examiner Specialist
• 1999	Amy Mundorff, PhD	New York City OCME, Forensic Anthropologist

2000-2010

• 2001	Jennifer Love, PhD, D-ABFA	Regional Forensic Center, Memphis
• 2001	Alexis Gray, PhD	San Bernadino County Sheriff's Department, Coroner's Division, Forensic Anthropologist
• 2002	Robert Karinen, MA	Ada County Coroner's Office, Boise, ID, Forensic Supervisor
• 2002	Rick Snow, PhD	Georgia Bureau of Investigation, Forensic Anthropologist
• 2002	Gina Hart, MA	Newark Regional ME, Forensic Anthropologist/Death Investigator
• 2002	Brian Spatola, MA	Washington D.C. OCME, Mortuary Supervisor and Anthropologist
• 2004	Katherine Taylor , PhD	King County, WA ME, Forensic Anthropologist
• 2004	Brad Adams, PhD, D-ABFA	New York City OCME, Director of Forensic Anthropology
• 2005	Jeanette Fridie, MA	New York City OCME, Forensic Anthropologist
• 2005	Pamela Steger, MS	Travis County Medical Examiner's Office, Medicolegal Death Investigator
• 2005	Daniel Jackson, MA	Travis County Medical Examiner's Office, Forensic Anthropologist/Death Investigator
• 2006	Christian Crowder, PhD, D-ABFA	New York City OCME, Deputy Director of Forensic Anthropology
• 2006	Benjamin Figura, MA	New York City OCME, Forensic Anthropologist/Director of Identification
• 2006	Fran Wheatley, MA	Shelby County ME, Administrator and Anthropologist
• 2006	Brian Spatola, MA	Central Virginia OCME, Morgue Supervisor and Anthropologist
• 2006	Sharon Derrick, PhD, D-ABFA	Harris County, TX ME, Agency Coordinator and Anthropologist
• 2006	Jennifer Love, PhD, D-ABFA	Harris County, TX ME, Forensic Anthropology Director
• 2006	Jason Wiersema, PhD, D-ABFA	Harris County, TX ME, Mass Disaster Coordinator
• 2006	Bruce Anderson, PhD, D-ABFA	Tuscon, AZ Forensic Science Center, Forensic Anthropologist
• 2006	Laura Regan, PhD, Lt. Col.	Armed Forces Medical Examiner System, Director of Operations and Deputy Chief Forensic Anthropologist
• 2006	Lisa Leone, MA	Greenville North Carolina Regional ME, Pathologist Assistant/Forensic Anthropologist/Death Investigator
• 2007	Chris Rainwater, MS	New York City OCME, Forensic Anthropologist/Director of Photography
• 2007	Kristen Hartnett, PhD	New York City OCME, Forensic Anthropologist/Assistant Director of Forensic Anthropology
• 2007	Dominique Semeraro, MS	Rhode Island OSME, Senior Medical Examiner Agent, RI State Forensic Anthropologist
• 2008	Murray Marks, PhD, D-ABFA	UT Regional Forensic Center, Forensic Anthropologist
• 2008	Lauren Zephro, PhD	Santa Cruz County Sheriff's Department, Latent Print Examiner, Forensic Anthropologist
• 2008	Hilary Sheaves, MA	North Carolina OCME, Chapel Hill, Autopsy Technician
• 2008	Olivia Alley, MA	Travis County Medical Examiner's Office, Forensic Anthropologist/Death Investigator
• 2009	Debra Prince Zinni, PhD, D-ABFA	Commonwealth of Massachusetts OCME, State Forensic Anthropologis

Figure 1.4 Forensic anthropologists working in the medical examiner's setting between 1980 and 2010.