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The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.

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13. ABSTRACT *(Maximum 200 words)*

Humans who are high risk takers and high sensation seekers show increasing amplitudes (augmenting) of the P1-N1 components of the visual evoked potential (VEP) increasing intensities of light flash, whereas low risk takers show VEP reducing. We developed an animal model of this important dimension of behavior in which we reported that cats and rats who display high levels of exploration, activity, aggression, and risk taking show VEP augmenting as do their human counterparts; similarly cats and rats that are low sensation seekers are VEP reducers. Our published papers describe a number of neurophysiological characteristics associated with VEP augmenting and reducing and thus high and low sensation seekers. We also demonstrated, in our rat model, that augmenting/reducing and the sensation seeking trait have a heritable basis.

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Statement of Problem Studied

Low risk takers do not function well under high stress. In contrast, high risk takers not only function well under stress, they often seek out such situations. High and low risk takers may also be described as high and low sensation seekers, respectively. The goal of this project was to determine the brain differences (electrophysiological and chemical) that determine high versus low risk-taking behavior. It has been shown that humans who are high risk takers and high sensation seekers tend to exhibit augmentation of visual evoked potentials (VEPs) to increasing intensities of light flash recorded from the cerebral cortex. In contrast, low sensation seekers show **reduction** of VEP amplitudes to increasing intensities of light. We have developed two animal models (cat and rat) of the relationship between this behavioral trait (sensation seeking) and a brain response (VEP augmenting and reducing). These animal models have permitted us to explore the neural and chemical factors that underlie individual differences of an important behavioral trait, namely the readiness to undergo and cope with stress in risky situations.

Summary of Most important Results

During the period of this project the findings of our research have been published in seventeen papers. The most important findings are summarized below.

1. VEP augmenting and reducing is related to high and low sensation seeking in cats and rats. This established these two species as animal models with a neurological marker for studying the neural basis of this important behavioral trait.

2. Stimulation of the ventral tegmental area in cats suppresses attack behavior and reduces the receptive field for hypothalamic biting attack.

3. A frontal sinus reference electrode in cats is **not** an indifferent reference lead for the recording of visual evoked potentials.

4. An area of the subcortical basal forebrain of cats has efficacy in inhibiting spinal dorsal horn responses to nociceptive stimulation.

5. VEP augmenting and reducing (A/R) responses are reliable and stable indicators of high and low sensation seeking behaviors in cats.

6. Chloral hydrate in doses controlled by EEG power spectra analysis can produce a stable anesthetic state that yields stable VEPs that are indistinguishable from VEPs recorded from unanesthetized rats.

7. Rats selectively bred for high and low avoidance behavior are VEP augmenters and reducers, respectively. High and low avoidance rats also exhibit traits of high and low sensation seeking, respectively. These two genetic strains of rats comprise an animal/rat model of A/R as related to high and low sensation seeking. This study also demonstrated that A/R and sensation seeking behaviors have a heritable basis.

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8. VEP A/R occurs at the cortex and is not a reflection of events at the thalamus. This finding indicates that future research on the brain mechanisms basic to the differences between A/R and high and low sensation seeking can concentrate on exploring the cortex where the neural differences are generated. Future work can determine the neural transmitters that differentially affect the cortex in augmenters and reducers and also bias behavior toward high or low sensation seeking and risk taking.

List of Publications During This Reporting Period

Goldstein, M. and Siegel, J. Stimulation of ventral tegmental area and nucleus accumbens reduce receptive fields for hypothalamic biting reflex in cats. Exp. Neurol., 1981, 71:239-246.

Joseph, R., Forrest, N., Fiducia, D., Como, P., and Siegel. J. Electrophysiological and behavioral correlates of arousal. Physiol. Psychol., 1981, 9:90-95.

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Saxton, P. M., Siegel, J. and Lukas, J. H. Visual evoked potential augmenting/reducing in cats: 1. Reliability as a function of flash intensity range. Personality and Individual Differences., 1987, 8:499-509.

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Siegel, J., Sisson, D.F. and Driscoll, P. Augmenting and reducing of visual evoked potentials in Roman high- and low-avoidance rats. Physiol. Behav., 1993, 54:707-711.

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Siegel, J. Augmenting and reducing of visual evoked potentials in high and low sensation seeking humans, cats and rats. Behav. Genet., in press.

Morton, C., Siegel, J., Xiao, H.-M. and Zimmermann, M. Modulation of cutaneous nociceptor activity by electrical stimulation in the brain stem does not inhibit the nociceptive excitation of dorsal horn neurons. Pain, 1997,71:65-70.

Driscoll, P., Escorihuela, R., Fernandez-Teruel, A., Giorgi, O., Schwegler,H., Steimer, T., Wiersma, A., Corda, M., Flint, J., Koolhaas, J., Langhans, P., Schulz, P., Siegel, J., and Tobena, A. Genetic selection and differential stress responses: The Roman lines/strains of rats. Ann. N.Y. Acad. Sci., in press.

In addition to the above publications, 47 presentations of the ARO-sponsored research were delivered at national and international conferences and at academic institutions in the U.S. and abroad.

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