

Chen Institute Symposium 2021

Speaker: John Donoghue

Title: Human Brain Computer Interfaces: Accomplishments, Insights and Challenges Ahead

Abstract: Brain Computer Interfaces (BCIs) designed to assist people with paralysis have progressed over the last 20 years from animal proof of concept through *first in human* trials. Translational and basic science studies have demonstrated the ability for people with longstanding paralysis following stroke, ALS or spinal cord injury to control devices or their own body using output from cortical signals during imagined actions. Signals decoded from cortical networks make it possible for people to communicate effectively and to generate useful reach and grasp actions with their paralyzed limb, though not as well as able bodied people. Human BCI studies have extended our understanding of motor cortex beyond a topographically organized template to one that dynamically integrates information across body parts within small, local populations. In order to create useful devices that provide dexterous and flexible actions it is essential both to understand this ensemble code and to develop long-lasting interfaces that effectively sample the necessary neural signals. Going forward, BCI advances not only have the potential to provide communication and simple actions to people with severe paralysis, but to create technologies for a larger set of people to restore skilled movement, to guide and promote rehabilitation, and to provide new diagnostic capabilities. BCIs will also create a new tool to understand human cortical function but their expanding presence may present deep ethical challenges.