



U.S. ARMY
RDECOM

Individual Differences and Human Variability
for Translational Neuroscience



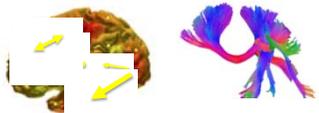
S&T Campaign: Human Sciences *Human Behavior*

Jean Vettel, (410) 278-7431
jean.m.vettel.civ@mail.mil

Research Objective

- Understand the underlying properties, principles, and mechanisms governing the differences between individual humans as well as difference within the same individual based on state changes (e.g., fatigue, stress)
- Develop new methods and algorithms that can predict an individual's performance in complex environments
- Design neurotechnologies that can improve Soldier-system performance by adapting the system to dynamic fluctuations in human performance

Functional & Structural Connectivity



Individualized
Neurotechnology

Challenges

- Robust techniques for low SNR in real-world, multi-tasking environments
- Developing new methods to detect dynamic changes in brain signals that are predictive of performance in concurrent task environments
- Collecting long-term data from individual subjects performing complex tasks to capture individual variability and enable method development to account for this variability
- Integrating data from multiple research sites and standardizing the data to support big data analysis approaches



ARL Facilities and Capabilities Available to Support Collaborative Research

- **Unique laboratory facilities (at APG, MD):**
 - Mission Impact for Neurotechnology Design (MIND) Laboratory
 - Brain Imaging and Experimental Research Suite (BIERS)
 - DoD Supercomputing Resource Center (DSRC)
- **Unique expertise:**
 - Access to unique, military relevant, and often one-of-a-kind data and data collection opportunities
 - Knowledge of translating basic science research to applied settings, including technology development
- **Unique experimental datasets:**
 - Database (N>600) of participants performing real-world tasks, including driving, target detection, etc.
 - Large-scale study of cognitive resilience and fatigue (N>150) with data on brain connectivity, sleep monitoring, behavioral performance, and blood chemistry
 - Study of long-term brain computer interaction (BCI) performance (200+ hours) for healthy users (N>10) by embedding BCI paradigms into a game environment



Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Innovative methods for state detection from physiological measurements
- Techniques for multimodal data integration
- Advanced computational and statistical analysis approaches for big data projects