

## Structure and Organization of Neural Systems in Animals

This topic is a call for papers on the structure and organization of neural systems in animals. This is a perspective that is between the cell biology of neurons and the functioning of a neural system as a whole, such as studied by the brain sciences. The structure and organization of a neural system includes the interconnections of neurons, their synapses, and the higher patterning of these connections, such as common motifs among the networks of neurons. These kinds of information are insightful for revealing the higher functions in these systems and repeatable patterns in their organization.

From the perspective at the cellular level, there is a working knowledge of the evolution and development of neurons and their positioning across the neural system. Further, there is a generic picture of how these neurons interconnect and synapse with one another, but knowledge of the variation in this design is very incomplete. This is relevant to diagnosis of a disease that is associated with the brain. With quantification of the variation in the neural system, then it is possible to identify unusual patterns of neural organization that may be associated with a disease state. These disease states range from those easily associated with tissue pathology to the complex cognitive disorders.

Identification of patterns in the neural system, particularly among individuals, offers a comparison between a control group and a disease that is hypothesized to show a pathology in the neural system. An example is a cognitive disorder that is known to have an association with early development. It should be possible to find a signature of a developmental error in the brain, such as by deviation in the size of a region and the neural interconnections within that region. These kinds of hypotheses range across the disorders that involve the brain, such as loss of long-term memory function. This function involves a pathway that includes many regions of interest, such as the hippocampus and the regions where long-term memories are distributed and stored.

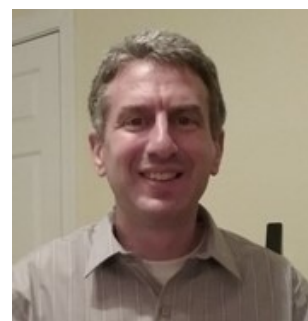
These approaches may include studies of neuron morphology, the organization and biology of synapses, and statistical analysis to find the common patterns in the system. Among the many hypotheses of interest in this area, one hypothesis is the role of the neuron in a complex neural system and how many functional roles it serves as a member of the system. Moving upwards in the hierarchy of neural organization results in questions about the overall organization of a complex neural system, presumably a non-linear dynamic system that is programmable across the many stages of an animal's development. This is in contrast to a view that these systems are largely hard-wired and intrinsically controlled by genetic elements.

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