Salivary Biosensor for Psychosocial Stress

Vivek Shetty[1] & Masaki Yamaguchi[2]

UCLA Collaborative Oral Fluid Diagnostic Research Center[1] *and Biomedical Engineering Center – Toyama University, Japan*[2]

Research Goal: To develop a portable biosensor platform that will "operationalize" the psychobiology of the stress response by detecting and reliably quantifying relevant salivary biological indicators.

Background: We have developed a hand-held biosensor prototype that utilizes a miniaturized optical platform and inexpensive, colorimetric test strips to rapidly detect and quantify salivary alpha-amylase (SAA), a primary bioindicator of the body's adrenergic stress response. Unlike elaborate, laboratory-based assays that frequently involve invasive sampling and provide static measurements, the instantaneous salivary biosensor allows a temporal and spatial resolution conducive to large-scale population studies of stress-health outcome interactions. Through the GEI research program, we propose the refinement, field validation and technical expansion of our prototype biosensor to facilitate rapid and precise measurement of salivary biomarkers of exposure to systemic and psychosocial stressors.

Research Strategy: We will first optimize the technical performance characteristics of the biosensor in a cohort of 50 healthy controls by: a) establishing calibration curves for the portable SAA biosensor and comparing it to laboratory assayed SAA; b) examining biosensor reliability (precision and accuracy) over the diurnal cycle; and c) demonstrating its validity as a exposure assessment tool under conditions of low and high stress. Subsequently we will conduct small-scale field testing and functional validation of the biosensor in a cohort of 185 vulnerable patients with high systemic (facial injury) and psychosocial stress. In this phase, we will a) test collection procedures and validity of the SAA biosensor across variations in systemic and psychosocial stress (hospital intake, 10 days post-surgery, 30-day post surgery); b) examine potential confounding effects of predisposing vulnerabilities (e.g., sociodemographics, stress burden, social support) and systemic milieu (e.g., substance use, health/lifestyle behaviors) on biomarker levels; and c) assess the predictive validity of biosensor SAA for maladaptive psychological (e.g., distress, anxiety, depression) and behavioral symptoms (e.g., increased substance use) following injury.

Concurrently, we will refine the technical capabilities of the biosensor platform and expand its capabilities to permit multiplexed assays of other salivary analytes reflective of the stress response (e.g., cortisol, DHEA-S, testosterone) as well as licit and illicit substance use.