**Multiscale Analysis of Trauma**

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Trauma presents complex and rapidly evolving scenarios for clinical decision making. As a patient bleeds, the individual’s life may be at extreme risk if their systemic blood function changes in a manner that is unable to stop further bleeding. The overall research goal is to achieve multiscale simulation of the trauma patient by accounting for changes in the systemic circulation and the traumatized blood and tissue so as to better stratify patient bleeding (or clotting) risks, prioritize improved biomarkers of risk, and potentially identify new opportunities for safer treatments. The multiscale model integrates: (1) Global hemodynamics, (2) Local tissue trauma, (3) Single vessel bleeding. Through controlled studies of healthy human blood, trauma patient blood, controlled flows in microfluidic devices, and validated animal models, we will quantify biological and hemodynamic mechanisms whereby trauma patients succeed or fail to maintain hemostasis. We will embed the single vessel model into a traumatized tissue model which is then embedded into the whole patient multiscale simulation by linking and simulating *four* interacting levels: (i) systemic circulation with concomitant blood loss, time-stamped transfusion events, changing cardiac function and hormonal status; (ii) traumatized tissue bleeding and clotting based upon a network ensemble of individual unit vessels; (iii) non-traumatized at-risk tissue responses to exposure to systemic circulation blood; and (iv) blood diagnostics (TEG, BP, HR, etc.) that drive clinician-mediated transfusion events. These high dimensional studies drive multiscale models of patients to identify trauma induced coagulopathy (TIC) risks.