

Jennifer Kiely¹, MS*; Kate M. Lesciotto², JD, PhD; Sheree Hughes¹, PhD
¹Department of Forensic Science, Sam Houston State University, Huntsville, TX 77340
²College of Osteopathic Medicine, Sam Houston State University, Conroe, TX 77301

INTRODUCTION

The Southeast Texas Applied Forensic Science (STAFS) facility is a willed body donor program located in Huntsville, TX, under the direction of the Department of Forensic Sciences at Sam Houston State University (SHSU). STAFS aims to advance scientific knowledge and practice by providing cadavers for research and teaching across many disciplines including forensic, anthropological, geological, chemical, and numerous biological sciences (Figure 1). In addition, education and training has also been provided for law enforcement and other agencies (1-4). The facility has received 640 willed body donations since its inception in 2009, with an average of 53 donations per year. STAFS currently operates both outdoor and indoor research facilities. The two-acre outdoor facility provides numerous research opportunities to actively recreate forensically relevant scenarios and perform taphonomic and other forensic analyses of human remains during the decomposition process. The indoor facility includes an intake area, donor storage, necropsy suite and laboratory for autopsy or maceration, temperature controlled skeletal collection room, X-ray equipment, microtome, and a blunt force trauma simulator.

The STAFS facility skeletal collection currently holds 335 skeletons obtained through the donor program with family consent (Table 1). Skeletal elements may be utilized for teaching or research at STAFS or off campus, with appropriate permission. The skeletal collection consists primarily of individuals of European descent (85%), with smaller proportions representing African (3.6%), Hispanic (3%), and Asian, Middle Eastern, or Native American (cumulatively, 8%) ancestries. Additionally, the skeletal collection offers opportunities to study the various skeletal pathologies, anomalies, and traumas (Table 2) represented. The STAFS facility offers broad potential for research and training to advance the application of many forensically relevant disciplines to medicolegal death investigations.

TABLE 1: The STAFS donation demographics. All donations received since 2009 arranged by Age, Sex, and Ancestry and whether an autopsy has been performed (autopsied donations may limit some forms of research, i.e., decomposition). The numbers under each category represent the total number of cadavers (denoted in black, n=640) and currently in the STAFS skeletal collection (denoted in red, n=335).

AGE	SEX		ANCESTRY					AUTOPSIED	
	Female	Male	European	African	Asian	Hispanic	Other	Yes	No
0-25	4 (1)	6 (2)	7 (3)	3				5 (3)	5
26-35	4 (1)	7 (3)	8 (4)		1	2		8 (4)	3
36-45	10 (5)	18 (9)	25 (14)	1	1		1	18 (8)	10 (6)
46-55	34 (23)	76 (45)	86 (57)	9 (2)	2 (1)	6 (3)	7 (5)	51 (36)	59 (32)
56-65	53 (31)	149 (84)	175 (99)	9 (4)	2 (2)	8 (4)	8 (6)	55 (37)	142 (78)
66+	109 (47)	170 (84)	237 (109)	14 (6)		12 (3)	16 (13)	47 (35)	237 (96)

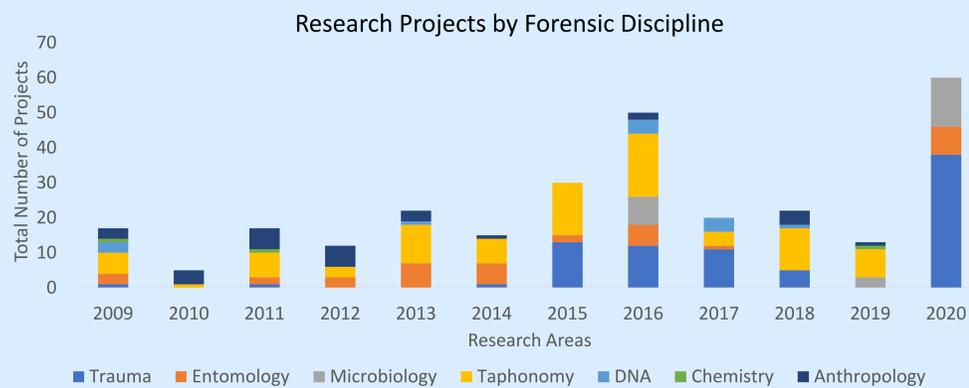


FIGURE 1: All research projects using STAFS donations for each year (2009-2020) based on research areas (does not include research performed in undergraduate or graduate level classes).

REFERENCES

- Alexander MB, Hodges TK, Bytheway J, Aitkenhead-Peterson JA. Application of soil in forensic science: Residual odor and HRD dogs. *Forensic Sci Int.* 2015;249:304-13.
- Bucheli SR, Lynne AM. The microbiome of human decomposition. *Microbe Wash DC.* 2016;11:165-71.
- Holmes AS, Roman MG, Gangitano D, Hughes-Stamm S. In-field collection and direct analysis of swabs from decomposing human remains for DVI. *2018 Forensic Sci Int Genet.* 2018 Sep;36:124-129.
- Lindgren NK, Sisson MS, Archambeault AD, Rahlwes BC, Willett JR, Bucheli SR. Four forensic entomology case studies: records and behavioral observations on seldom reported cadaver fauna with notes on relevant previous occurrences and ecology. *J Med Entomol.* 2015;52(2):143-50.

SURVEY OF SKELETAL TRAUMA

TABLE 2: The blunt force (BFT), sharp force (SFT), and gun shot wound (GSW) trauma represented at STAFS. These traumas occurred during the perimortem period while the bone was still "wet" either prior to being received by the STAFS facility or as part of a controlled research project at STAFS. These data include the total number of bones exhibiting trauma at STAFS (including all cadavers with trauma in the field or being processed) (denoted in black, n=113) as well as what is ONLY represented in the current STAFS skeletal collection (denoted in red, n=88).

TRAUMA TYPE	SKULL	MANDIBLE	OS COXA	SACRUM	FEMUR	TIBIA	FIBULA	RADIUS	ULNA	SCAPULA	CLAVICLE	VERTEBRAE	STERNUM/MANUBRIUM
BFT	15 (10)	8 (6)	9 (8)	2	6 (6)	5 (4)	8 (7)	2 (2)	2 (2)	2 (1)	4 (4)	5 (5)	2 (2)
SFT	1 (1)				1 (1)	3 (3)	1 (1)	2 (2)	2 (2)				
GSW	26 (17)	3 (1)									2 (2)	1	1 (1)

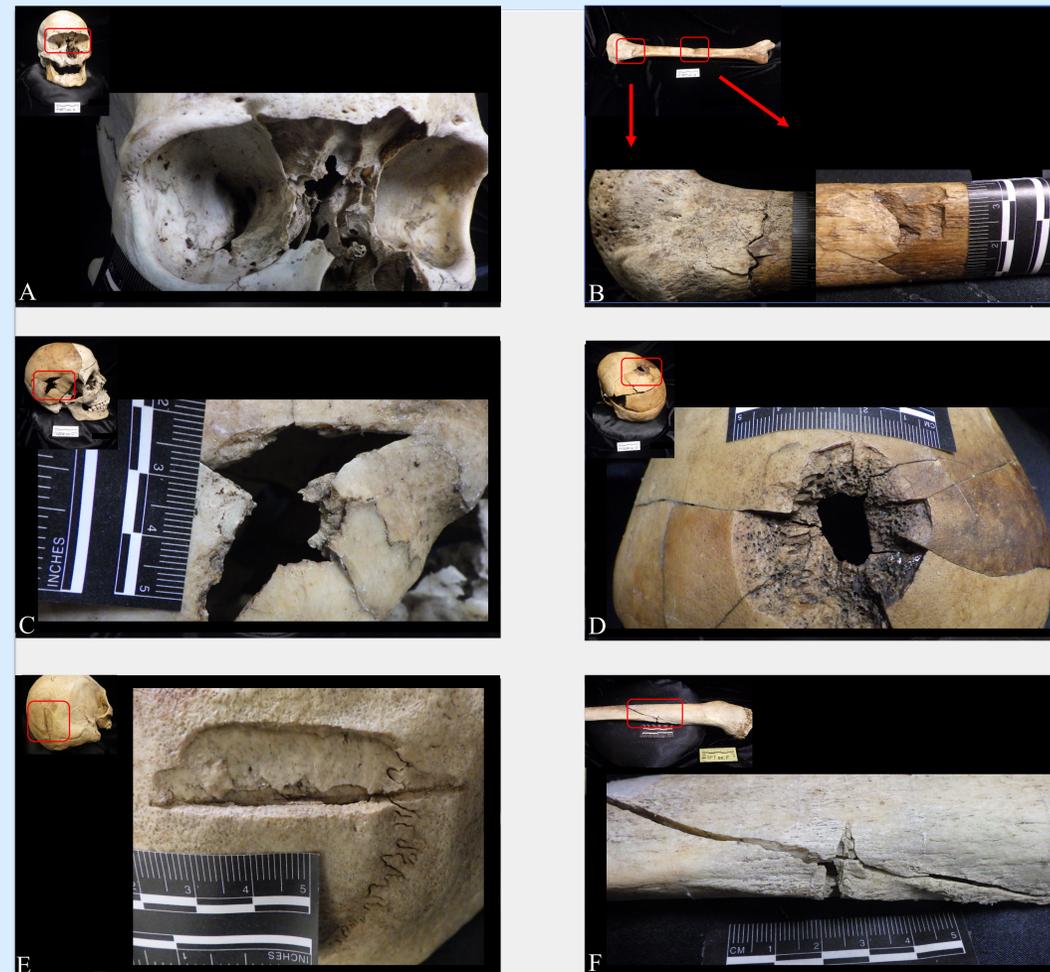
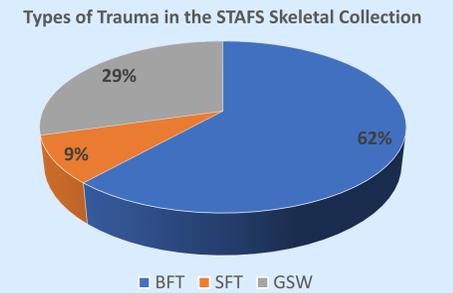


FIGURE 2: Examples of cranial and post-cranial trauma surveyed at the STAFS facility. Blunt force to the cranium (A) inflicted during trauma research and post-cranial trauma to the tibia (B) from an auto-pedestrian accident; Self-inflicted gunshot wounds to the cranium through the temporal bones (C) and intraorally, exiting the right parietal bone (D); Sharp force machete wounds to the cranium (close-up is rotated 90° counterclockwise) (E) and tibia (F) inflicted during trauma research.



DOCUMENTING TRAUMA

Our current project involves surveying the extent of trauma represented in the STAFS collection with the following research question in mind: *Which imaging modalities allow for the most detailed and accurate visualization of various types of skeletal trauma?*

Cranial and postcranial elements were evaluated with particular attention to those areas that are forensically significant (i.e., head, thorax, and long bones) (Figure 2). Each specimen exhibiting perimortem skeletal trauma has been documented, photographed, and categorized (blunt force trauma (n=70), gunshot trauma (n=33), and sharp force trauma (n=10)). Perimortem was defined as occurring when the bone was still fleshed (i.e., "wet") but before any evidence of healing could be seen macroscopically.

A variety of reflective and transmissive imaging modalities including radiography, photogrammetry, surface scanning, and computed tomography will be used to investigate methods for precise imaging, measurement, and documentation of skeletal trauma. The data from this preliminary study will then form the basis for future controlled cadaver trauma studies at the STAFS facility.

ACKNOWLEDGEMENTS

We would like to thank the families that have donated their loved ones to the STAFS facility. Without their valuable donations, this research would not be possible. For any questions regarding this research or any other potential collaborations, please email us at: STAFS@shsu.edu