AChemS Symposia 2010

Cilia, Sensory Dysfunction and Disease
Organizers: Jeffrey Martens, Barry Davis
Olfactory dysfunction in the general population is frequent, affecting at least 2.5 million people in the U.S. alone. In at least 20% of the cases the etiology of the chemosensory disturbance cannot be identified. Olfactory dysfunction due to genetic mutations or neurodegenerative disorders affecting cilia has emerged as a clinical manifestation of a newly recognized class of human genetic disorders, termed ciliopathies. This class of diseases involves defects in ciliary assembly and/or protein transport. This symposium will feature talks from several investigators both within and outside the olfactory field whose work combines clinical studies with basic science research to investigate the mechanisms of cilia dysfunction to provide us important new information regarding the pathogenesis of human sensory perception diseases.

Wiring the olfactory systems
Organizer: Jean-Francois Cloutier
The detection of odorant signals from the environment relies on the formation of accurate stereotypical connections between olfactory sensory neurons (OSNs) located in the olfactory epithelium (OE) and second order neurons located in the olfactory bulb (OB). In the mouse, OSNs expressing a single olfactory receptor project their axons to two symmetrically bilateral glomeruli within the OB. Interestingly, these glomeruli are linked to one another through intrabulbar projections of external tufted cells. How do OSN axons select their target glomeruli in the complex three-dimensional target field that represents an OB? The target choice of OSN axons appears to rely on a combination of molecular determinants that enhance the growth of axons to the OB, promote their segregation into broad regions of the OB to form a crude topography and then favor their sorting and convergence into specific glomeruli. This symposium will examine recent progress in our understanding of the molecular mechanisms that underlie both the formation of an accurate glomerular map and the elaboration of intrabulbar connections between specific glomeruli.

Chemoreception in context: interactions with endocrine systems and metabolic state
Organizers: Debra Fadool and Steven Munger
Recently published work and emerging research efforts suggest that olfactory and taste systems are intimately linked with endocrine systems that regulate or modify energy balance. During regular cycles of food intake or during disorders of endocrine function, chemoreception may be modulated in response to changing levels of glucose, insulin, glucagon or incretins. Given the worldwide health concern regarding the rising incidence of diabetes, obesity and related metabolic disorders, we are proposing a symposium that addresses the current knowledge of hormonal modulation of chemosensory perception and how disruption of hormonal signaling in the olfactory or taste systems can impact energy homeostasis or nutrient utilization. The symposium will consist of presentations on the interactions of endocrine systems with olfactory and gustatory systems.

Transient Dynamics, Metastable States and Temporal Coding in Chemosensory Processing
Organizers: Brian H Smith, Maxim Bazhenov
Over the last decade there have been rapid and significant advances in understanding how sensory cells transduce and represent information about odorants and tastants in a wide variety of animals. However, a similarly thorough understanding of how neural networks in the brain process this sensory information remains poorly understood and much more controversial. Computational

modeling studies using realistic biophysical properties and connectivities predict very complicated dynamics in these networks, which is supported by a number of empirical studies. There are two fundamental ways that neural networks might represent chemosensory information. In the first type of model the network rapidly settles into a steady state or into a sequence of repeating states called an 'attractor'. The qualities of the odorant or tastant are associated with that final state, and the path taken to reach that state is not relevant. A second, newer theoretical account of network behavior in early chemosensory processing uses transient states. In these models information about qualities and intensities of odorants and tastants is encoded by the entire response trajectory including the transient path taken to reach the attractor state. These models, therefore, are capable of achieving optimal sensitivity to small differences between inputs, and to ensure reliable responses to repeated presentations of an input in a noisy environment. The symposium will bring together theoreticians and experimentalists who have studied these networks with the explicit goal of comparing how one or another type of model may apply to different animals and chemosensory systems in the brain.

Genetics of Human Olfaction
Organizer: Danielle Reed
The contribution of genetic effects to human olfactory perception in humans is largely unknown. Genetic modeling studies using twins suggest both genetic and environmental effects influence olfactory perception but the research is relatively sparse and does not fully take into account the wide diversity of odorants and the possibility that the genetic architecture of odor perception may differ by odor type or other features of the stimulus. Data do, however, support the notion that individual differences in olfaction are heritable and studies of genotype-phenotype relationships have begun. Genetic variation in odorant receptors is a logical first choice to examine for alleles that affect perception. Thus olfactory receptor segregating pseudogenes, cSNPs and SNPs in regulatory regions, copy number variants and other chromosomal structural variants are candidates that may underlie individual differences in olfactory sensitivity. In this symposium the nature of these differences in human olfactory perceptions and their associations with underlying genotypes will be explored.

Sensory Integration and Competition
Organizer: Denise Chen
Sensory integration and competition are central to our perceptual experience, and yet an understanding of their behavioral properties and neural mechanisms is rather limited. The proposed symposium aims to bring together researchers of diverse backgrounds who will address this broad issue using a variety of novel approaches. The proposed topics include neural mechanisms of olfactory-auditory integration in mice, neural mechanisms of olfactory, visual, and auditory integration in humans, neural mechanisms for the resolution of conflicts between different sensory modalities, binaral rivalry – competition of olfactory percepts between nostrils and in the cortex – and olfactory awareness, and the neuroanatomical integration of olfactory information between the hemispheres.