Analysis and Quantification of Commingled Human Skeletal Remains in Syracuse University's Historic Medical Teaching Collection Using the CoRA Ecosystem

By Madeline Kelly

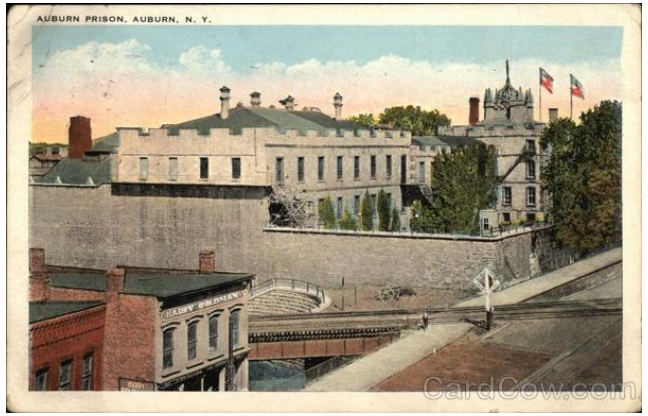
Outline

Background
Project Goals
Methods and the Commingled Remains Analytics (CoRA) ecosystem
Results
Future Directions and additional applications of CoRA
Conclusion

Background

Anatomical Era

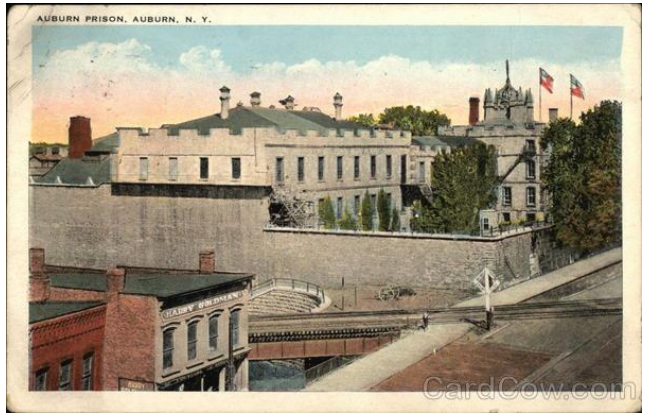
- Beginning in the late 18th and early 19th century[1]
- Textbooks/ lectures → Dissections and anatomical demonstrations[1,2]
- Increase in the need for human cadavers[1,2]
- Disproportionately affected immigrant groups, minorities, and the poor[1]



Prisons

“Body-snatching”

Unclaimed Persons



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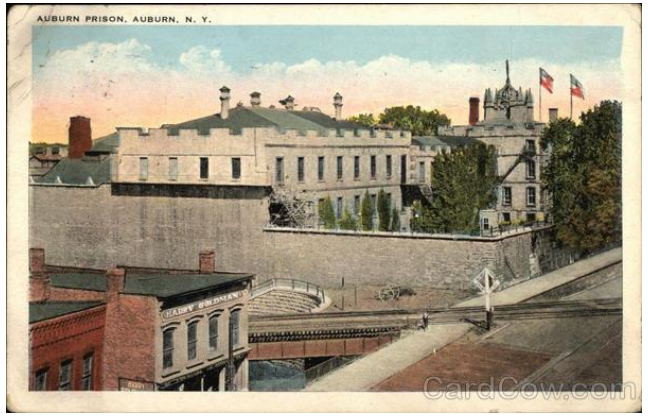
Dissections/ Anatomical Demonstrations



Prisons

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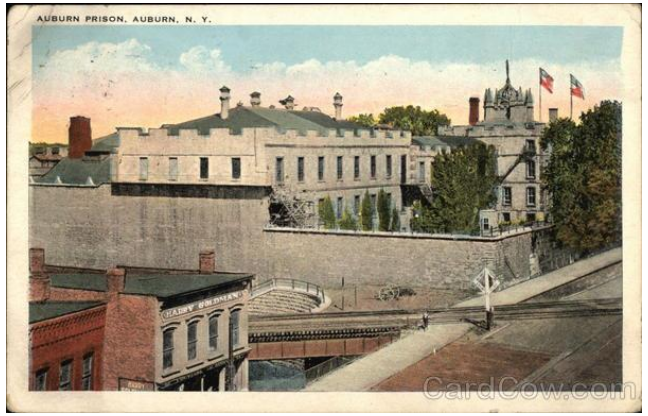
Dissections/ Anatomical Demonstrations

Osteological Collections

Disposal



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Directly to cleaning/processing

Dissections/ Anatomical Demonstrations

Osteological Collections

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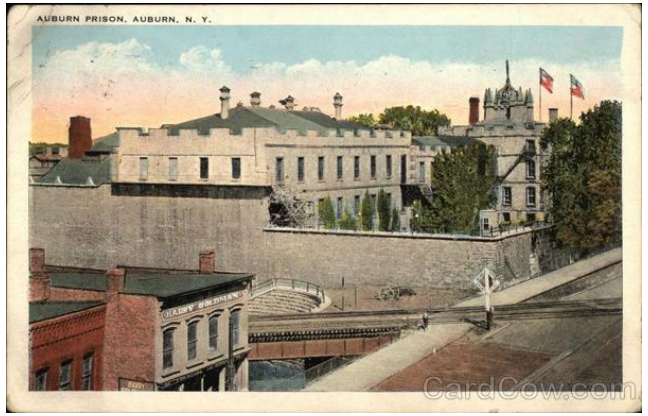

Prisons

“Body-snatching”

Unclaimed Persons

Directly to cleaning/processing

Dissections/ Anatomical Demonstrations

Osteological Collections

Disposal

?

Osteological Collections

Syracuse University's Medical Teaching Collection - History

What we know

> Previous and subsequent schools associated with Syracuse University

> Anatomy courses and dissection opportunities

> Archival material – exhumation, cadaver trade, Auburn prison

What we don't know

> Age of the collection/ length of accumulation

> Method of procurement

> Fate of the Gevena College Anatomical Museum

Syracuse University's Medical Teaching Collection - Contents

What we know

> Mainly adult human skeletal remains with some sub-adult specimens

> Mostly commingled and sorted by element and side

What we don't know

> Number of individuals

> Information associated with biological profiles (age, sex, ancestry, stature)

> Age of remains/ where they were obtained from

> Trauma, pathology, taphonomy, anomalies, etc?

Project goals

Is there evidence to support the theory that these remains were part of a medical/ anatomical teaching collection?

How many individuals are present in this collection?

Can CoRA be used as a valuable database and data analysis tool for documenting and analyzing anatomical and medical teaching collections of skeletal remains?

Materials and Methods

What is CoRA?

Commingled Remains Analytics (CoRA) – web application, database, and Application Programming Interface[3]

Created by **Dr. Sachin Pawaskar**, University of Nebraska Omaha

Developed specifically for inventorying and analyzing assemblages of **commingled human remains**[3]

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DEGLI STUDI
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Why CoRA?

Why CoRA?

Why CoRA?

We need **standardization**, **organization**, and **cooperation**!

Why CoRA?

Old Methods

ID Number 1	ID Number 2	New ID	Element	Side
AC-06-127	HB3		Fem	L
HB2005		AC-06-40	Femur	Left
0-AC-06-128	HB11	Fem01	femur	lft

New Methods

	Key	Bone	Side	External ID
☐	SUTC:::132	Femur	Right	AP-2000-1-84
☐	SUTC:::143	Femur	Right	AP2000-1-379
☐	SUTC:::126	Femur	Right	AP2000-1-54

Why CoRA?

Old Methods

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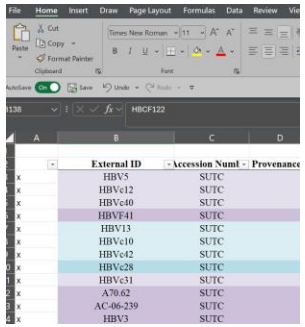

External ID	Accession Numl	Provenance
HBV5	SUTC	
HBVc12	SUTC	
HBVc40	SUTC	
HBVF41	SUTC	
HBV13	SUTC	
HBVc10	SUTC	
HBVc42	SUTC	
HBVc28	SUTC	
HBVc31	SUTC	
A70.62	SUTC	
AC-06-239	SUTC	
HBV3	SUTC	

New Methods

Key	Bone	Side	External ID
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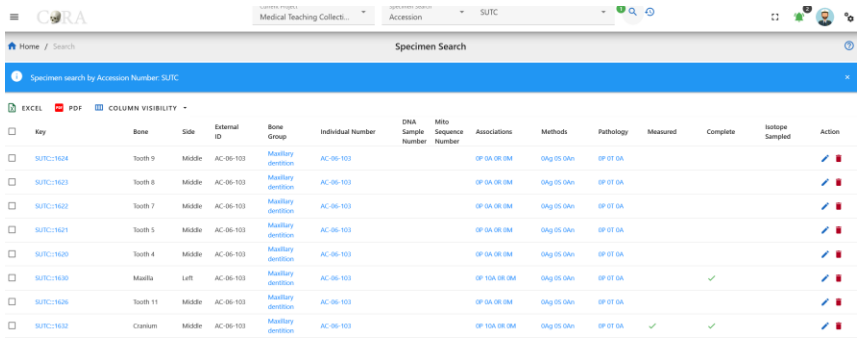
SUTC:::143	Femur	Right	AP2000-1-379
SUTC:::126	Femur	Right	AP2000-1-54



Why CoRA?

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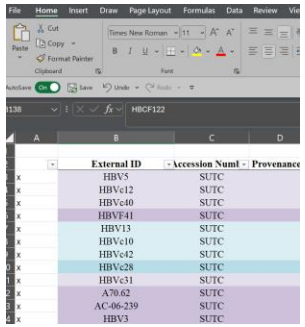

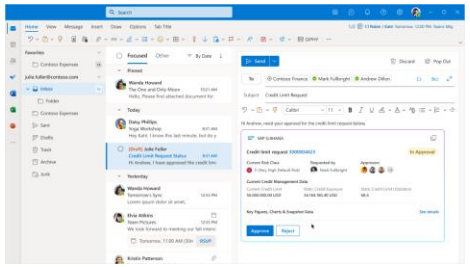

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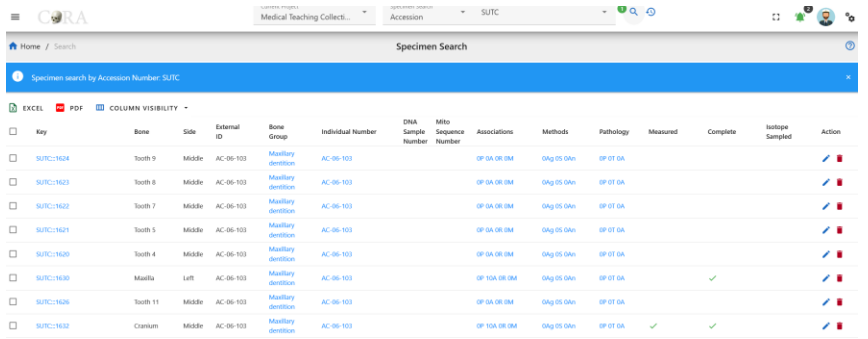

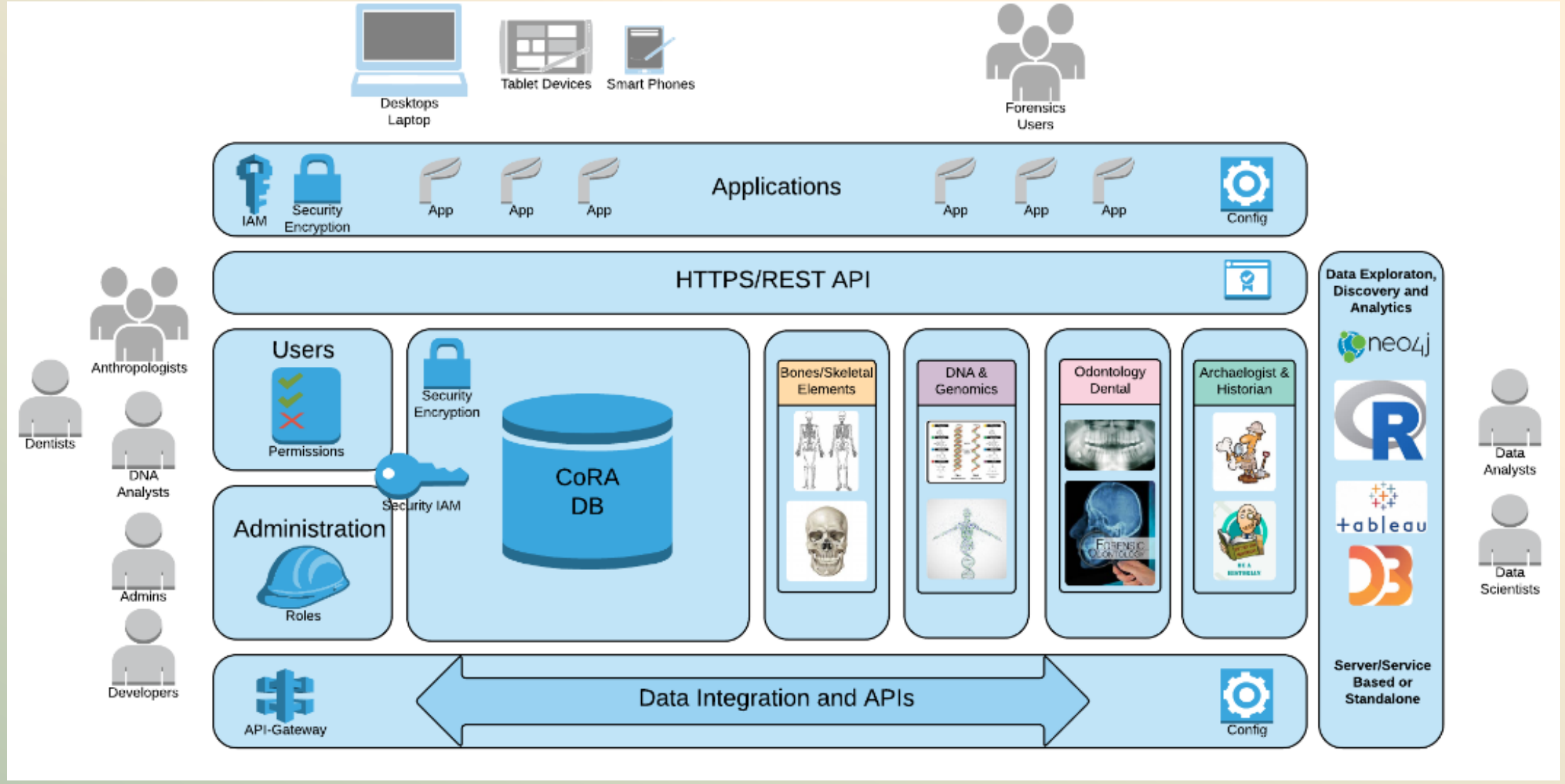
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Laptop
Tablet Devices
Smart Phones
Forensics
Users
IAM
Security
Encryption
App
App
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Applications
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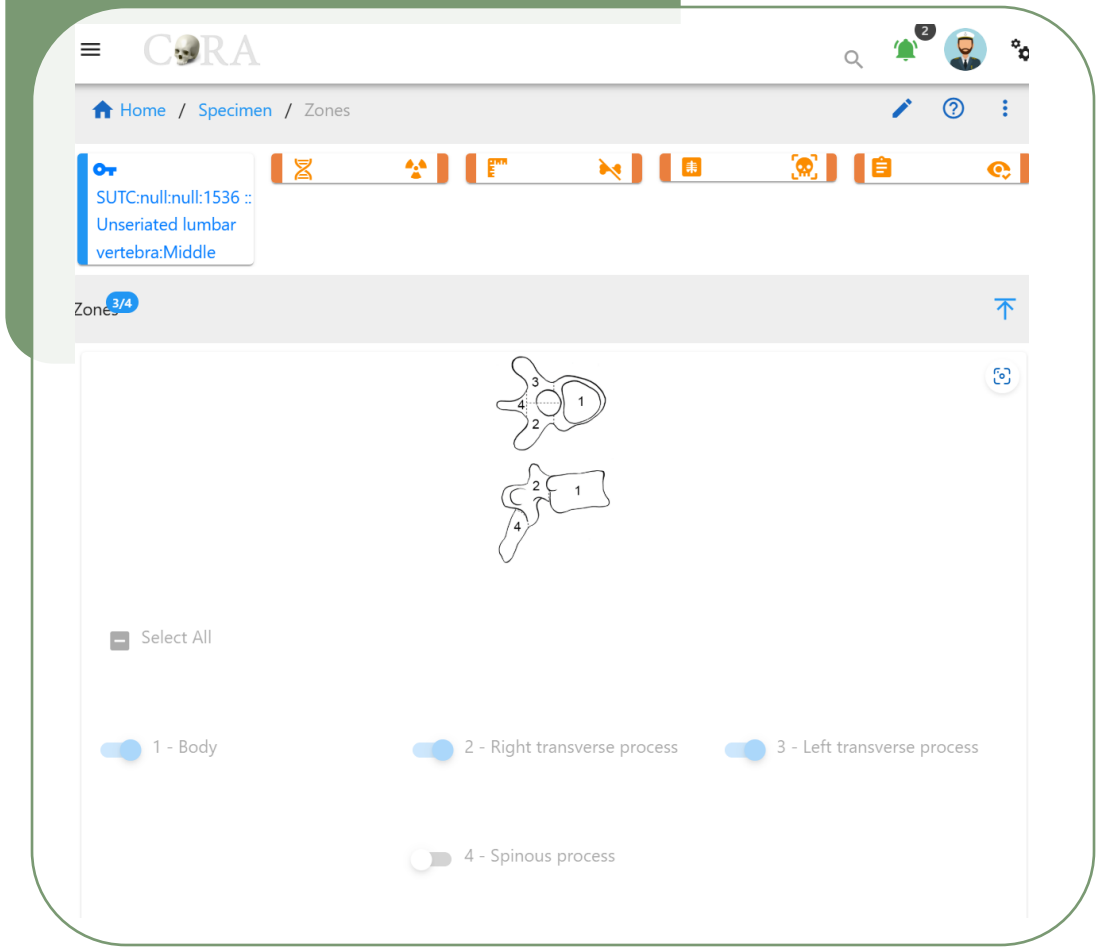
Config
HTTPS/REST API
Anthropologists
Dentists
DNA
Analysts
Admins
Developers
Users
Permissions
Administration
Roles
Security
Encryption
Security IAM
CoRA
DB
Bones/Skeletal
Elements
DNA &
Genomics
Odontology
Dental
Archaelogist &
Historian
Data Exploraton,
Discovery and
Analytics
neo4j
+ableau
Server/Service
Based or
Standalone
Data
Analysts
Data
Scientists
API-Gateway
Data Integration and APIs
Config

Methods

1. Basic Inventory

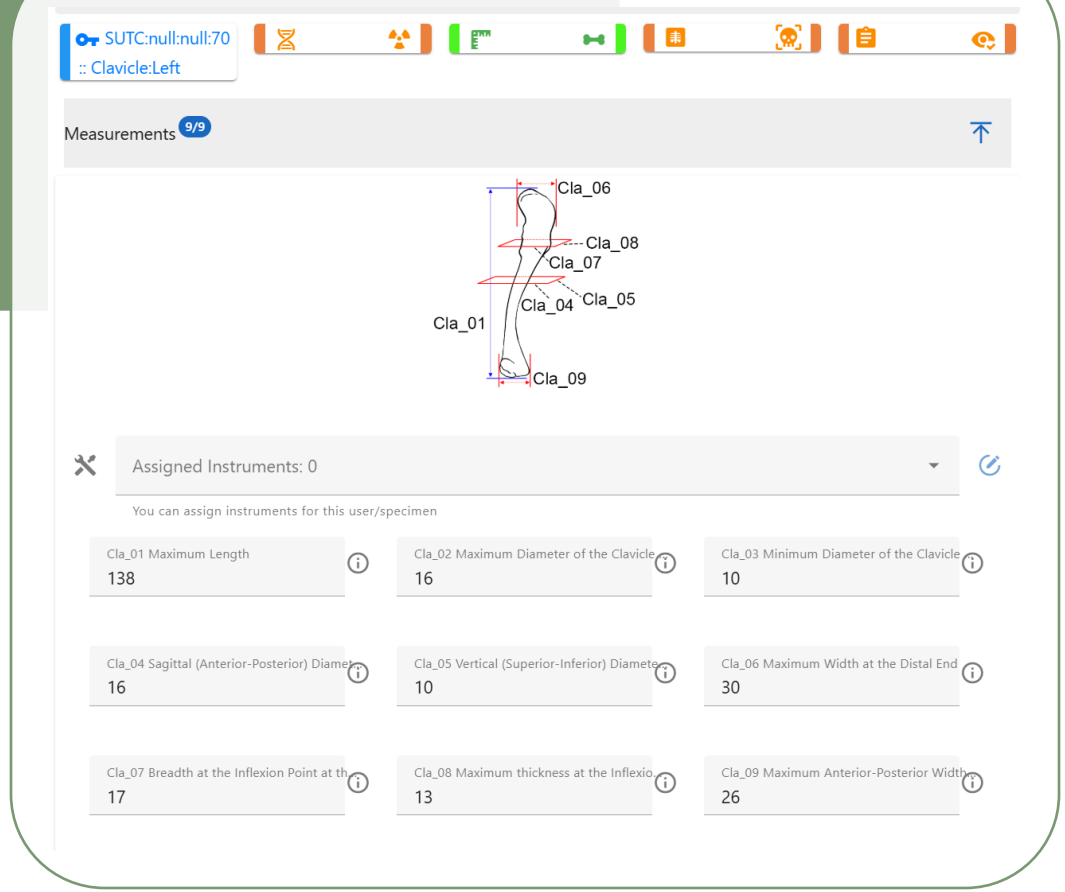
Key	Accession Number	Bone	Side	External ID	Bone Group	Individual Number
SUTC:::727	SUTC	Ulna	Left	AP2000-1-411		
SUTC:::114	SUTC	Femur	Left	AP-2000-1-68		
SUTC:::728	SUTC	Ulna	Left	AP2000-1-416		
SUTC:::115	SUTC	Femur	Left	AP-2000-1-69		
SUTC:::729	SUTC	Ulna	Left	AP2000-1-429		
SUTC:::1254	SUTC	Cranium	Middle	AC-06-104		
SUTC:::1081	SUTC	Rib 11	Left	HBR145		
SUTC:::1082	SUTC	Rib 11	Left	HBR161		
SUTC:::1083	SUTC	Rib 11	Left	HBR205		
SUTC:::1084	SUTC	Rib 2	Left	HBR3		

2. Completeness

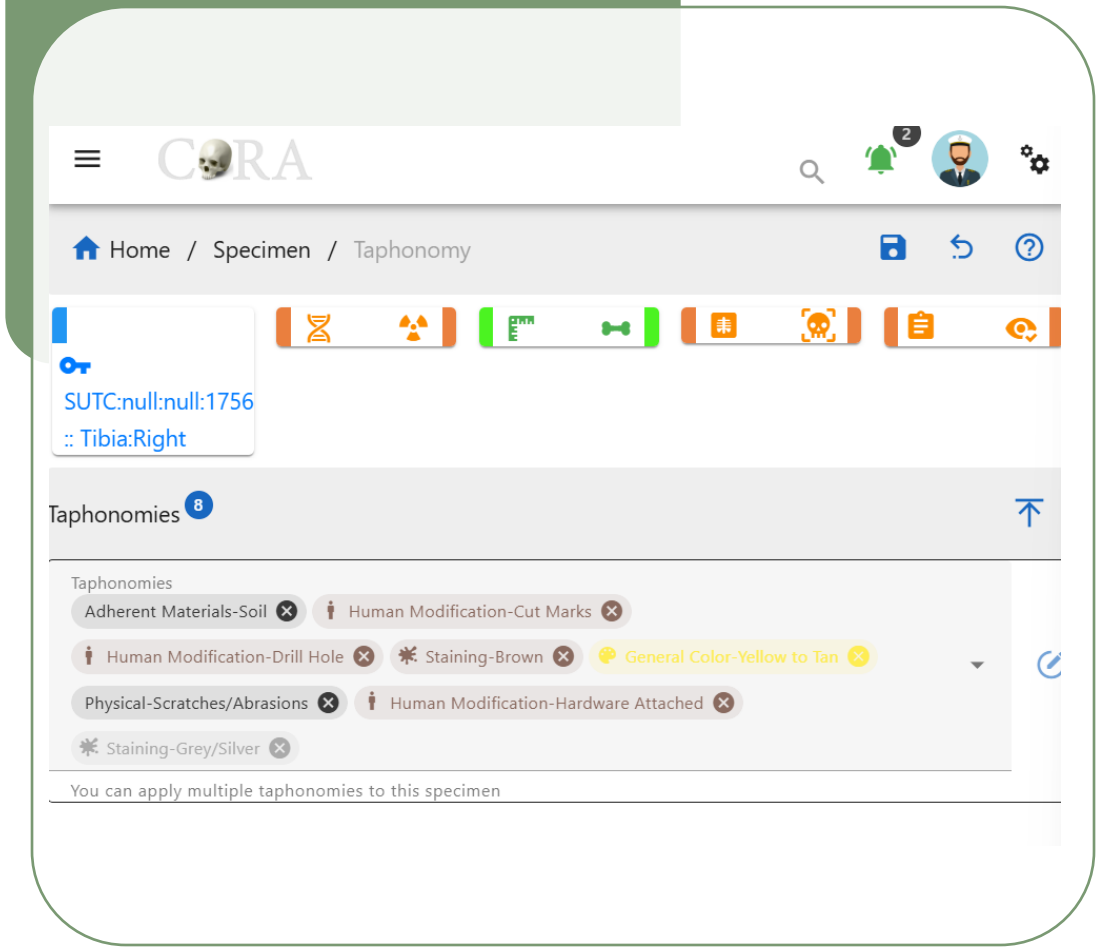


Methods

3. Measurements

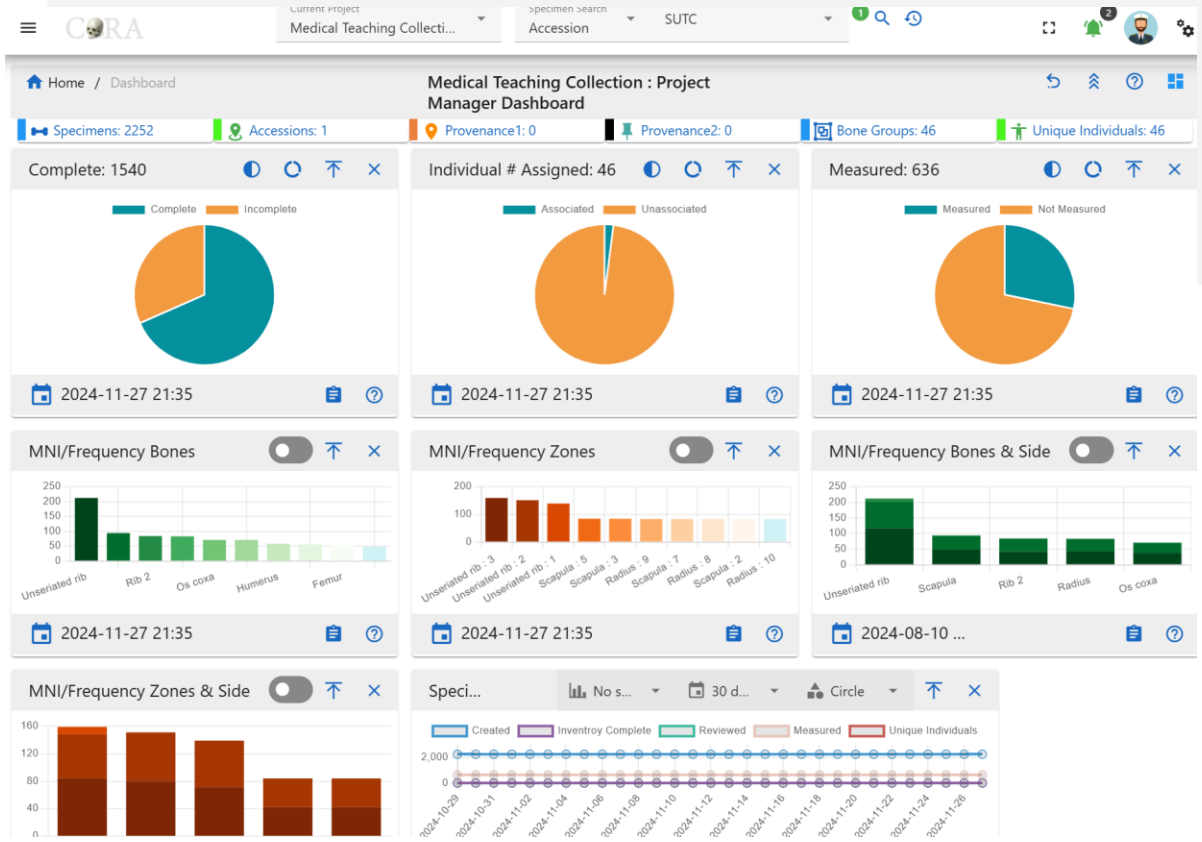


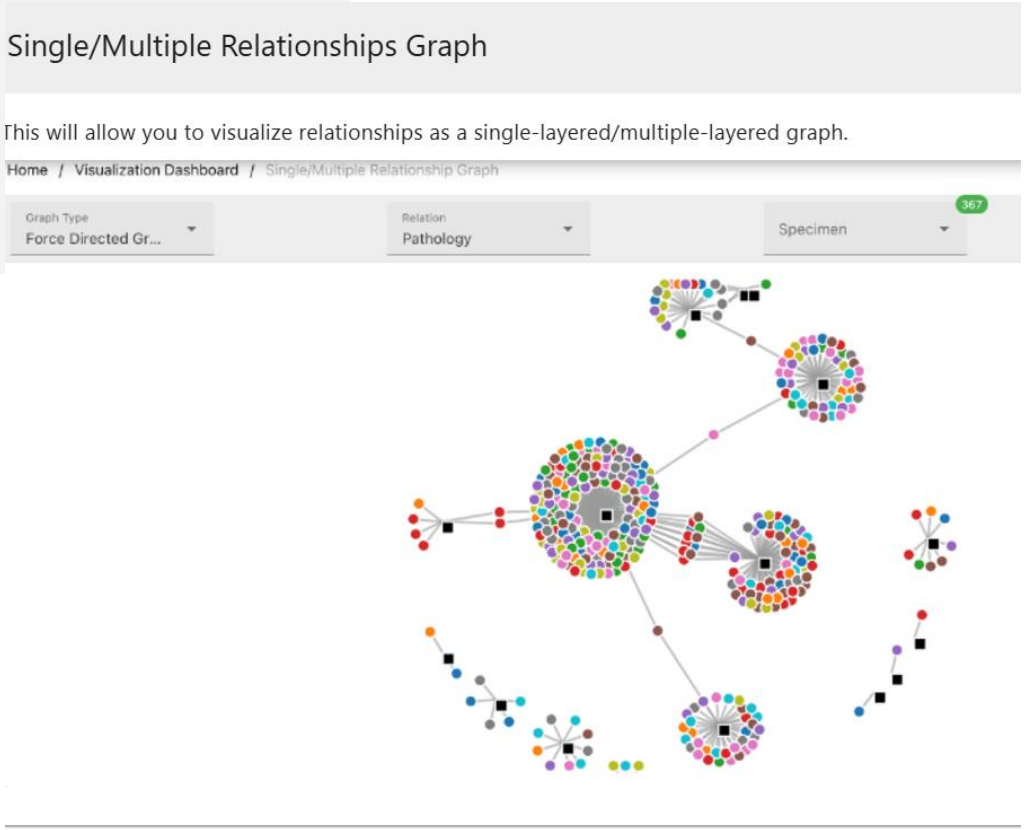
4. Taphonomy

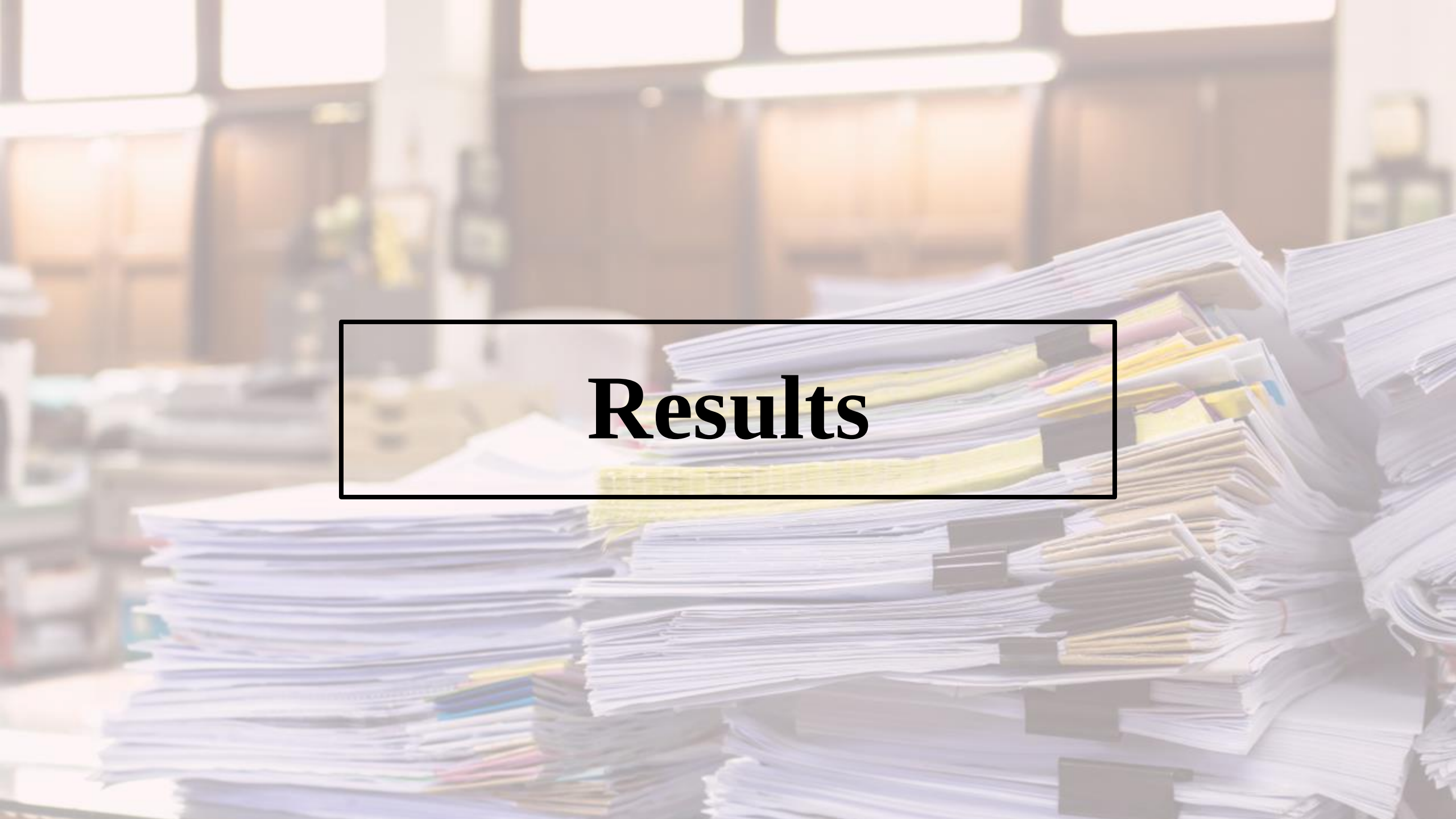


Methods

5. Data Visualization







Results

Overall Inventory

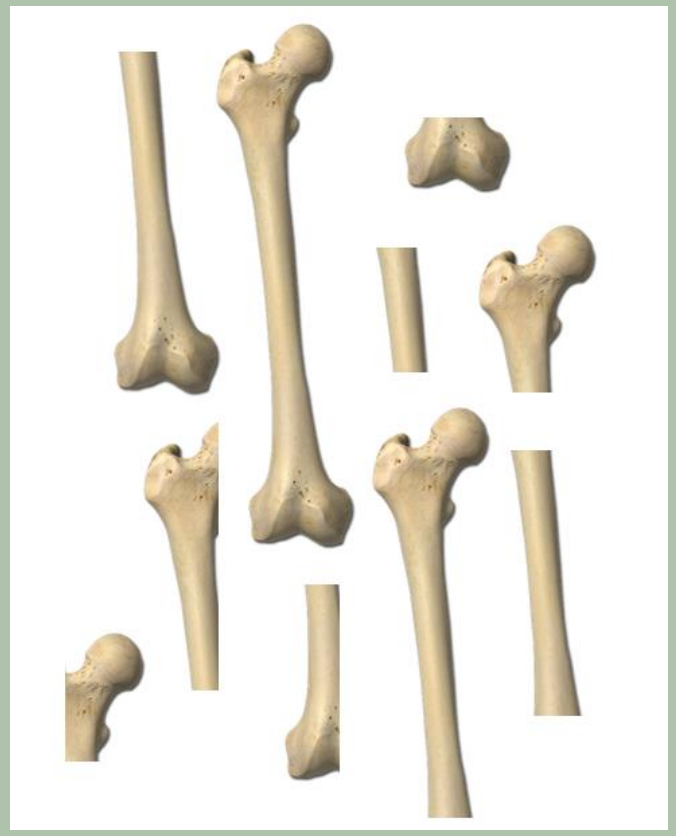
2252 individual specimens recorded (excluding hands/feet)

Over **two-thirds** of the specimens were complete

Most common elements: Ribs 3-10 > Scapula > Rib 2

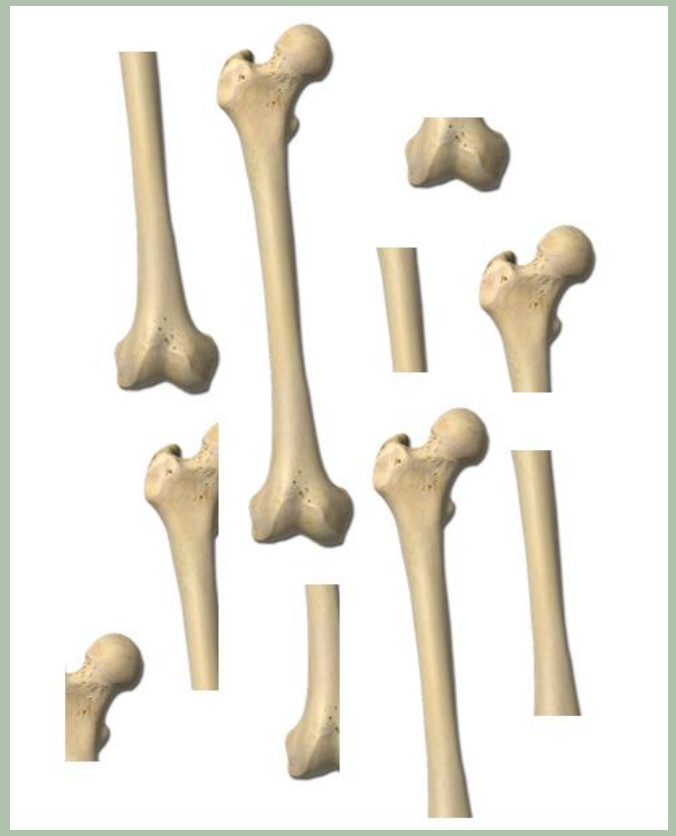
Minimum Number of Individuals – Traditional vs. Zonation MNI

Traditional MNI =



Minimum Number of Individuals – Traditional vs. Zonation MNI

Traditional MNI = 10



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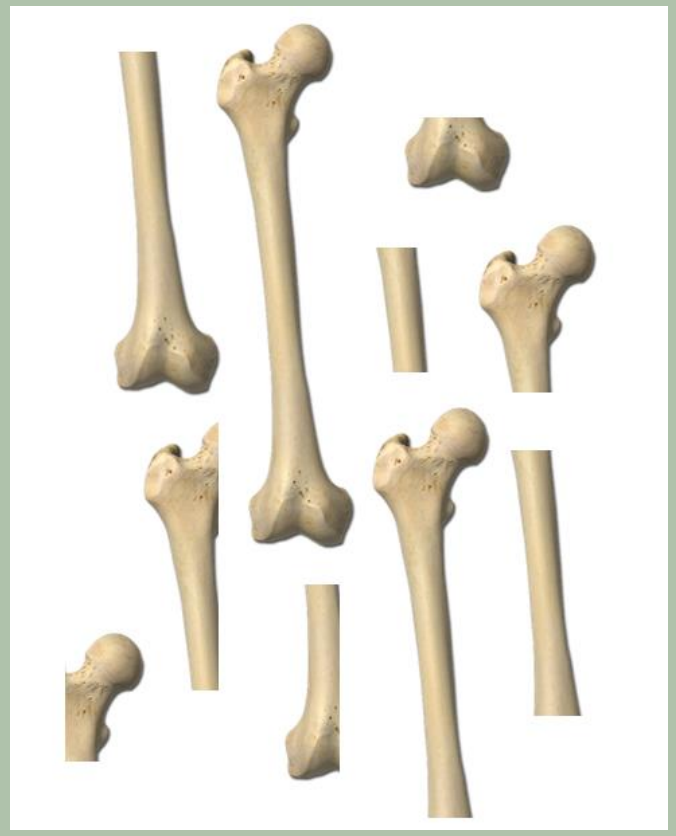
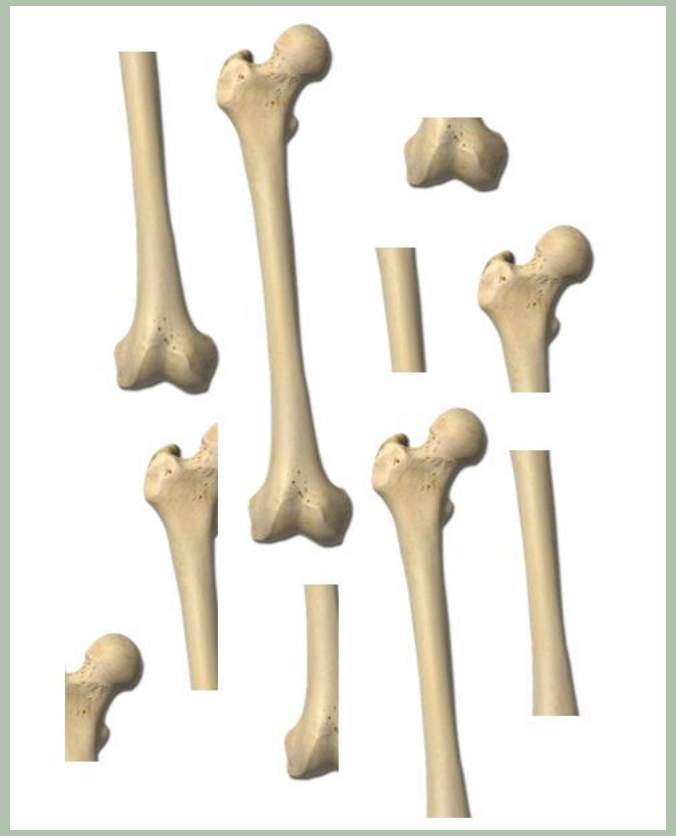


vs.

Zonation MNI =



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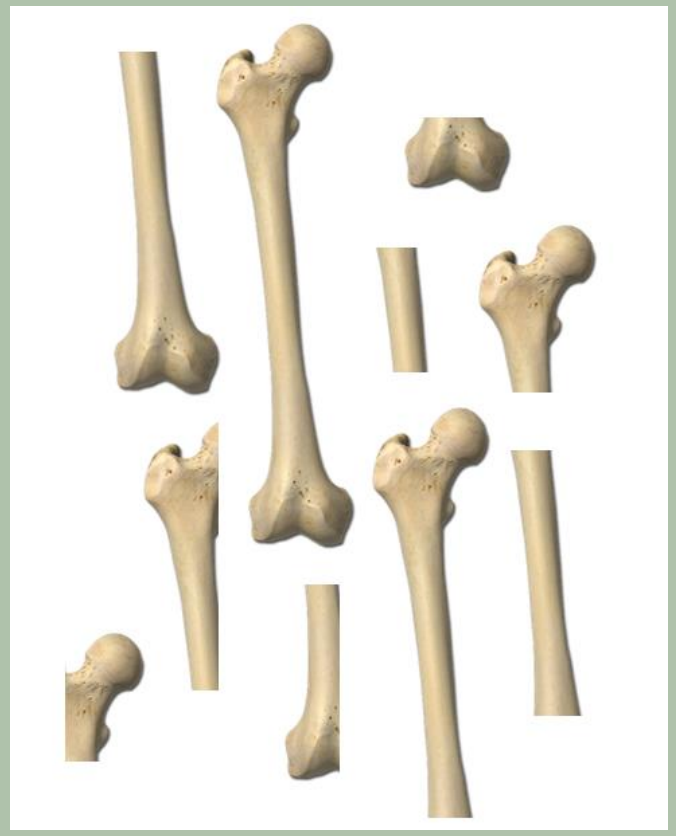
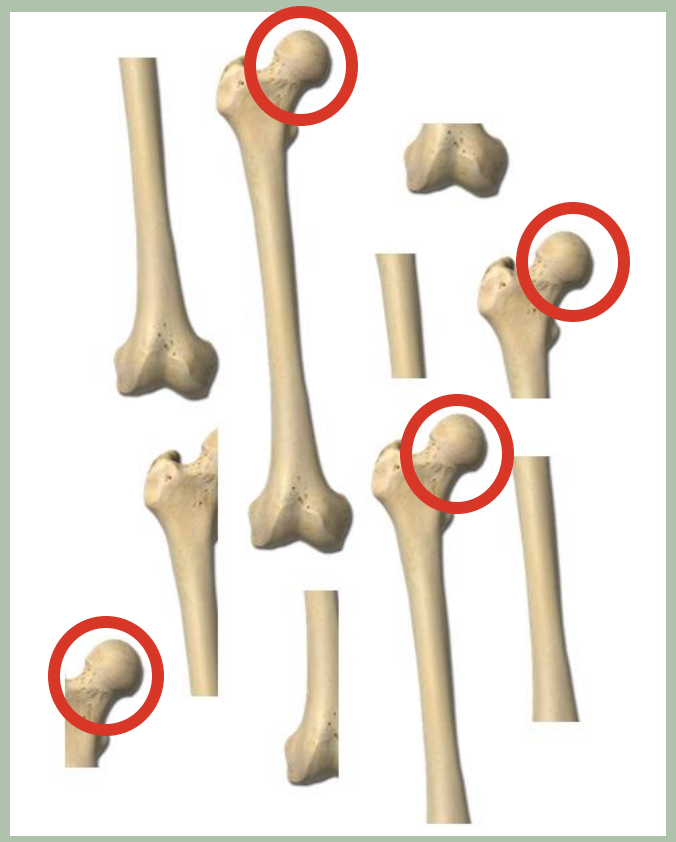


vs.

Zonation MNI = 4



Traditional vs. Zonation MNI

Element (left)	Traditional MNI	Zonation MNI
Scapula	43	42
Radius	43	43
Os Coxa	33	27
Humerus	24	24
Clavicle	29	29
Femur	24	24
Tibia	23	23
Ulna	26	25
Fibula	17	16
Patella	12	12

Element (right)	Traditional MNI	Zonation MNI
Scapula	49	43
Radius	40	40
Os Coxa	37	25
Humerus	34	33
Clavicle	27	26
Femur	28	27
Tibia	26	26
Ulna	22	22
Fibula	22	21
Patella	18	18

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Element (right)	Traditional MNI	Zonation MNI
Scapula	49	43
Radius	40	40
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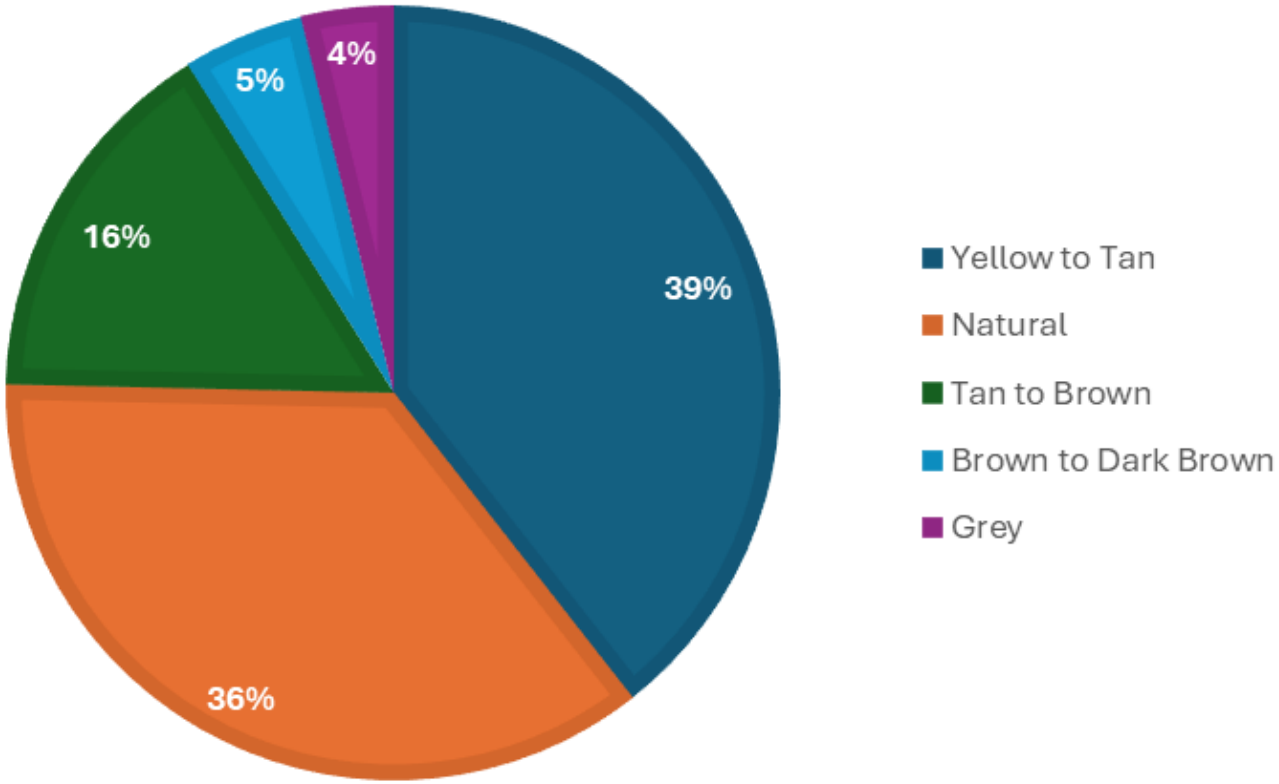
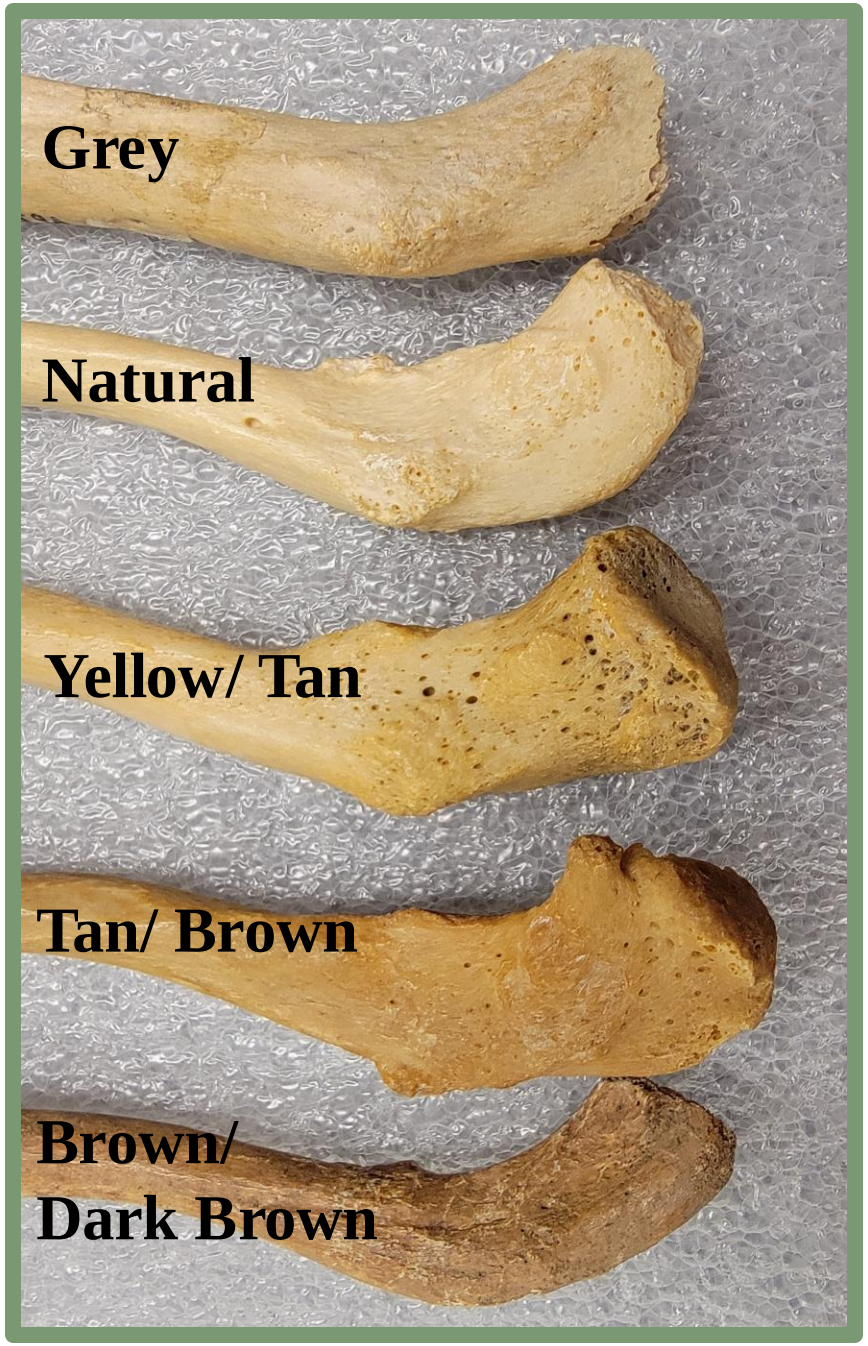
Humerus	34	33
Clavicle	27	26
Femur	28	27
Tibia	26	26
Ulna	22	22
Fibula	22	21
Patella	18	18

Taphonomy – General Color

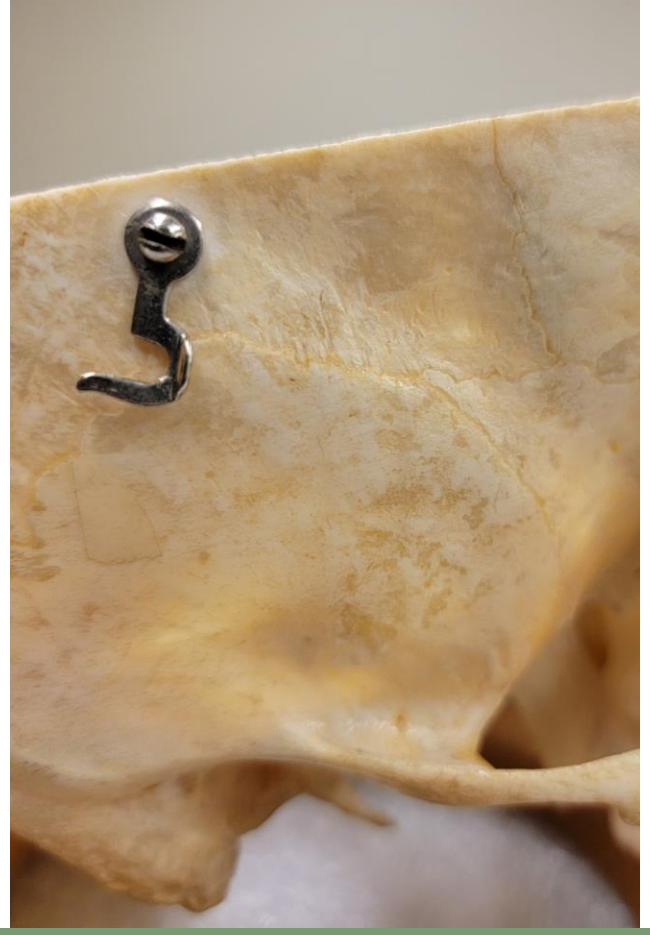
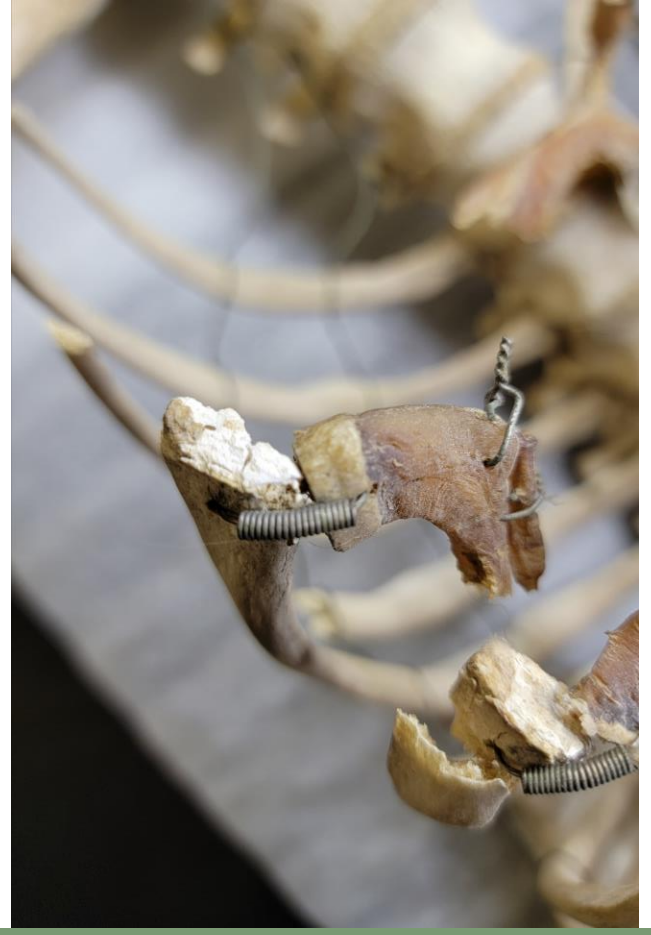




Taphonomy – Human Modification

Writing

Drill Hole


Hardware Attached

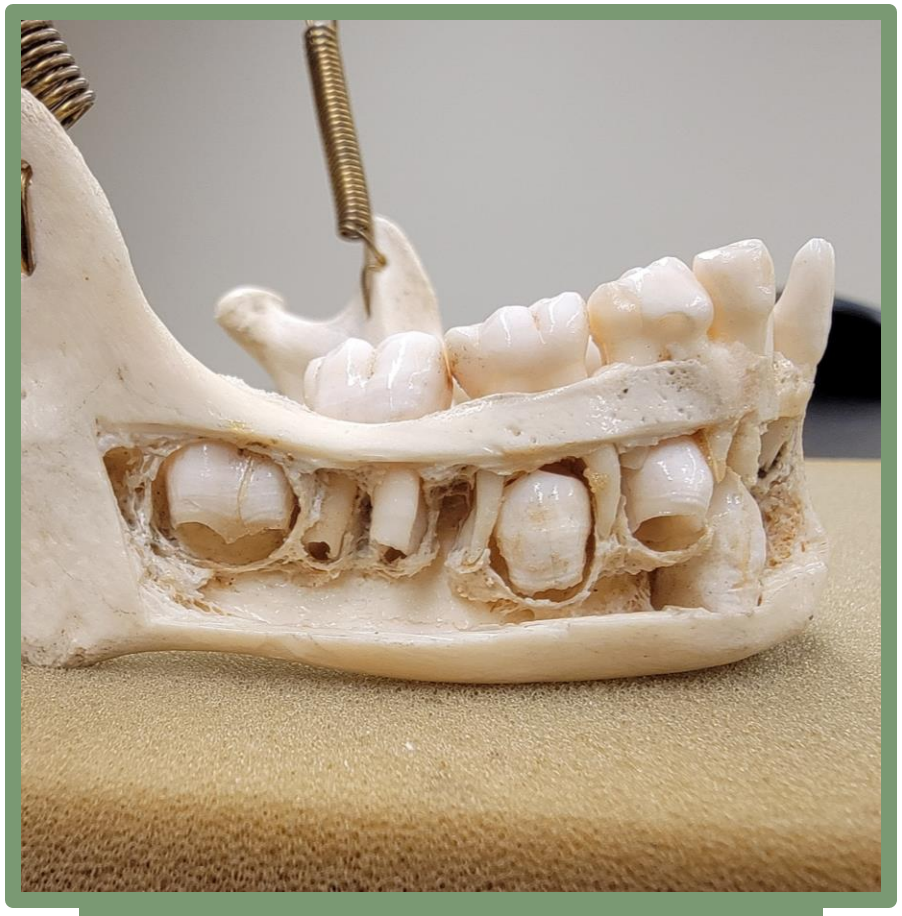
Taphonomy – Human Modification

Taphonomy – Human Modification

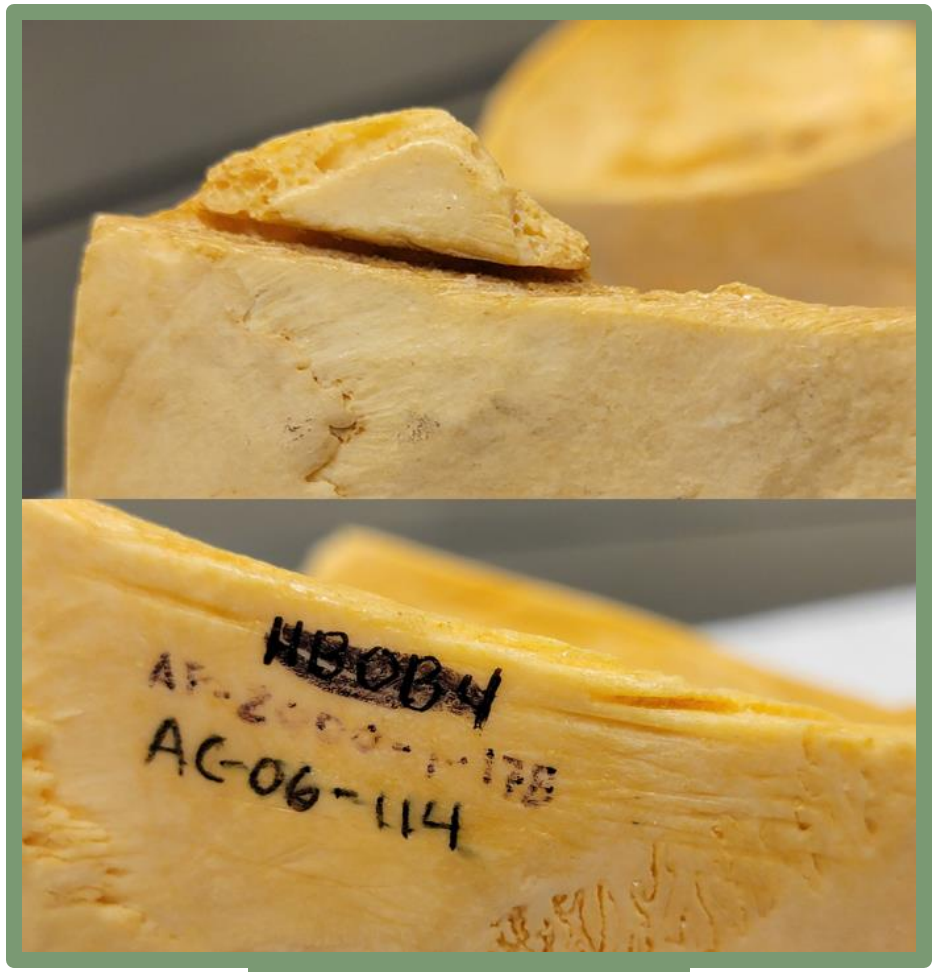
Adherent Material

Reconstructive Material

Taphonomy – Human Modification



Bone Section Removed



Cut Marks

Project Goals… Met!

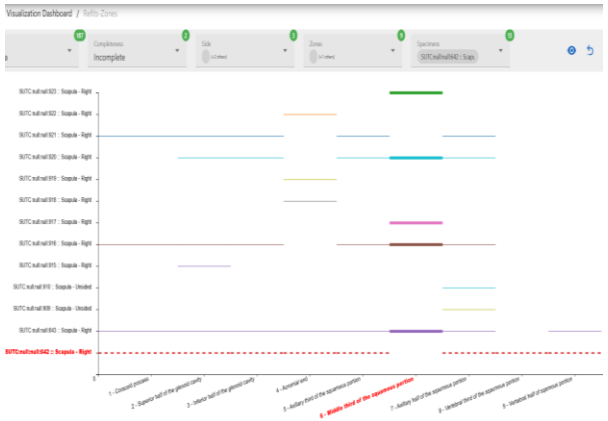
1. Evidence for medical/ anatomical teaching collection?
   - **Taphonomic traits** consistent with other known skeletal teaching collections (i.e., sectioning of the skull, attached hardware, etc.)
   - **Archival Records** of dissection/ anatomy courses at SU
2. Minimum number of individuals?
   - Traditional MNI = **49** (right scapula)
   - Zonation MNI = **43** (right scapula/ left radius)
3. CoRA as a valuable tool for documenting/ analyzing this collection?
   - Increased **organization** and ease of **inventorying/ documentation** of specimens
   - **Data Analysis** and **visualization** features (i.e., project dashboard, MNI charts, single/multiple relationships graphs)

Future Directions

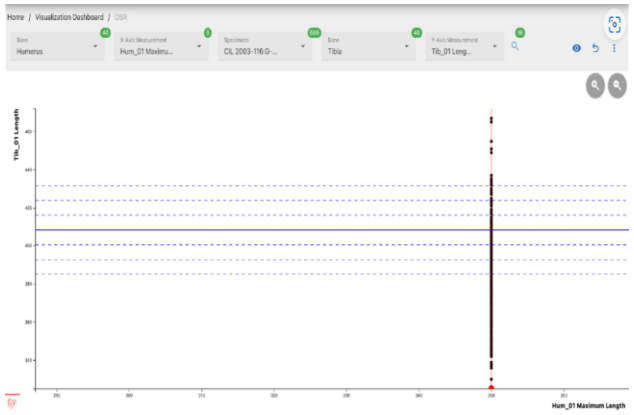
Inventory remaining specimens

Resolution of commingled remains/ identification of individuals using CoRA

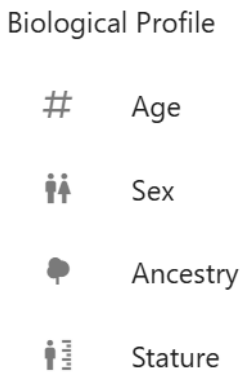
Alternative quantification methods



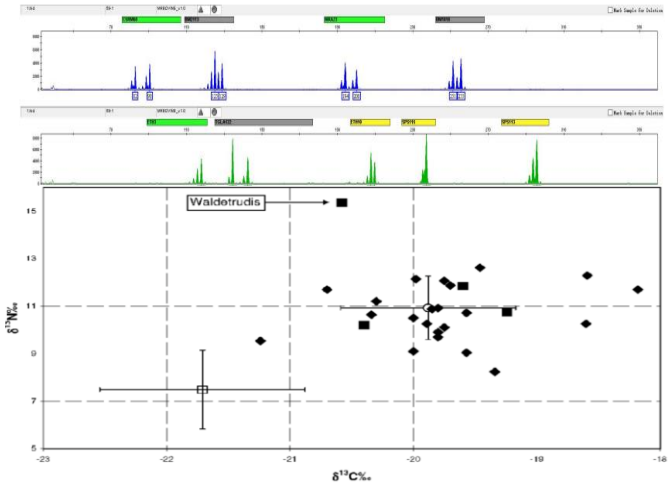
Refits



Osteometric Sorting Regression



Biological Profile



DNA/ Stable Isotope Analysis

Questions?

References

1. Sappol M. A Traffic Of Dead Bodies: Anatomy and Embodied Social Identity in Nineteenth-Century America. 2002.

2. Wright KW. Foundations Well and Truly Laid: A History Leading to the Formation of the State University of New York Health Center at Syracuse. Alumni Association of the SUNY Health Center at Syracuse; 1994.

3. Pawaskar S, Streetman E, C. LeGarde, Jensen N, Stuti Raut, Damann F, et al. spawaskar-cora/cora-docs: v2.1.0 Open Community Release [Internet]. Zenodo; 2021 [cited 2024 Oct 29]. Available from: https://zenodo.org/record/5694496

Photos

1. My photo
2. https://www.laphamsquarterly.org/roundtable/body-snatchers-old-new-york
3. https://www.villagepreservation.org/2018/05/17/elizabeth-blackwells-nyc-the-historic-sites-where-americas-first-female-doctor-made-her-mark/
4. https://www.cardcow.com/461826/birds-eye-view-auburn-prison-new-york/
5. https://www.civilwarmed.org/bodysnatching/
6. https://www.buzzfeednews.com/article/gabrielsanchez/pictures-history-of-new-york-city-hospitals-coronavirus
7. https://www.sciencephoto.com/media/150111/view/american-university-of-beirut
8. https://commonwealthtimes.org/2022/01/28/researchers-at-mcv-to-conduct-dna-analysis-on-19th-human-remains-found-on-campus/
9. https://www.shorpy.com/node/644
10. https://www.nationalww2museum.org/war/topics/defense-powmia-accounting-agency
11. https://universitypositions.eu/universities/europe/university-of-milan?
12. Dr. Sachin Pawaskar
13. Dr. Sachin Pawaskar
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15. https://cora-analytics.coracore.org/
16. https://i.pinimg.com/736x/3e/68/f7/3e68f786fe175b1f77b2abe34c6ba667--in-the-classroom-paper-industry.jpg
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19. https://cora-analytics.coracore.org/
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Photos

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