



OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:

Keyword(s):

Submitting subcommittee(s): **Date Approved:**

(If SAC review identifies additional subcommittees, add them to the box above.)

Background Information:

1. Description of research need:

Deaths involving blunt force trauma are challenging cases, as the baseline data that allows interpretation of fracture patterns are limited for all ages of adults and subadults. At present, forensic pathologists and anthropologists often have difficulty interpreting skeletal fractures. Unknown variables include number and location of blows, and force and implement involved. Controlled experimental bone trauma studies in collaboration with biomechanical engineers are needed to further the understanding of fracture patterns across the skeleton, including on the skull and the long bones.

2. Key bibliographic references relating to this research need:

Vaughan PE, Vogelsberg CCM, Vollner JM, Fenton TW and Haut RC, 2016. The role of interface shape on the impact characteristics and cranial fracture patterns using the immature porcine head model. *Journal of Forensic Sciences*, in press.

Reber SL, Simmons T, 2015. Interpreting injury mechanisms of blunt force trauma from butterfly fracture formation. *Journal of Forensic Sciences* 60(6): 1401-1411.

Powell, BJ, Passalacqua NV, Fenton TW, Haut RC, 2013. Fracture characteristics of entrapped head impacts versus controlled head drops in infant porcine specimens. *Journal of Forensic Sciences* 58: 678–683

Powell BJ, Passalacqua NV, Baumer TG, Fenton TW, and Haut RC, 2012. Fracture Patterns on the Infant Porcine Skull Following Severe Blunt Impact. *Journal of Forensic Sciences*, Vol. 57, No. 2, March 2012.

Kroman A, Kress T, Porta D. 2011. Fracture propagation in the human cranium: a re-testing of popular theories. *Clinical Anatomy* 24:309–318.

Martens M, van Audekercke R, de Meester P, and Mulier JC, 1986. Mechanical behaviour of femoral bones in bending loading. *Journal of Biomechanics* 19(6):443-454.

Gurdjian ES, Webster JE, Lissner HR. 1950. The mechanism of skull fracture. *Radiology* 54:313–339.

3a. In what ways would the research results improve current laboratory capabilities?

Most currently used references on skeletal blunt force trauma suggest that the analyst use description with limited interpretation. But description without interpretation is of limited value in the medicolegal death

investigation. Interpretation will be possible with experimental data confirming the link between known conditions and resultant fracture patterns. Variables such as bone geometry and morphology can further be considered: these play a currently unknown role in fracture pattern variability. In particular, a better understanding of fracture initiation and propagation will make it possible to accurately identify the point of impact, to determine if the observed trauma is consistent with a single or multiple blows, or to make assessments about the implement and force involved.

3b. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

Interpretation of fracture patterns has been based on analyst experience and a theoretical interpretation of the known biomechanical properties of bone. Validation experiments will scientifically confirm the interpretation of fracture patterns by demonstrating the link between real world injury variables and fracture pattern characteristics.

3c. In what ways would the research results improve services to the criminal justice system?

Forensic pathologists and anthropologists participate in the medicolegal death investigation, where cases involving trauma are particularly high-stakes. Accurate interpretation of number of blows, location of blows, implement involved, directionality of impact and other factors can significantly affect criminal proceedings. Experimental research on skeletal trauma will strengthen the accuracy of injury scenario interpretation from fracture patterns.

4. Status assessment (I, II, III, or IV):

I

	Major gap in current knowledge	Minor gap in current knowledge
No or limited current research is being conducted	I	III
Existing current research is being conducted	II	IV

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.

Approvals:

Subcommittee

Approval date:

01/28/2016

(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)

SAC

1. Does the SAC agree with the research need? Yes No

2. Does the SAC agree with the status assessment? Yes No

If no, what is the status assessment of the SAC:

Approval date:

(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)