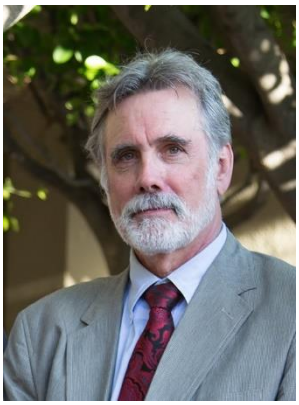

Bio:

Dr. McNaughton's research focuses on the physiological and computational basis of cognition, with particular focus on memory and memory disorders, and the dynamic interactions among neuronal populations and synaptic plasticity mechanisms that underlie these phenomena. He has made significant contributions to the understanding of central synaptic plasticity mechanisms, spatial information processing in the hippocampal formation and cortex, cortico-hippocampal interactions and memory consolidation, and the aging of the nervous system. His current activities focus on understanding the neural mechanisms underlying spatial orientation ('head-direction', 'place', and 'grid' cells in the hippocampal formation and associated networks), the interaction between hippocampal outflow and neocortical signal processing, the reactivation of memory traces during rest periods following learning and the role of this process in memory consolidation, and the self-organization of synaptic networks during early post-natal development of the temporal lobe memory system. He is also engaged in preclinical studies involving altered signal processing in animal models of sporadic Alzheimer's disease and early detection of seizures in medial temporal lobe epilepsy. His work emphasizes the development and application of advanced technologies in neuroscience including high density electrophysiological recording and optical imaging of neural activity at cellular and network levels.

Throughout his career he has been involved in the development and application of new conceptual approaches and innovative technologies to neuroscience research questions and has made numerous contributions in theoretical/computational neuroscience. He was the originator of the 'tetrode' concept, which is the currently most widely used technology for simultaneous recording from large numbers of single brain cells in behaving animals, and which has opened an unprecedented new window on understanding brain mechanisms of cognitive processing and their disorders due to aging, brain disease, substance abuse, developmental disorders and brain trauma. More recently, he has played a key role in the development of two-time point functional neural imaging at cellular resolution based on activity dependent expression of multiple immediate-early genes.

He currently directly supervises 6 postdoctoral fellows, and 8 graduate students, and also directs the Polaris Brain Dynamics research group within CCBN (http://lethbridgebraindynamics.com). He has been a mentor to over 30 graduate and postdoctoral students who have gone on to successful research careers at major research institutions. His research is supported by a $20M/10 year Polaris Award and personnel awards from Alberta Innovates – Health Solutions, and grants from NSERC and the European Commission.