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existing toxic materials. New, more efficient and environmentally benign organic reactions, both stoichiometric and catalytic, are of interest, especially nitration and oxidative and nucleophilic displacements at phosphorus and sulfur for destruction of toxic organic compounds. Selected mechanistic studies that promise new insights to the pathways of the above reactions are encouraged as are new synthetic pathways with reduced production of waste by-products.

Technical Point of Contact: Dr. Stephen Lee, e-mail: Stephen.Lee2@us.army.mil, (919) 549-4365.

7.4. Polymer Chemistry. The Polymer Chemistry Program seeks novel, fundamental polymer research that may lead to new materials that provide the soldier with critical protection and required materiel. Research of interest may be related to chemical and biological agent protective materials, ballistic protection, transparent materials for eye protection and sensors, including laser protection, materials that have tunable optical properties, and lightweight super-strong materials. Research areas of interest that may be relevant include synthesis of polymers, including polymers with novel architectures and compositions, new approaches to synthesizing polymers, organic/inorganic hybrid polymer materials, creating light-weight polymeric materials with enhanced strength, and the design and synthesis of environmentally benign polymeric materials that may benefit the soldier. Also of potential interest is characterization structure/property relationships, diffusion and transport, and fiber properties related to polymer chemistry.

Technical Point of Contact: Dr. Douglas Kiserow, e-mail: Douglas.Kiserow@.us.army.mil, (919) 549-4213.

7.5. Surfaces and Catalysis. This program supports fundamental research on the decomposition and interaction of molecules on well-characterized surfaces, and catalysts. The development of new experimental probes of these reactions is also of interest. The most important species are organo-phosphorus, -sulfur, and -nitrogen molecules, and reactions of organic functional groups on surfaces and catalysts. Research areas of interests include nanoparticle reactivity, the interface between nanostructures and biomolecules, the reaction mechanisms of hazardous materials with plasmas, and the fate of toxic materials on surfaces in the environment.

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7.6. Theoretical Chemistry. Army requirements for insensitive munitions, for propellants and explosives with greater energy density, for the control of propellant burning rates, and controlled energy release from explosives provide a continuing interest in a variety of theoretical explorations. Theoretical investigations may provide predictive capabilities relevant to the properties and behavior of a wide spectrum of energetic materials and their prototypes. Specific erxamples are studies of energy transfer mechanisms in condensed phases, the prediction of molecular reactivities, the investigation of heterogeneous reactions, and the prediction of reaction pathways. Theoretical understanding of atoms, molecules and clusters on surfaces may provide the basis for rational design of catalysts.

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RESEARCH AREA 8
LIFE SCIENCES

8.0. Extramural research in the Life Sciences is supported by the Army Research Office. For those proposals related to purely medical topics, the investigator is invited to contact the U.S. Army Medical Research and Materiel Command. For research in the behavioral and social sciences or in training techniques, contact the Army Research Institute for Behavioral and Social Sciences. The ARO Life Sciences Division research program is currently focused on four sub area work packages. The titles, scopes and points of contact for these work packages, each of which address general aspects of basic research in biotechnology, as well as the specific thrusts described, are listed below. A small number of symposia, conferences and workshops are also supported in part or in whole to provide an exchange of ideas related to ongoing programs in Army laboratories.

Potential offerors are strongly encouraged to contact the appropriate Technical Point of Contact (TPOC) for preliminary discussions on their ideas before any submissions. The TPOC may invite the offeror to submit a preproposal.

8.1. Biomolecular and Cellular Materials and Processes. Fundamental studies are needed to define structure-function relationships and biochemical interactions for enzymes, receptors and other macromolecules exhibiting mechanisms and properties uniquely relevant to synthetic and degradative pathways of interest to the military, including establishment of the foundations for manipulation and exploitation of biocatalysis, ribosomal and non-ribosomal biosynthesis to enhance permissiveness toward elaboration of useful biomolecular structures and cellular systems designed with "metabolic engineering" in mind. Also, research to provide insight from nature on novel theoretical principles and mechanisms in sensory and motor function, as well as on materials with extraordinary properties from biological sources is needed. Research topics include not only initial molecular events, signal transduction pathways and integrated information processing for the powerful sensing capabilities exhibited in the biological world, but also self-assembly processes, hierarchical structure formation, and functional characterization of biomolecular materials such as those with potential "biomimetic" utility for nanometer scale fabrication or for energy and information transfer, among other possibilities.

Technical Point of Contact: Dr. Robert Campbell, e-mail: Bob.Campbell@us.army.mil, (919) 549-4230.

8.2 Molecular Genetics and Genomics. This program emphasizes basic research in molecular genetics and genomics that will enable optimization of soldier cognitive and physical performance, soldier protection, and Army logistics. This includes human performance and protection under both normal conditions, and when affected by a variety of stressors that are likely to be encountered in battlefield situations, such as dehydration, heat, cold, sleep deprivation, fatigue, caloric insufficiency, microbial factors, and psychological stress. Genetic and genomic research areas include identification and characterization of gene function, gene regulation, genetic interactions, gene pathways, gene expression patterns, mitochondrial regulation and biogenesis, and nuclear and mitochondrial DNA replication, mutagenesis, oxidative stress, and DNA repair. Also, areas of research interest are molecular responses to pathogens, pathogen identification, and pathogen inactivation, as well as host-pathogen interactions, and host components of infection and resistance to infection. This program is also interested in the biotechnology of microarrays, including both genomic- and proteomic-based platforms, for real time detection of pathogens or physiological states that would reduce or interfere with human performance. This program also supports development of new biomaterials and bioproduction methods, and other advances in biotechnology methods and applications.

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8.3. Microbiology and Biodegradation. Biochemical and physiological mechanisms, underlying the biodegradative processes in normal, extreme, and engineered environments and fundamental studies on organisms in these environments, the properties of materials that make them susceptible or resistant to biological attack, basic concepts for anti-fungals, and studies of microbiological mechanisms with potential for contributing to the remediation of sites contaminated with toxic wastes are of interest in this subarea. Included are research investigations in analytical microbiology (including microbial signatures), and in general microbial mechanisms with relevance to Army problems. Addressed here also is research into microbial communities and how to study organisms that cannot be grown in the lab, as well as research into methods to enhance the stabilization of military materiel, which would include methods to prevent microbial growth. Also included is the development of microbial systems for unique biotechnological applications and bioengineering processes with individual microbial species or consortia of microorganisms, emphasizing the control, stability, and mechanisms of the basic cellular processes involved.

Technical Point of Contact: Dr. Shirley Tove, e-mail: Sherry.Tove@us.army.mil, (919) 549-4344.

8.4. Neurophysiology and Cognitive Neuroscience. Research in the perception and cognition subfields of neurophysiology and the cognitive neurosciences, covering several or all areas of electrophysiology, psychophysiology, sensory and perceptual physiology, computational neurobiology, psychophysics, neuropsychology, and integrative neurobiology is of interest. Specific examples can include physiological, neuro-psychological and/or cortical/cognitive mechanisms underlying successful completion of complex task behaviors applicable to non-laboratory environments under non-ideal conditions, to include both amelioration of induced

losses as well as enhancement in defined perceptual, cognitive and/or motor abilities. Investigations can span the gamut from multi-unit recordings through evoked potentials and neuro-imaging technologies to humoral and psychological correlates of both central and peripheral nervous system function. Non-medically oriented research designed to elucidate the fundamental physiology underlying cognition and possible non-invasive methods of monitoring cognitive states and processes during normal activity is appropriate. Perceptual and/or psycho physiological implications of mind-machine interfaces ranging from optimizing auditory, visual and/or somatosensory display and control systems based on physiological or psychological states through modeling of individual cognitive dynamics and decision making is appropriate to this research area.

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RESEARCH AREA 9
MATERIALS SCIENCE

8.0. The objective of research supported by the Materials Science Division of the Army Research Office is to discover the fundamental relationships that link chemical composition, microstructure, and processing history with the resultant material properties and behavior. The work, although basic in nature, is focussed on developing new materials, material processes, and properties that promise to significantly improve the performance, increase the reliability, or reduce the cost of future Army systems. With the need for lighter weight and higher performance systems in the future, program emphasis has increasingly shifted away from metals research to a more balanced program with interests that cross a broad spectrum of materials, including polymers, ceramics and semiconductor materials. Fundamental research that lays the foundation for the design and manufacture of multicomponent systems such as composites, hierarchical materials and "smart materials" is of particular interest.

Potential offerors are encouraged to contact the appropriate Technical Point of Contact (TPOC) for preliminary discussions on their ideas. The TPOC may invite the offeror to submit a preproposal.

9.1. Materials Design. The objective of the materials design program is to tailor material properties for application-driven property requirements. The research should investigate property interrelationships in materials growth, processing or characterization with the approach eventually leading to stronger coupling of experimental research with theory or modeling (including phenomenological modeling). The goal is to predict and control material behavior during processing and operation, to predict property changes over time (based on science rather than statistics), to optimize performance and reliability, and to reduce cost and time to development. It would also be advantageous to develop strategies to define constraints imposed by the experiment and theory and to establish and populate open databases for processing-microstructure-properties-performance etc. These could be continually updated to enable design, simulation, modeling and theory to evolve and ultimately for property tradeoff in support of performance optimization to occur. In addition, this should also facilitate communication among researchers and engineers at the materials, subsystem, and system level. One area of emphasis will be surface and interface engineering in support of materials integration. There is particular interest in identifying new ways of combining similar and dissimilar materials which provide multifunctional capabilities, recognizing that functionality is often derived from properties very close to the interface. Processing models that build a solid theoretical underpinning will be a key to control/optimization of surface and interface properties. Surface and interface research in areas such as organic/semiconductor, bio/semiconductor, or bio/organic/semiconductor interfaces; dielectrics/semiconductor interfaces; transparent conductive thin films; dissimilar material and nano electrical contacts; and bonded or alternative substrates can be envisioned. Another area of emphasis will be development of in-situ and ex-situ analytical methods for analysis over the appropriate dimensions, that is, methods with appropriate spatial resolution or appropriate sensitivity. The goal is to understand and control material and growth parameters that affect a desired or undesired property within a particular property range. Other areas of interest are investigations of high temperature materials and their relevant degradation modes; development of adaptive materials capable of response to internal or external stimuli; study of self-repair or self-healing effects; growth and characterization of embedded nano-sized constituents designed for material and performance health monitoring; and investigations of novel methods leading to large-scale, large-quantity processing of nanomaterials. It is intended that in addition to