B44 Burnin' Down the House: Predictive Cadaver Models in Structural Fires

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After attending this presentation, authors will have: 1) demonstrated benefits of collaborative research with Arson Investigation, Anthropology, and Pathology, 2) established how burn patterns are influenced by structural conditions within the fire, 3) illustrated scene reconstruction using patterns and condition of burned human remains, and 4) interpreted body patterns as part of the scene.

This presentation demonstrate the importance of how identification and recovery of fragmentary bone are valuable specimens when reconstructed and provide specialized information about personal identification or preexisting trauma of human remains.

Discovery of human remains in structural or vehicular fires presents many challenges to the investigative process. Traditionally, expedient removal of human fatalities precedes the comprehensive structural analysis of the scene. Ideally, the independent examinations of burn patterns at the scene and on the body should correlate with reconstructed events surrounding the fire. However divorcing analyses of the two types of physical evidence invites the potential for information loss when examined in isolation. This presentation demonstrates how a contextual analysis of human remains in situ strengthens the fire death investigation as burn patterns of the body are interpreted within the unique conditions of the scene.

Similar to charred patterns on walls, burn patterns on the body readily disclose information about its orientation to heat, position within the fire, exposure, and presence of preexisting trauma. When human remains are examined as an integral part of the original fire scene this context additionally provides relative proximity to exits, entrapment or protection by collapsed debris, and spatial orientation within the structure. However, in most fire death cases human remains are often removed in haste, leaving valuable fragments of soft tissue, bones, or teeth camouflaged among debris as overlooked and permanently lost specimens. An awareness of how the body burns in response to different spatial and structural conditions aids in reconstruction since complete recovery of these fragmentary remains is not always accomplished.

Collaboration with the Hickory Creek Volunteer Fire Department, Anthropology Department, and Shelby County Medical Examiner conducted field experiments creating predictive cadaver models within structural fires to improve reconstruction techniques for arson investigation. Actual research using unembalmed human bodies from anatomical gift donations and condemned residential structures were the primary research materials. Bodies were strategically placed in known locations and positions within different types of structural settings. Variable selected conditions include direct placement upon carpeted concrete foundation slab, elevated floors over crawlspace or basement, and placed upon the second level of a multiple story house to examine burn patterns and spatial distribution of associated fragmentary remains for each situation during the post burn recovery phase.

Fully ignited structures were documented for the entire duration: recording known conditions of materials, times, and temperatures until natural extinguishment. Remains of the structure and body were left to smolder and excavated the following day. Collaboration of archaeological and arson investigative techniques were employed to interpret the contextual position, condition, and spatial patterns of human remains and associated fragmentary pieces camouflaged among debris. In most cases fragmentary remains of extremely incinerated bodies fell within close proximity beneath the resting position. Relative differences in ventilation access and variable height correlated with the distribution and extent of burning for each body. Fragmentary remains lying directly on the concrete foundation were larger, easily identified, and predictably positioned compared to conditions with increased distances between the body's vertical position and ground level. For the latter combinations of vertical descent, impact with architecture (flooring and joists), and dimensional collapse of debris contributed to morphological differences for surviving remains of elevated cadavers, producing smaller fragments and wider dispersal area.

The use of different residential structural types generates predictive models to help arson investigators recognize how the body burns in response to environmental conditions and effectively identify expected distributional patterns of fragmentary human remains during recovery. In addition to examining physical evidence of the scene, burn patterns of soft tissue and bone are equally valuable tools used to reconstruct events of the fire. This presentation stresses how identification and recovery of fragmentary bone are valuable specimens when reconstructed and provide specialized information about personal identification or preexisting trauma of human remains. Results from these experimental burns demonstrate the fruits of collaborative multidisciplinary field research and offer new information for effectively investigating fire fatalities.

Fire Investigation, Burned Bodies, Burned Bone

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