How does the brain prepare?

Abstract: A key goal of the nervous system is to prepare us for upcoming events. This can be in the form of readiness for a motor action, such as a runner in the starting blocks before a race, or a perceptual decision, such as that same runner trying to identify the starter’s whistle amid a noisy crowd. A key form of preparation is attention, the process by which we select some aspects of the external world for special processing, while withdrawing from or ignoring others. This is adaptive because it improves our perceptual abilities at the target of attention, allowing us to recognize stimuli with greater speed and accuracy. Because we are overwhelmed with sensory inputs continuously throughout our daily lives, understanding attention is a key to deciphering the code by which the brain interprets sensory inputs, processes them, and generates motor outputs. My laboratory uses experimental and computational techniques to reverse engineer the biological principles by which the brain deploys attention. In order to do this, we combine single-cell electrophysiology with non-invasive physiological and imaging techniques in the context of a rigorous behavioral paradigm in non-human primates. Bringing all of these methods together, we have been able to identify important principles by which the brain prepares for the rich experiences of our complex natural environment.