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Neuroscience research could benefit US Army, yet challenge traditional approaches

WASHINGTON -- Advances in neuroscience research could benefit the Army, particularly in areas of soldier training and education. However, an emerging trend of using individual variability in neural processes such as cognition, stress response, and decision making to improve group performance is likely to challenge conventional approaches to training and educating soldiers, says a new report from the National Research Council.

Taking advantage of the cognitive and behavioral differences among soldiers could enhance individual and unit performance through improved training protocols and provide insight into interventions for stress disorders including post-traumatic stress disorder (PTSD). The Army should expand its own research to include the neural bases of training, learning, and performance, and monitor nonmilitary research in neuroscience to stay abreast of advances that may have military application, said the committee that wrote the report.

Neuroscience research has shown that individual differences in cognitive processes such as memory, learning, resilience, and decision making are deeply rooted in neural structure. These differences can lead to variability in performance at a given task, a consequence that is at odds with the conventional military approach of training soldiers to be interchangeable components of a unit. Rather than attempting to eliminate the differences among soldiers, says the report, the Army should consider how to take advantage of this variability to improve overall unit performance.

Measuring neural indicators of learning, for instance, can aid in assessing how well a trainee has mastered information, and by monitoring these indicators over time, the Army could characterize differences in learning styles and tailor training regimens to the individual. In addition, developing assignment-specific neuropsychological profiles would help predict an individual's success at a particular mission -- critically important when it comes to high-cost, high-stakes assignments. Identifying factors such as decision-making style -- characterizing individuals as either risk-tolerant or risk-averse, for example -- would allow the Army to assign soldiers duties based on their particular style of decision making.

Individual soldiers vary in performance ability, notes the report, both at baseline and in response to stressors such as physical and mental fatigue. This variation is recognized by the Army; elite units such as Special Operations are comprised of individuals hand-picked for their superior performance. By expanding its research into the neural basis of performance, the Army would be able to better assess the baseline performance abilities of all soldiers, and could potentially identify interventions to prevent stress-induced performance degradation, such as nutritional supplements or altered sleep/wake cycles. Biomarkers for resilience -- the ability to adapt to stressors and maintain psychological well-being -- have been identified, as have neurological risk factors for PTSD.

According to the report, neuroscience advances in learning, training, and performance are likely to provide the most benefit to the Army in the near term. Other areas of research that could have military application include the neuropathology of traumatic brain injury, the development of pharmaceuticals for use in cognition enhancement, and neuroergonomics -- a field that looks at the ability of the brain to control an external system like a computer or vehicle. To take advantage of all the potential opportunities in neuroscience research and technology development, the Army should make selective investments -- highlighted in tables S-1 and S-2 of the report -- and monitor areas of nonmilitary neuroscience research being

performed in academia, other federal agencies, and the private sector to identify advances made by others that could be leveraged for Army-specific applications.

In 2008, the National Research Council released a report titled EMERGING COGNITIVE NEUROSCIENCE AND RELATED TECHNOLOGIES, which identified areas of neuroscience research that could be of specific interest to the intelligence community.

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This study was sponsored by the U.S. Department of Army. The National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council make up the National Academies. They are private, nonprofit institutions that provide science, technology, and health policy advice under a congressional charter. The Research Council is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering. A committee roster follows.

Copies of OPPORTUNITIES IN NEUROSCIENCE FOR FUTURE ARMY APPLICATIONS are available from the National Academies Press; tel. 202-334-3313 or 1-800-624-6242 or on the Internet at [HTTP://WWW.NAP.EDU](http://www.nap.edu). Reporters may obtain a copy from the Office of News and Public Information (contacts listed above).

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