An Introduction

FORENSIC ANTHROPOLOGY

The study of humans past and present

- Archaeology
- Cultural Anthropology
- Linguistics
- Physical Anthropology
  - Primatology
  - Paleoanthropology
  - Human osteology
Forensic Anthropology

- The application of physical or biological anthropology in a legal context.
- Forensic anthropologists recover & analyze human remains for legal authorities (typically coroners or medical examiners).

Involvement in the Field

- Searches
- Recoveries of surface scatters
- Excavations of burials
RECOVERY OF REMAINS

- Forensic Anthropologists use archaeological methods to recover human remains.
- *Archaeology* is a subfield of anthropology that involves the *controlled* recovery of physical evidence of the past.

GOALS OF RECOVERY

- Find all elements without damaging them.
GOALS OF RECOVERY

- Record the location of all elements found. The act of recovery destroys the context!

Map courtesy of Dr. Stephen Nawrocki, University of Indianapolis Archeology and Forensics Laboratory

Area 1
Plan View

GOALS OF RECOVERY

~90 yards to Area 1

Area 1: skull

~90 yards

Area 2: main scatter of remains

unharvested beans

harvested beans

utility pole

debri[s pile

Datum

Area 1:

Map courtesy of Dr. Stephen Nawrocki, University of Indianapolis Archeology and Forensics Laboratory
GOALS OF RECOVERY

- Determine if the remains have been moved or disturbed.

Did the body naturally decompose this way?

- If the remains were buried, note soil stratigraphy (layering).

Photo courtesy of Dr. Stephen Nawrocki, University of Indianapolis Archeology and Forensics Laboratory
GOALS OF RECOVERY

- Note other environmental information:
  - Insect/scavenger access?
  - Water exposure?
  - Sunlight exposure?
  - What sorts of plants are growing nearby?

- All of these factors (and others!) can affect how a body decomposes, can damage bones, or can change the way bones look.

IN THE LAB...

- Forensic anthropologists establish forensic relevance by answering a number of questions.
IS IT HUMAN?

IS IT MODERN?
OR IS IT ANCIENT?

HOW MANY ARE THERE?
THE BIOLOGICAL PROFILE

- Age at Death
- Sex
- Stature
- Ancestry
- Pathological conditions
- Trauma
- Other
AGE AT DEATH: ADULTS
AGE AT DEATH: SUBADULTS

SEX
PATHOLOGICAL CONDITIONS

TRAUMA
What Happens to a Body After Death?

**POSTMORTEM PROCESSES**

- Death is a process, not an event.
- A cascade of chemical reactions begins a series of changes that cannot be reversed.
- The body will be reduced to a skeleton (and eventually to dust) if the immediate environment is not altered to constrain decomposition and promote preservation.
Involves two internal processes:
- Autolysis
- Putrefaction

When circulation stops, cells become deprived of $O_2$
- Cells swell and become more acidic
- Eventually organelle and cell membranes break down
  - Release of intracellular enzymes degrades other structures
  - Organs rich in enzymes autolyze fastest
- Autolysis is slowed by cold, accelerated by heat
PUTREFACTION

- Autolysis releases protein, carbohydrate, and fatty byproducts of cells and tissues
- Existing bacteria and fungi in the large intestine proliferate in the now oxygen-poor environment, feeding on these byproducts
- Bacteria from GI tract invade the vascular system spreading throughout the body.
- Onset depends on:
  - The environment (temperature, microbes in soil, etc.)
  - The individual (fever, infection, variation in gut, etc.)

EXTERNAL INDICATORS

- Livor Mortis
- Rigor Mortis
- Algor Mortis (body temperature)
- Decomposition:
  - Color changes
  - Marbling
  - Bloating
  - Blistering
  - Hair and skin slippage
LIVOR MORTIS

- Once the heart stops, blood components pool in lower (dependent) parts of the body.
  - Starts ½ to 2 hours after death
  - Is reversible until it becomes fixed 8-12 hours after death
- Skin in these regions appears to turn purple or deep pink.
- Livor can reveal if a body has been moved after death.
LIVOR MORTIS
RIGOR MORTIS

- **Muscle stiffening**
  - Starts 2-4 hours after death
  - Disappears after muscle decomposes (36+ hours)

- **Autolysis reveals access to muscles’ contractile unit**

- **No O₂ means no muscle energy source (ATP) to complete contraction-relaxation cycle**

- **Without ATP, muscles become contracted until the filament proteins begin to break down.**

RIGOR MORTIS

- **Factors that speed onset:**
  - Exertion immediately prior to death
  - High body temperature immediately prior to death
  - Convulsions immediately prior to death
RIGOR MORTIS

RIGOR MORTIS
ALGOR MORTIS

- A change in body temperature to match that of the external environment after death.
- If the environment is colder than the body, then the body temp will drop approx. 1.5°F per hour
  - Assumes that the body temp at death was normal
  - Assumes that the body cools at a constant rate

DECOMPOSITION

- Greenish skin discoloration
  - Begins 24-36 hours after death
  - Starts in the lower quadrants of the abdomen, usually the right turns green first
    - Recycled hemoglobin from liver
    - Hydrogen sulfide and iron from colon
  - Followed by greenish discoloration of the head, neck and shoulders.
DECOMPOSITION

- Face swells due to bacterial gas formation.
- Marbling:
  - Produced by hemolysis of blood in vessels.
  - Vessels near surface of skin appear dark in color.
Decomposition

- **Bloating**
  - Begins 60-72 hours after death.
  - Caused by gas formation due to bacterial action.
  - First noticeable in the face:
    - Eyes bulge
    - Tongue protrudes
    - Face turns green then black
    - Purge fluid may drain from mouth and nose
BLOATING

BLOATING/PURGE
DECOMPOSITION

- Vesicle (blister) formation
- Skin and hair slippage

VESICLE FORMATION
One day after placement at decomposition facility.

Seven days after placement at decomposition facility.

Late stage phenomena:
- Hair, nail, and tooth loss (weeks to months)
- Adipocere formation (weeks to months)
- Mummification (weeks to years)
- Skeletonization (weeks to years)
ADIPOCERE

Photo from Smithsonian National Museum of Natural History Anthropology Collection Photostream

MUMMIFICATION
Things used to estimate PMI:
- Degree of decomposition
- Livor Mortis
- Rigor Mortis
- Body temperature
- Insect activity
VARIABLES

- Temperature
- Humidity/precipitation/submersion
- Soil conditions/acidity/abrasion
- Flora and fauna
- Method of deposition (indoors/outdoors; buried/unburied)
- Clothing/wrapping
- Body size
- Cause of death (exsanguination, infection)

HOW DO WE LEARN ALL OF THIS?
THE FOREST

- Western Carolina University’s Forensic Osteology Research Station

MORE INFORMATION

- http://bones.wcu.edu
- Cheryl Johnston: johnstonc@wcu.edu
- Holly Williamson: hollywilliamson@gmail.com

See also: