



## Physical Anthropology Section – 2007

### H96 Burned Human Remains: Myths in Forensic Science

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After attending this presentation, attendees will understand how observation-based experimental research improves answers to old questions or problems in the field.

This presentation will impact the forensic community and/or humanity by re-examining old problems with current techniques and technologies.

Current developments in forensic anthropology have taken the field in a new direction by embracing methodologies, technologies, or techniques from other subdisciplines such as biology, chemistry, engineering, pathology, and fire investigation, just to name a few. Integrating these approaches allow the authors to reexamine old problems through new lenses. Experimental research allows for repeatable observation-based testing that either supports or provides alternative explanations to existing phenomenon encountered in forensic casework. This paper draws from observations of 12 human cadavers and 15 individual limbs utilized in previous burn experiments. The results presented are responses to current misconceptions that directly influence recovery and analysis of burned human remains. One goal is to first improve the ability of scientists to look closer and with fresh eyes at the evidence. Then it becomes the responsibility to teach each other and other professionals working within the medicolegal system. In some cases, an alternative explanation for long-held traditions opens the door to change and improvement. This paper attempts to provide new ways of looking at old problems by responding to the comment, **"I was taught that..."**

**"...Blisters indicate the victim was alive or the presence of accelerants."** Blister production is not necessarily evidence of antemortem vital reaction, but instead occurs from the effects of heat to skin moisture in both ante- and postmortem exposure to fire. Blisters result from fluid (water, blood, lipids) collection at the dermal-epidermal junction upon initial heat exposure to skin and may precede or accompany early color changes in the postmortem state and in the absence of accelerants.

**"...Arms and legs burn away."** Contrary to popular belief, smaller distal bones do not burn away but simply fall below the mass of charred human remains as supporting soft tissues burn away from fingers, wrists, toes, and ankles. In most cases these are present and discoverable with observant excavation and recovery. Bones of extremities do not burn away but instead may appear absent from extreme fragmentation of weak from strong bone or lack of recovery. Often the charred bulky torso is assumed to be all that remains of a burn victim and may be prematurely removed. Incomplete recovery leaves body parts at the scene and disregards potential skeletal evidence of defensive cut marks of the hands, callouses of healed fractures, or any congenital deformations that would aid personal identification.

**"...Broken bone prevents pugilistic posture."** Several traumatized limbs with known sites of completely fractured bone did not prevent adjoining distal joints of wrists, fingers, ankles, and toes from flexing. Also, amputated limbs completely transected at the humeral or femoral midshafts did not affect flexion of distal joints as movement of these was influenced by localized tissue contraction. The pugilistic posture is more the result of contraction of tissues immediately adjacent to the joint and does not depend upon a 'fulcrum effect' involving either an intact or complete musculoskeletal system intended to move the joint in life. The fractured sites of long bones were under direct influence of contracting muscle, causing bone fragments to either slide over one another or split apart depending on thickness of the surrounding tissues.

**"...Bone color indicates temperature of the fire."** Color simply indicates the stages of pyrolysis of organic bone materials. Color directly correlates with the progression of soft tissue reduction and organic pyrolysis of bone rather than as an indicator of temperature levels.

Identical features of charring and calcination can occur in a body burned at extremely high temperatures for a short time period or one burned at lower temperatures for a longer duration. Time and temperature are independent variables that can produce similar heat effects in burned human remains. Color can be superficial with an external calcined appearance, but still retain charring within deeper layers of bone.

**"...Bone shatters from heat."** The exterior cortical surfaces of bone are exposed to heat the earliest and longest compared to deeper layers insulated within soft tissues (tubular bone or cranial bone). Visible changes of color and heat-fractures commence externally and progress inward. Heat causes cortical bone to shrink and split into superficial heat fractures as it loses its organic constituents. Heat fractures likewise will shrink and split first at the external cortical surface and can travel through the bone as a full-thickness fracture. Fractures allow heat to reach lipid rich tissues of marrow and brain, causing them to leach and burn out, but not shatter bone.

**"...The skull explodes if there's no injury."** In a fire, cranial bone experiences color changes and



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heat-fractures; often as delamination, crazing, or full-thickness fractures. Also external taphonomic factors typically present at fire scenes contribute to the 'exploded' appearance. Fragile burned cranial bone also fractures during burning from environmental disintegration, impacting debris of collapsing walls, ceiling, floor, and furniture, and from extinguishment methods. If one accepts the fragmented or 'exploded-looking' skull as proof for the absence of preexisting trauma, it discourages further investigation of evidence for possible homicides. Additional fragmentation of fragile burned cranial bone can result from recovery and transport from the fire scene.

**"...All bodies burn the same."** Trying to predict what a body will look like during search and recovery after an extensive fire requires basic knowledge of anatomy and osteology. The body is a fuel source and contributes to the burning process. There are obvious differences among individuals such as their weight, age, and sex that relate to differential amounts of soft tissues and body-fat ratios. Likewise, bone density and mineralization differs among babies, children, adolescents, adults, and the elderly. Denser mature bone survives heat better than osteoporotic bone of the elderly and immature bone of epiphyses and diaphyses of subadults. Prior knowledge of the victim's information will help anticipate the final condition of remains during the search process.

Exemplars from observation-based research on burned human will be presented to illustrate the alternative mechanisms and processes responsible for creating each problem discussed.

**Burned Bone, Fire Death Investigation, Myths**