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M. K. Taylor
K. P. Sausen, L.R. Mujica-Parodi
E. G. Potterat, M. A. Yanagi
H. Kim

Naval Health Research Center

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Naval Health Research Center
140 Sylvester Road
San Diego, California 92106

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Marcus K. Taylor, Kenneth P. Sausen, Lilianne R. Mujica-Parodi, Eric G. Potterat, Matthew A. Yanagi, and Hyung Kim

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Training in Survival, Evasion, Resistance, and Escape (SERE) is required for U.S. military members at high risk of capture. This physically and psychologically demanding course is considered an analog to the stress imposed by war, captivity, and related events, thus offering a unique and unprecedented medium in which to systematically examine human stress and performance during a realistically intense operational context. Operational stress is multifaceted, manifesting cerebral, neuroendocrine, cardiac, and cognitive characteristics, and necessitating an integration of multiple methods of measurement to appropriately characterize its complexity. Herein we describe some of our present research methods and discuss their applicability to real-time monitoring and predicting of key aspects of human performance. A systems approach is taken, whereby some of the "key players" implicated in the stress response (e.g., cerebral, neuroendocrine, cardiac) are briefly discussed, to which we link corresponding investigative techniques (fMRI, acoustic startle eye-blink reflex, heart rate variability, and neuroendocrine sampling). Background and previous research with each investigative technique and its relationship to the SERE context is briefly reviewed. Ultimately, we discuss the operational applicability of each measure, that is, how each may be integrated with technologies that allow computational systems to adapt to the performer during operational stress.
Keywords: cortisol, MRI, acoustic startle, heart rate variability.

TRAINING IN Survival, Evasion, Resistance, and Escape (SERE), including a period of confinement in a Resistance Training Laboratory (RTL) is required for U.S. military members at high risk of capture. After an initial phase of classroom-based didactic training, students are taken to the field where they receive applied training in survival, evasion, resistance, and escape techniques. Students are then released into the field and tasked with the goal of evading enemy captors. On eventual capture, students are taken to the RTL, where they are expected to apply their recently learned skills of resistance to political indoctrination and captivity-related problems. The structured, choreographed nature of this training platform provides a unique and unprecedented medium in which to systematically and scientifically examine human stress and performance in a realistic military context. Moreover, since SERE training is designed to simulate the prisoner-of-war experience, it offers a unique medium in which to study the effects of captivity stress on key aspects of human performance. Our program of research is designed to identify the extent to which individual differences in brain and peripheral stress system reactivity to (pre-SERE) laboratory tasks are predictive of stress reactivity, military performance, and subsequent memory for captivity-related events that occur during training. Herein we review key methods we are using to quantify individual differences in stress reactivity in an operationally relevant setting; describe how these methods are being applied in a highly relevant operational environment; and discuss possible operational applicability of each neurophysiologic measure relative to real-time monitoring systems.

Some of the research methods presently being employed in our study aimed at elucidating the multifaceted nature of extreme operational stress are described in this report. To begin, some of the "key players" of the stress response (e.g., cerebral, neuroendocrine, cardiac, and cognitive-behavioral systems) will be briefly discussed, to which we will link specific investigative techniques used to characterize their respective responses during SERE training (e.g., fMRI, acoustic startle eyeblink reflex, heart rate variability, neuroendocrine sampling). Background and previous research with each investigative technique in the SERE context will build the "theoretical platform" for each method. Most importantly, we will discuss the operational applicability of each neurophysiologic measure, how each may serve

From the Naval Health Research Center, San Diego, CA (M. K. Taylor, K. P. Sausen, M. A. Yanagi); State University of New York, Stony Brook, NY (L. R. Mujica-Parodi); and Fleet Aviation Specialized Operational Training Group, Pacific, San Diego, CA (E. G. Potterat, H. Kim).

Address reprint requests to: Marc Taylor, Ph.D., LT, MSC, USN, Naval Health Research Center, PO Box 85122, San Diego, CA 92186-5122; taylorm@nhrc.navy.mil.

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as a tool to monitor and predict stress reactivity, cognition, memory, and other key elements of human performance during operational stress. The Institutional Review Board at the Naval Health Research Center has approved this study, and each subject has provided written informed consent prior to participating.

"Key Players" in the Stress Response

Cerebral Factors

The limbic system includes the hypothalamus, hippocampus, amygdala, and several related structures (e.g., cingulate gyrus, septum, ventral tegmental area, and prefrontal cortex). The amygdala is implicated in emotional memory as well as the generation of anger and fear, and is particularly important for modulating the storage of emotionally charged memories (15). More specifically, it has been shown that the amygdala is particularly important for recalling the gist (though not the details) of emotionally charged memories (2), and is known to play a vital role in the memory of faces (1). The hippocampus is primarily responsible for consolidation of declarative information into long-term memory, and is particularly important for declarative, spatial, and contextual memory, and for modulation of the hypothalamic-pituitary-adrenal (HPA) axis. The hippocampus and its surrounding structures, richly populated with cortisol receptors, are particularly vulnerable to damage from glucocorticoids secreted during chronic stress by the HPA axis, thus demonstrating a key neurobiological link between stress and memory. Stimulation of the hippocampus is known to result in hypervigilance and apprehension (3).

Background/precedence: The use of fMRI technology to study cerebral responses in SERE-related research is unprecedented. Our initial work (Mujica-Parodi LR, et al. Unpublished observations; June 1, 2006) on individual variability with respect to cognitive and physiological resilience to stress indicates that selectivity of amygdalar response to threatening vs. nonthreatening stimuli (rather than either the amplitude or habituation of the amygdala response to threatening stimuli) is predictive of physiological (cardiac, endocrine), cognitive, and self-perceived stress-resilience. Subjects grouped by high and low selectivity show markedly different patterns of neural activation; that is, individuals with high-selectivity demonstrate tight patterns of activation centered exclusively on the limbic regions, whereas individuals with low selectivity show diffused and global cerebral activation.

Overview of current research strategy: In light of the established links between key limbic structures, stress, and memory, we are presently applying fMRI technology for noninvasive neuroimaging of the brain prior to SERE training, and then exploring its ability to predict key aspects of human performance and stress resilience during training. Specifically, subjects are asked to view a standard set of facial pictures developed by Eckman & Friesen (8). Some of the faces display neutral expressions, while others show emotionally evocative faces (e.g., anger, fear). Endpoints of interest include amygdalar, frontal, and hippocampal activation as determined by the blood oxygen level-dependent signal. It is expected that selectivity of amygdalar response to emotionally evocative vs. neutral faces will relate positively to stress resilience during SERE. Also, in light of the established link between amygdalar activation and memory, it is predicted that increased amygdalar activation in response to the faces task will be associated with greater recall of SERE-related people and events. We are also exploring associations between hippocampal and frontal activation, subsequent SERE performance, and memory of SERE events. Initial data from our collaborative laboratory (Mujica-Parodi LR. Unpublished observations; June 1, 2006.) indicate specific patterns between amygdala reactivity and pre-pulse inhibition (PPI) of the startle reflex (discussed later), where amygdala reactivity to threatening (vs. neutral) facial stimuli is associated with reductions in PPI in response to threatening stimuli. These data indicate that amygdala reactivity is implicated in resilience to mild laboratory stress, but more work is needed to establish the predictability of amygdala reactivity relative to the extreme operational stress endured during SERE training. These and subsequent SERE-specific data will be fully addressed in separate reports. Finally, it is important to note that our research distinguishes between general limbic activation and fear- and anger-related activation. Given the central role of the amygdala in the processing of these emotions, future research should similarly appreciate this distinction.

Operational impact: fMRI technology may be applicable as a means to profile individual differences in stress and performance a priori. This information could then be woven into emerging technologies to combine neurophysiologic sensors and cognitive state gauges within operational platforms, yielding human-computer systems that are modifiable to individual neurophysiologic input. More specifically, fMRI findings from this study could provide additional information to pinpoint task-specific cerebral regions of interest that may be affected during intense military stress, as well as correlate the environmental situations and patterns that elicit the observed responses. This information could then be integrated with emerging real-time field applications, such as head-mounted neurophysiologic monitors designed to detect stress overload and mitigate stress-induced performance decrement via reduction or redistribution of information or workload. Additionally, once the environmental patterns and situations are identified that elicit harmful responses, an inference engine or classifier can be implemented to scan subsequent incoming information and stimuli to "keep an eye out" for future events of similar consequence. The prerequisite, of course, is a clear understanding not only of a causal link between the limbic structures of interest and subsequent operational decrement, but also of the particular patterns of brain activation in response to operational stress, both of which this program of research is designed to improve our understanding. Although our protocol does not address this, it also would be of special interest to examine functional brain activation during and after SERE training. One obvious limitation is that, although there are portable MRI ma-

chines that could be used in the field, SERE students would have to be taken out of the scenario for a substantial period of time, thus detracting from their training experience (**Table I**). Post-SERE FMRI, however, would be an invaluable addition to the growing body of knowledge. In sum, our findings are expected to elucidate the brain regions implicated in the response to extreme military stress, which will then aid in the identification of regions of interest useful to emerging technologies used to promote stress detection and mitigate performance decrement in the operational domain. This will be accomplished either via reduction, redistribution, or modification of the performer's workload, through moderation of environmental stimuli, or both.

Acoustic Startle Eye-Blink Response (ASER)

In addition to fMRI, another readily observable measure with an established biological link to the limbic system concerns the acoustic startle eye-blink response (ASER). This measure, a useful probe for studying brain activity linked with fear, anxiety, and other emotional states in humans, is described in this section.

The ASER is elicited by an abrupt noise, which is processed as a reflex from the auditory nerve by ventral cochlear root neurons projecting to the nucleus reticularis pontis caudalis and on to the facial nerve innervating the orbicularis occuli (muscle that blinks the eye) (6,12). The ASER is measured by placing surface electrodes beneath and beside the eye to record an integrated electromyographic signal. The nucleus reticularis pontis caudalis is innervated by neurons from the amygdala, thus enabling it to modulate the ASER during emotion. In humans, the amplitude of the ASER is increased by images that evoke fear or are otherwise aversive (10). In essence, ASER is believed to be an amygdala-modulated defensive reflex to aversive stimuli when the motivational state is one of avoidance or withdrawal. ASER technology can best be integrated with other measures of stress reactivity, including galvanic skin responses (GSR) and heart rate variability (HRV; discussed later), in order to appropriately characterize the complex, multidimensional nature of stress reactivity. We have taken these steps in our present research, integrating ASER with GSR, HRV, fMRI, and neuroendocrine measures of stress.

Background/precedence: As is true with fMRI, the use of ASER technology in the SERE context is unprecedented. In the laboratory setting, however, Lang and colleagues (5,10,11) have examined ASER in relation to visual stimuli ranging from highly pleasant to highly unpleasant. ASER was shown to increase in response to aversive stimuli; likewise, it is reduced when the emotional content of the picture is rated as pleasant or positive.

Overview of current research strategy: In our study, we present to the participant several standardized photographs from the International Affective Picture System (IAPS), some of which are emotionally neutral, while others are emotionally evocative. All emotionally neutral stimuli are presented on one day while evocative stimuli are presented on the other day, and order of presentation is counterbalanced. The task starts with a 2-min orienting cross followed by 48 IAPS pictures, which are presented for 6 s each. During the task, subjects hear a series of 10 "test" trials and 10 "control" trials, interspersed in pseudorandom order with an interstimulus interval of 8–24 s. Test trials are composed of a brief white-noise pulse (95 dB for 50 ms) preceded by a white-noise prepulse (70 dB presented for 20 ms). The beginning of the prepulse and the beginning of the pulse stimulus are separated by 120 ms. Control trials are composed of a pulse alone (95 dB for 50 ms, without a prepulse). White noise pre-pulses have been shown to exert an inhibitory effect on physiological responses (i.e., sensory gating) to immediately subsequent stimuli relative to non-prepulsed control stimuli.

In light of Lang et al.'s findings (10,11) we hypothesize that participants will demonstrate an increased ASER response to aversive stimuli compared with the neutral stimuli. We further expect that ASER amplitudes will relate to key endpoint measures of stress reactivity during SERE training, including cortisol reactivity, psychological symptoms of dissociation, and declarative memory. Finally, we hypothesize that PPI of the startle reflex will be reduced during the emotionally evocative condition, and will inversely relate to stress reactivity during SERE training as measured by salivary cortisol reactivity. Our pilot work (Mujica-Parodi et al., unpublished observations; June 1, 2006) indicate less pre-pulse inhibition of the startle reflex in the presence of threatening (vs. neutral) stimuli. These data and

TABLE I. SUMMARY OF EXPERIMENTAL TECHNIQUES USED IN SERE RESEARCH.

Technique	Key Measurement Factor	Advantages	Disadvantages
fMRI	Amygdala function, Hippocampal structure and function, and frontal activation	Specifies neuroanatomical regions of interest	May be impractical for real-time monitoring
ASER	Startle reflex; amygdala-modulated defensive reflex to aversive stimuli	Accessible, portable, affordable, minimally invasive; easily synchronized with other stress measures (HRV, GSR) with available software	Possible technology limitations
HRV	Sympathetic and parasympathetic activation	Sensitive to changes in emotional state, stress, and physical exertion; easily synchronized with other measures	Lack of real-time measurement capabilities
Neuroendocrine Sampling	HPA/Sympathomedullary activation	Strong scientific basis linking to stress (predictive power); portable detection systems and patch technology may be available options for operational use	No apparent disadvantages

subsequent links between ASER, PPI, and SERE performance will be addressed in separate reports.

Operational impact: ASER technology is fairly accessible, portable, and reasonably affordable. We anticipate that this technology will be useful as a means to profile individual differences in stress and performance a priori, and it is also conceivable that ASER technology could be integrated into closed-loop human computer interface (HCI) systems (e.g., head-mounted neurophysiologic monitors) designed to improve cognitive performance under operational stress (Table I). Specifically, ASER can help to identify *acute* threat responses (specific time points when the performer is responding to a perceived environmental threat). HCI systems could then accommodate these momentary deviations in affective state of the performer by redistributing or reducing workload, deleting the stressor from the performer's sensory field, and/or by implementing strategies for stress mitigation (e.g., relaxing music). By extension, since prepulses have been shown to inhibit the startle reflex, it is also possible that if monitoring systems could anticipate (through threat recognition) the environmental stressor causing the performer to startle, it could systematically attach prepulse stimuli to inhibit startle. These strategies would help to filter the threatening stimulus from the performer's sensory field or mitigate its effects, thereby promoting attentional control and enhancing operational performance. It is also possible that ASER amplitudes could be converted into gauges made accessible directly to the performer regarding his or her startle responses in the operational environment. This form of biofeedback could be used as a training apparatus to aid the performer in making cognitive or tactical adjustments to adapt to the stressor and, subsequently, improve his or her capacity to cope with environmental demands and prevent performance decrement. Ultimately, it is expected that ASER methodologies could be best utilized by integrating with other established methods of monitoring, including galvanic skin response (GSR) and heart rate variability (HRV), to better characterize and accommodate for acute stress responses in the performer. Such triangulation of data is likely to sense the performer's state with greater accuracy, because multiple methods of measurement converging at a single time point provide greater validity that any single measure alone. To this end, we are employing complex systems analysis, an analytic approach involving the application of complex mathematical models to demonstrate how multiple stress systems behave in synchrony.

In sum, ASER may be a useful instrument not only as a predictor of stress response to environmental threats, but also as a tool to perform real-time monitoring of a performer's perceived threat in the operational domain.

Heart Rate Variability

While ASER is an observable measure of avoidance and withdrawal that is biologically linked to the limbic system, HRV refers to an observable measure of autonomic function that is sensitive to changes in emotional states, stress, and physical exertion. This measure is discussed here, along with a description of its use in our study as well as its possible operational impact.

HRV refers to the variation in heart rate between successive beats, and is commonly described by the standard deviation of intervals between successive R waves in the cardiac cycle. Short-term variation can be decomposed mathematically into components of the frequency spectrum that estimate autonomic modulation of heart rate. In particular, the high frequency component (0.15–0.5 Hz) is believed to correspond to modulation of the cardiac cycle by vagus nerve stimulation, reflecting rapid transmission of acetylcholine in inhibiting heart cells by directly opening ion channels. Conversely, the low-frequency (LF) spectrum (0.05–0.15 Hz) corresponds to baroreflex control of heart rate and reflects mixed sympathetic and parasympathetic modulation. This response is slower, primarily because the action of norepinephrine on heart cells depends on a second-messenger system to open ion channels, in contrast to the direct action taken by acetylcholine. HRV, then, is a noninvasive test of autonomic function which can be dramatically affected by emotional states, stress, and physical exertion (9). As alluded to earlier relative to ASER technology, HRV should be integrated with other measures of stress reactivity to more fully appreciate the complexity underlying stress reactivity—a step we have taken in our present research.

Background/precedence: Anxiety and stress have been associated with lowered HRV, causing a reduction in parasympathetic (vagal) activity and corresponding increase in sympathetic tone. Pagani et al. (24) related stress in humans to an increase in the low frequency variability (LF: 0.04–0.15 Hz) of heart rate, and Dinca-Panaitescu et al. (7) and others (25) found that increases in the QT interval LF component are more specific to mental stress. Additionally, evidence suggests that circadian rhythm of HRV is blunted in rats during chronic stress (31), a finding that has also been reported in humans with coronary artery disease. HRV has also been shown to correlate with cortisol and norepinephrine elevation (13), as well as lowered immune response after stress exposure (4). Furthermore, data from our collaborative laboratory (Mujica-Parodi LR, et al. Unpublished observations; June 1, 2006.) demonstrate links between HRV and amygdala function as well as perceived stress, trait anxiety, and trait anger.

Overview of current research strategy: HRV analysis represents another novel research method being applied in SERE research. In the present study, 24-h electrocardiographic recordings are performed prior to SERE training using the Aria Holter monitor (Del Mar Reynolds Medical, Irvine, CA) with a sampling rate of 128 samples per second. The records are then reviewed and edited using the Impresario Holter Analysis system (Del Mar Reynolds Medical, Irvine, CA). In correlational analyses, HRV during a 24-h period is expected to relate to perceived stress, trait anxiety, and trait anger. In prospective analyses, HRV is expected to predict cortisol reactivity, dissociation, and declarative memory during SERE training.

Operational impact: This program of research will help

to determine whether HRV may be useful as a means to profile individual differences in response to extreme military stress. It appears that HRV could be integrated into augmented cognition platforms and related technologies designed to provide cognitive feedback to an HCI system. As discussed earlier, it is expected that the integration of multiple methods to detect stress responses (e.g., HRV, GSR, and ASER) is needed to optimally monitor, appropriately characterize, and effectively accommodate acute stress responses in the performer. A central limitation, however, concerns the ease with which HRV data could be processed in real-time (Table I). At present, data analytic methods for HRV are tedious and time consuming, and advancement in these methods is a crucial prerequisite to the successful application of HRV technology during stressful military operations.

Neuroendocrine Sampling

As ASER and HRV refer to observable measures of biological processes implicated in operational stress, HPA axis reactivity is also observable through noninvasive sampling of stress hormones. Our method for quantifying HPA reactivity to SERE training is discussed in this section, along with a description of its use in our work as well as its future operational impact.

Perhaps the most well known physiological response to stress concerns the HPA axis. Emotional responses to perceived threat are generated in the limbic system, and signals are sent to subcortical brain centers and the hypothalamus. The hypothalamus, in turn, activates the posterior pituitary to secrete vasopressin and oxytocin, and the adrenal medulla to secrete epinephrine and norepinephrine. Similarly, the anterior pituitary releases adrenocorticotropic hormone, which activates the adrenal cortex to release glucocorticoids. The primary glucocorticoid is cortisol, which mobilizes energy for action and inhibits the immune response (23).

Background/precedence: Captivity is known to elicit elevated levels of cortisol. For example, free-ranging monkeys that were subsequently captured and held for 45 d manifested significantly higher cortisol levels during captivity than free-ranging monkeys who were killed by hunters just prior to blood sampling (30). The later group presumably had no substantial systematic threat prior to being killed. Restraint stress, an animal model of captivity, consistently results in elevated stress-related hormones and neurotransmitters (16). SERE training has likewise been shown to result in significantly elevated catecholamine levels (20).

Excessive cortisol levels resulting from chronic exposure to severe stress (as occurs during SERE training) are also known to degrade recall (14,26,29). Specifically, cortisol evokes suppressing effects on the hippocampus (14) and degrades perceptual processes important not only for encoding information (i.e., tunnel vision) but also for memory of salient information (29). Acute exposure to high cortisol levels results in degraded declarative memory, which is reversible on return to normal levels. By contrast, chronic exposure to elevated levels of cortisol has been shown to damage hippocampal neurons (27-29), and may further suppress normally occurring neurogenesis.

Unlike the research methods discussed earlier, measurement of cortisol responses and other stress-related hormones is not without precedence in SERE research (17–21). Morgan and associates (19), for instance, collected salivary data from 109 Army SERE students at baseline, during 4 stress exposure time points during SERE training, and at recovery. Cortisol increased significantly during the captivity experience, was greatest after exposure to captivity-related problems, and remained elevated during recovery. These researchers have also studied neuropeptide-Y (NPY) at baseline, during a captivity phase of SERE training, and after conclusion of training (21). In this study of 49 Army SERE students, NPY levels were significantly elevated compared with baseline following captivity-related problems and were significantly higher in Special Forces soldiers, compared with their non-Special Forces counterparts. NPY was positively related to both cortisol and behavioral performance under stress, and inversely related to psychological symptoms of dissociation, thus implying a stress-buffering effect of NPY. These findings were replicated in a similar study conducted at the Navy SERE School (18). In yet another study of neuroendocrine reactivity to SERE stress, Morgan et al. (20) demonstrated that cortisol release accounted for significant portions of variance in psychological symptoms of dissociation (22%) as well as military performance (31%). Finally, these scientists (22) have more recently demonstrated that dehydroepiandrosterone sulfate (DHEAS)/cortisol ratios were significantly higher in subjects who reported fewer symptoms of dissociation and exhibited superior military performance during SERE training, further implying a stress-buffering role of DHEAS.

Overview of current research strategy: In our research, an extensive panel of pre-SERE cortisol samples are taken at regularly scheduled times throughout a 2-d period in order to establish a normal baseline of diurnal patterns. Cortisol responses to a series of mild cognitive laboratory stressors are also measured prior to initiation of SERE training. Next, we assess cortisol reactivity at several time points during the captivity phase of SERE training, including a particularly challenging training event. In total, we establish baseline cortisol measures with extensive pre-SERE sampling, to which we compare cortisol responses to acute military stress (i.e., postevasion SERE captivity). It is expected that baseline cortisol values as well as cortisol reactivity to mild laboratory stressors will predict cortisol reactivity during SERE training. Also, in agreement with Morgan et al.'s findings, our current data demonstrate that cortisol during captivity differs rather dramatically from baseline, and peaks directly after the challenging training events. These findings are in preparation for report in subsequent publications. We are further exploring individual differences in cortisol reactivity to SERE training, as well as its relation to other neuroendocrine responses.

Operational impact: The next step is to explore the applicability of the present neuroendocrine research to

mitigate performance decrements in the performer or warfighter. A possible application can be found in "skin patches" currently being researched to monitor biochemical responses to operational stress via detection of cortisol, catecholamines, DHEA, NPY, other relevant stress hormones, alarm pheromones, and related chemicals (Table I). Detection of extreme amounts of cortisol via patch technology, for instance, could be fed back to a monitoring system that could then make adjustments in the workload or complexity of tasking for the overstressed performer, thus bringing his or her cortisol levels back within a predetermined effective range. Alternatively, a feedback system could be designed, where the patch is programmed to counter the detected stress responses with input of naturally occurring stress-countering substances such as DHEA or NPY, or a pharmacologically based alternative.

Summary

In the preceding discussion, we described several research methods aimed at capturing the multifaceted nature of acute operational stress during SERE training; we briefly reviewed some of the key players implicated in the stress response, to which we linked specific investigative techniques (e.g., fMRI, acoustic startle reflex, HRV, and neuroendocrine analyses) presently employed in the SERE study; we discussed the operational relevance of each neurophysiologic measure, how each may serve as a tool to predict and monitor stress reactivity, cognition, memory, and other key elements of human performance during operational stress.

By no means are these methods all-inclusive approaches to characterizing human stress during extreme environments and associated performance decrement. It may be beneficial, for instance, to combine spatial measures (e.g., fMRI) with more temporal methods (e.g., EEG, ERP) which may give more insight into how quickly someone may or may not react to certain stressors. Such integration of methodologies may be beneficial for identifying predictors of resilience a priori. Additionally, it is critical to appreciate that stress responses and resultant human performance outcomes is an inherently complex phenomenon, and the use of multiple methods to characteristic physiologically distinct (but possibly cross-correlated) mechanisms is greatly preferred over any single measure alone. Finally, the realistically stressful SERE environment confers unprecedented ecological validity. This, in turn, may lead to new knowledge and associated neurophysiologic monitoring techniques leading to new treatment options for combat stress and post-traumatic stress disorder.

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6. AUTHORS
M. K. Taylor, K. P. Sausen, L. R. Mujica-Parodi, E. G. Potterat, M. A. Yanagi & H. Kim

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14. ABSTRACT (maximum 200 words)

Introduction*:** U.S. military members at high risk of capture are required to attend Survival, Evasion, Resistance, and Escape (SERE) training. This physically and psychologically demanding course of training is considered a reasonable analogue to the stress imposed by war, captivity, and related catastrophic events. SERE training offers the scientist a unique and unprecedented medium in which to systematically examine human stress and performance during a controlled, yet realistically intense, operational context. Operational stress is multifaceted—manifesting cerebral, neuroendocrine, cardiac, and cognitive–behavioral characteristics—necessitating an integration of multiple methods of measurement to appropriately characterize its complexity. ***Methods: This paper describes some of our present research methods with potential for applicability to monitoring and predicting key aspects of human performance in operational contexts. To begin, a systems approach is taken, whereby some of the "key players" implicated in the stress response (e.g., cerebral, neuroendocrine, and cardiac systems) is briefly discussed, to which we link corresponding investigative techniques (e.g., FMRI, acoustic startle eyeblink reflex, heart rate variability, neuroendocrine sampling) presently employed in the SERE study. Background and previous research with each investigative technique in the SERE context is briefly reviewed. ***Operational Relevance:*** Ultimately, we discuss the operational applicability of each neurophysiologic measure, how each may be integrated with personal monitoring systems designed to enhance performance during operational stress.

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