ENQUIRE 2019 – Cluster 11 - Functional/Cognitive Neuroscience

This report details the changes in scientific scope for study sections evaluated under the ENQUIRE process in 2019 as part of Cluster 11. ENQUIRE integrates data and input from multiple stakeholders – the external scientific community, extramural programs at NIH, and CSR staff. An external panel of accomplished scientists, each with broad expertise and experience with multiple study sections was convened and asked to recommend changes necessary to facilitate the identification of high impact science, with special consideration of emerging science. Second, a panel of NIH extramural staff was convened and asked to focus on review process and concerns raised by the external recommendations. Additional input was provided by the CSR Advisory Council and by CSR staff in drafting of study section guidelines. Finally, to test the practicality of the recommended changes and the likely size of resulting study sections, CSR performed mock application referral using the new guidelines.

These changes will be implemented for grant applications submitted for Oct 2020 grant deadlines and beyond. New slates will be developed for each new standing panel to ensure expert review of the topics within each. Those who are members of currently existing panels with time remaining in their term will be to be asked to continue to serve, on one of the newly formed panels.

Evaluated Study Sections

Neuroendocrinology, Neuroimmunology, Rhythms and Sleep (NNRS)
Neurobiology of Learning and Memory (LAM)
Language and Communication (LCOM)
Somatosensory and Pain Systems (SPS)
Sensory Motor Integration (SMI)
Ocular Surface, Cornea, Anterior Segment Glaucoma, and Refractive Error Special Emphasis Panel (ZRG1 BDCN-J 81)
Cognition and Perception (CP)
Mechanisms of Sensory, Perceptual, and Cognitive Processes (SPC)
Auditory System (AUD)
Biology of the Visual System (BVS)
Diseases and Pathophysiology of the Visual System (DPVS)
Chemosensory Systems (CSS)

Formed Study Sections

Auditory Systems (AUD)

Neuroscience of Basic Visual Processes Study Section (NBVP)

Behavioral Neuroendocrinology, Neuroimmunology, Rhythms, and Sleep (BNRS)

Biology and Development of the Eye (BDE)

Neuroscience of Interoception and Chemosensation (NIC)

Human Complex Mental Function (HCMF)

Language and Communication (LCOM)

Learning, Memory and Decision Neuroscience (LMDN)

Neurobiology of Pain and Itch (NPI)

Pathophysiology of Eye Disease 1 & 2 (PED)

Sensory-Motor Neuroscience (SMN)

Auditory System Study Section - (AUD)

The Auditory System Study Section (AUD) reviews applications on the structure and function of the auditory and peripheral vestibular systems in human and animal models. Approaches include molecular, cellular, physiological, genetic, pharmacological, computational, behavioral, bioengineering, and neuroimaging methods. Research reviewed in this study section generally emphasizes mechanisms underlying normal and abnormal function in the auditory and vestibular systems, and/or ways to improve diagnosis and treatment of auditory and vestibular diseases.

Topics:

- Anatomy and physiology of the auditory and vestibular sensory organs.
- Auditory function and changes across lifespan, at the levels of neural circuits, cellular systems, and synaptic physiology.
- Molecular and genetic mechanisms, and gene discovery, for auditory and vestibular function, development, maturation, and aging.
- Development of clinical tools for diagnosis of auditory dysfunction, including ear diseases, hearing loss, central auditory processing disorders, tinnitus, and hyperacusis.
- Hair cell regeneration, gene therapy, drug discovery and delivery.
- Development of hearing aids and other auditory prostheses, including middle ear implants, cochlear implants, brainstem implants, and tinnitus suppression devices.
- Behavioral and psychological therapy for auditory dysfunction, such as auditory training and behavioral therapy for tinnitus.
- Auditory perception, neural correlates of auditory function.
- Computational modeling of synaptic plasticity, neural circuitry, and interactions among brain structures for auditory processing.
- The influence of attention on auditory representation and information flow in the brain. Multisensory integration when the focus is the auditory system.

Neuroscience of Basic Visual Processes Study Section - (NBVP)

The Neuroscience of Basic Visual Processes Study Section (NBVP) reviews applications seeking to study the neurobiological and developmental mechanisms underlying vision and visual perception in both humans and animal models. Any animal model visual system is potentially appropriate. A broad range of approaches is appropriate including electrophysiology, anatomy, behavior, pharmacology, cell or area-specific control of neural activity, EEG, fMRI, psychophysics, invasive recordings and brain stimulation in humans, and theoretical and computational modeling.

Topics:

- Perception, including visual processing of brightness, color, form, motion, and depth.
- Studies of the structure, connectivity, hemispheric specialization, and function of brain regions potentially involved in visual perception.
- Visual information processing in the neuronal circuits from the retina to and including all visual areas of the brain.
- Visual guidance of eye movements and the impact of eye movements on perception.
- Pattern and object recognition in vision, multi-sensory integration that includes vision, and visual perceptual decision-making.
- The control and influence of attention on visual representation, computation, and information flow within the brain.
- Testable theoretical and computational modeling of visual systems with clear ties to the underlying neurobiology.
- Fundamental science that uses retinal and cortical prosthetics to understand visual function.
- The normal and abnormal development of visual neural circuits. The sensory and perceptual consequences of strabismus and amblyopia.

Behavioral Neuroendocrinology, Neuroimmunology, Rhythms, and Sleep - (BNRS)

The Behavioral Neuroendocrinology, Neuroimmunology, Rhythms, and Sleep Study Section (BNRS) reviews applications to study circadian rhythms and sleep, neuroendocrinology, and neuroimmunology in a behavioral context. Studies may employ genetic, biochemical, bioinformatic, molecular, anatomic, or developmental approaches. Studies typically use either vertebrate or invertebrate animal models, but relevant applications involving human subjects are also reviewed. BNRS considers applications across the lifespan including development, maturation and aging, as well as rhythmicity and plasticity in the adult.

Topics:

- Neural circuitry of circadian and other activity rhythms including pacemaker mechanisms, output pathways, and peripheral clocks.
- Neural circuit mechanisms that generate, maintain and regulate sleep, and promote arousal, including the influences of external stimuli, neuroendocrine systems, and the internal state on circadian rhythms and sleep.
- Mechanisms through which circadian rhythms or sleep affect organ systems, and normal physiological processes, such as ingestive behaviors, reproductive hormones, stress hormones, emotional states, cognition, the immune system, aging, and disease.
- Reproductive neuroendocrinology of the hypothalamic-pituitary-gonadal (HPG) axis and related circuits, with emphasis on the impact of reproductive hormones on the neural basis of reproductive, cognitive, and other behaviors.
- Stress neuroendocrinology of the hypothalamic-pituitary-adrenal axis (HPA) and related circuits, with emphasis on the impact of stress hormones on neuronal processes in affective and cognitive behaviors.
- Social/affiliative neuroendocrinology with emphasis on the impact of hormones on neuronal processes contributing to maternal, affiliative, and social behaviors.
- Ingestive behavior, including neural regulation of food and fluid intake, and whole-body energy homeostasis.
- Interactions between the nervous and immune systems with an emphasis on associated sickness, affiliative, cognitive, and depressive behaviors.

Biology and Development of the Eye - (BDE)

Biology and Development of the Eye Study Section (BDE) reviews applications to study the basic biology of the eye and other light sensing systems. It reviews applications where the major focus is the elucidation of the fundamental biology and mechanisms important for normal visual function or non-visual light sensing systems. Basic studies of eye development are also reviewed here. Studies may use mammalian, vertebrate, invertebrate, bioengineered tissue (e.g. organoids), cell lines, and computational approaches in pursuit of fundamental knowledge.

Topics:

- Anatomy, physiology, cellular biology, molecular biology, vasculogenesis, and biochemistry that underlie the function of the ocular system.
- Control of cell signaling, cell cycle, neuroprotection, autophagy, and apoptosis.
- Ocular stem and progenitor cells and regeneration.
- Photoreceptor and retinal pigment epithelial cell biology and function, including phototransduction, visual cycle, outer segment disc morphogenesis, phagocytosis, etc.
- Retinal circuitry and signaling between photoreceptors and neurons.
- Development or morphogenesis of any part of the eye or light sensing cells.
- Basic biology of aqueous humor outflow and dynamics.
- Mechanisms of non-image forming light sensation and contributions of these systems to animal behavior.
- Development and biology of the ocular surface, cornea, lens, lacrimal and meibomian glands.
- Biology of refractive error.

Neuroscience of Interoception and Chemosensation - (NIC)

The Neuroscience of Interoception and Chemosensation Study Section (NIC) reviews applications to investigate the genetics, molecular biology, anatomy, and physiology of chemosensation and interoception in humans as well as vertebrate and invertebrate animals, including insect disease vectors. The involvement of these systems in behaviors such as ingestive or social behavior is also an area of interest. The emphasis is on integrative systems approaches to understanding normal sensory function as well as sensory pathology due to injury or disease. Studies may be basic or translational in nature and may use established or emerging model systems, including vertebrate, invertebrate, bioengineered tissue models, and computational approaches.

Topics:

- Chemosensation including olfactory, gustatory and chemesthesis.
- Olfactory and gustatory systems and extended to other types of chemical signaling, such as semiochemicals (pheromones, allomones, and kairomones).
- Chemical sampling used by cells in organ systems outside of the nasal and oral cavities, such as in the gut, kidneys, and sperm.
- Neuroanatomical and neurophysiological aspects of interoception.
- Effects of olfaction and taste, or the microbiome on ingestive behaviors and social behavior.
- Somatosensation in the context of interoception.
- Multisensory Integration: convergence and interaction among the chemosensory, somatosensory, and interoception systems related to composite sensations (e.g. flavor) and/or behavior.
- Mechanisms of olfaction, gustation, touch, and temperature sensation in disease vectors and effects on behavior.

Human Complex Mental Functions - (HCMF)

Human Complex Mental Functions Study Section (HCMF) reviews applications to investigate a broad range of complex mental functions in humans, including attention, perception, navigation, learning, memory, cognition, decision making, executive function, and social cognition. Applications to investigate interactions between functional systems (e.g., emotion and cognition) are reviewed. Developmental, aging, and lifespan applications are covered. Approaches and methodologies include neuroimaging and electrophysiology, electrocorticography, neuropsychology, computational modeling, and non-invasive brain stimulation. HCMF reviews predominantly human subject applications with occasional consideration of other applications proposing non-human primates.

Topics:

- Perception: higher-order perceptual mechanisms for all sensory modalities; object and scene recognition; processing of spatial and temporal relations.
- Attention: attentional control and allocation; capacity and resource limitations; automatization.
- Executive Function: planning and monitoring of complex behaviors; coordination of cognitive operations; consciousness; cognitive control; goal-oriented processing; decision neuroscience.
- Learning and Memory: Encoding, consolidation, and retrieval processes; short-term, working, and long-term memory; episodic/semantic, declarative/procedural, explicit/implicit and other types of memory and their interactions.
- Knowledge and Semantics, including categorization and expert knowledge.
- Skill learning; rule induction; cognitive training, roles of instruction, and practice.
- Reasoning: deductive and inductive reasoning; mathematical and statistical reasoning; analogical reasoning,
- Computational and machine learning approaches to modeling of interactions among brain structures that affect learning, memory, and decision making in humans.
- Problem Solving: use of rules, models, strategies, and heuristics.
- Mathematical Cognition: cognitive processes (and their development) related to science, technology, engineering and math; spatial awareness, number concept.
- Navigation: driving, simulated driving, way-finding, and spatial navigation/representation; effects of age, substance use, and other factors on driving and navigation outcomes.
- Social-affective neuroscience; learning, perception, cognition.

Language and Communication - (LCOM)

The Language and Communication Study Section (LCOM) reviews applications investigating normal and disordered language and communication, and their development across the lifespan (infancy through old age), primarily in humans. Research methods include, but are not limited to, psychological experiments, naturalistic observation, linguistic and logical analyses, computational modeling, and neuroimaging studies.

Topics:

- Perception and production of spoken, written, gestural/signed, and tactile languages at the phonetic, morphological, syntactic, pragmatic and semantic levels.
- Aphasia, developmental language disorder, and other language and communication disorders: their nature, origins, developmental course, assessment, prevention, treatment, and remediation.
- Language acquisition and development across the lifespan, including bilingualism and multilingualism.
- Perceptual and cognitive processes underlying reading and writing abilities and disorders such as dyslexia and dysgraphia; interventions for reading and writing disorders.
- Neurobiological foundations underlying language and communication abilities; including speech, reading, and writing.
- Relations between language and thought; social roles and norms on use of language and other forms of communication; social-cultural influences of assessment and interventions for language and communication disorders.

Learning, Memory and Decision Neuroscience - (LMDN)

The Learning, Memory and Decision Neuroscience Study Section (LMDN) reviews applications to investigate the anatomical and functional neurobiology and mechanisms of learning, memory, and decision making. It includes social/affective learning. The scope of this committee is broad and includes studies focused on the cellular and molecular changes, circuitry, and neural coding and integration that underlie learning, memory, decision making, and cognition. Studies may use established or emerging model systems including vertebrate or invertebrate animals with behavioral readouts, as well as computational approaches. Applications with non-human primates may be reviewed but human studies are generally not.

Topics:

- Anatomical pathways, functional circuits, and behavioral physiology that mediate learning and memory or decision making in normal and pathological states.
- Mechanisms and function of memory encoding, retrieval, and forgetting.
- Unconventional molecular, cellular, and biochemical concepts for memory engrams.
- Neural and synaptic correlates of learning, memory, and decision making assessed at the level of single neuron and population firing patterns, brain rhythms, and imaging in *in vitro* and *in vivo* models including awake behaving animals.
- Cellular, molecular, genetic, and epigenetic events that underlie plasticity, as they relate to learning, memory, and decision making
- Biomarkers of learning, memory, and decision making.
- Circadian influences on learning and memory.
- Effects of developmental perturbations (e.g., stress, drugs of abuse), or age-related change on learning, memory and decision making across the lifespan.
- Effects of disease and injury on the fundamental neurobiological processes underlying learning, memory and decision making.
- Neurobiological mechanisms behind normal developmental and age-related changes in learning, memory and decision making
- Circuitry-level studies of the neural basis of cognition and executive functions (other than those associated with visual, auditory, or chemosensory cues) in animal models.
- Computational, AI, and machine learning approaches to modeling of synaptic plasticity, neural circuitry, intercellular and intracellular processes, and interactions among brain structures that affect learning, memory and decision making

Neurobiology of Pain and Itch - (NPI)

The Neurobiology of Pain and Itch Study Section (NPI) reviews research applications on the neurobiology of pain, analgesia and itch in animals and humans. Approaches include, but are not limited to, molecular biology, genetics, anatomy, physiology, imaging and psychophysics. The emphasis is on approaches to understanding normal sensory function and sensory pathology due to injury or disease.

Topics:

- Mediation and modulation of nociception analgesia; itch and antipruritics. Discovery of novel pharmacological targets and treatments for pain and itch.
- Analysis of the critical circuitry, both spinal and supraspinal, important in pain sensation.
- Analgesics including opiates, non-opioids and other analgesics; mechanisms and clinical treatment approaches to tolerance and dependence on opioids and other drugs with abuse potential.
- Endogenous pain modulatory systems (e.g., endogenous opiates and endocannabinoids).
- Non-pharmacological approaches to pain treatment, including but not limited to, novel therapies, such as neurostimulation, and complementary and integrative approaches (e.g., behavioral interventions).
- Interaction of pain and comorbid conditions, such as anxiety, depression, sleep and other contributory factors.
- The role of the immune system and glia in pain and itch.
- Somatosensation in the context of pain and itch.

Pathophysiology of Eye Disease - (PED 1 & 2)

The Pathophysiology of Eye Disease Study Section (PED) reviews applications to investigate disorders and diseases of the eye. The science ranges from investigations of etiology, to pathogenesis, diagnosis, detection, treatment, and prevention of eye disorders and disease. PED reviews applications proposing to use human subjects or animal models of ocular disease to investigate pathophysiology or translational/clinical approaches. PED 1 and 2 are twin study sections that handle essentially the same set of topics, models, and approaches.

Topics:

- Etiology and pathogenic mechanisms of diseases and disorders of the retina and choroid, including age-related macular degeneration (AMD), retinopathy of prematurity (ROP), diabetic retinopathy (DR), and inherited retinal degenerations, such as retinitis pigmentosa, Stargardt's Disease, Leber's Congenital Amaurosis, etc.
- Diseases, disorders, and treatments of the ocular surface and cornea, such as wound-healing, allergies, dry eye syndrome, lacrimal and meibomian gland dysfunction, bacterial, fungal, and viral corneal infections, corneal dystrophies, Fuchs' dystrophy, keratoconus, uveal melanoma, etc.
- Understanding the pathogenesis and treatment of glaucoma (anterior and posterior) and other neuropathies.
- Neuroimmunology and inflammation associated with age-related macular degeneration, diabetic retinopathy, optic neuropathies, etc.
- All aspects of immunology, infection, and inflammation unique to the eye, such as uveitis.
- Preclinical evaluation of treatment targets and approaches, including gene therapy and stem cell-based therapy.
- Drug delivery to the ocular surface or cornea.
- Application of new technologies of imaging and visual function testing for diagnosis and monitoring of diseases and disorders of the retina and optic nerve.
- Refractive error treatments.
- Pathological aspects of retinal vasculogenesis and angiogenesis.
- Cataracts and posterior capsule opacification.

Sensory-Motor Neuroscience - (SMN)

The Sensory-Motor Neuroscience Study Section (SMN) reviews applications on the anatomical and functional neurobiology of motor, sensorimotor, vestibular, and somatosensory systems. Emphasis is on integrative approaches to elucidate neural substrates of these systems employing neurophysiological, molecular/genetic, neuroanatomical, biophysical, behavioral, neuroimaging, bioengineering and computational methods. Studies may use established or emerging model systems including vertebrate or invertebrate animals, brain-machine interfaces, invasive recordings and stimulation in humans, or computational approaches.

Topics:

- Structure and function of neural systems involved in voluntary and involuntary movement, including neural control and biomechanics of balance, posture, and stance in human and animal models.
- Cortical control of reaching and grasping, motor learning.
- Studies to use brain machine interfaces or neuroprosthetics in order to understand the brain control of movement
- Investigations of sensory-motor control based on invasive recordings and brain stimulation in human subjects.
- Computational and statistical models of sensory and motor control.
- Neuronal and circuit control of vertebrate and invertebrate locomotion, including studies of motor central pattern generators, respiratory central pattern generators, and oral motor function.
- Neural control of sequential and learned movements; movement decision making.
- Integration and coordination of sensory and motor signals, including neural and biomechanical mechanisms of active whisking, escape behaviors, proprioception, birdsong vocal motor control, and learning.
- Vestibular systems studies including vestibulo-ocular reflex, vestibulo-spinal reflex, dizziness, and spatial orientation in human and animal models.
- Integration of sensory inputs and action systems, multisensory integration involving vestibular or proprioceptive senses.
- Disorders of motor control, complex and learned motor behavior in the absence of primary motor deficit, e.g. apraxia. Disorders of motor control involving the basal ganglia (e.g., dystonia) when the focus is on the basic mechanisms.
- Somatosensation; neurobiology of touch, vibrotactile and temperature sensation.