BIOENGINEERING
Spring 2020 Seminar

Dante Picchioni, Ph.D.

Biography: The idea of studying consciousness within psychology was extremely appealing to me as an undergraduate. After graduating from University at Albany, I volunteered as a research assistant in the laboratory of Terry Pivik at the University of Ottawa and studied sleep EEG. I wrote to Bob Hicks at San Jose State University about his research on nightmares. He was impressed with my experience, so we worked together on a study on the potential adaptive value of nontraumatic nightmares for my master's thesis. At the same time, at Stanford University, I worked as a clinical sleep technologist and volunteered in the narcolepsy laboratory of Emmanuel Mignot. Dr. Mignot had just discovered the hypocretin/orexin gene mutation that caused canine narcolepsy, and I was fortunate to study these animals with EEG. I wanted to continue studying narcolepsy, so I completed my dissertation on environmental risk factors with John Harsh at University of Southern Mississippi. Narcolepsy is the quintessential sleep disorder because its symptoms are closely tied to basic sleep and arousal processes. To understand narcolepsy, I needed to understand all the basic theoretical and methodological tenets of sleep research, thus it was an ideal dissertation topic. I then decided to learn neuroimaging so that I could apply a technique with superior spatial resolution to sleep research. I was welcomed by Tom Balkin and the sleep group at the Walter Reed Army Institute of Research and told to continue the longstanding collaboration with the NIH Intramural Research Program on sleep neuroimaging projects. I collaborated with Allen Braun in NIDCD, Carolyn Smith in NIMH, and Jeff Duyn in NINDS. With Drs. Braun and Duyn, we collected simultaneous EEG-fMRI data during sleep and thoroughly mined those data. With Dr. Smith, I was the lead associate investigator on a protocol designed to study protein synthesis during sleep with L-[1-(11)C]leucine PET. After collaborating with Dr. Duyn for many years, I was happy to be hired into his laboratory. We have started an all-night fMRI sleep study designed to use auditory arousal thresholds to establish fMRI as an independent measure of sleep and states of reduced consciousness.

Title: All-night functional magnetic resonance imaging sleep studies

Abstract: *Background:* Previous functional magnetic resonance imaging (fMRI) sleep studies have been hampered by the difficulty of obtaining extended amounts of sleep in the sleep-adverse environment of the scanner and often have resorted to manipulations such as sleep depriving subjects before scanning. These manipulations limit the generalizability of the results. *New method:* The current study is a methodological validation of procedures aimed at obtaining all-night fMRI data in sleeping subjects with minimal exposure to experimentally induced sleep deprivation. Specifically, subjects slept in the scanner on two consecutive nights, allowing the first night to serve as an adaptation night. *Results/comparison with existing method(s):* Sleep scoring results from simultaneously acquired electro- encephalography data on Night 2 indicate that subjects ($n = 12$) reached the full spectrum of sleep stages in- cluding slow-wave ($M = 52.1$ min, $SD = 26.5$ min) and rapid eye movement (REM, $M = 45.2$ min, $SD = 27.9$ min) sleep and exhibited a mean of 2.1 ($SD = 1.1$) nonREM-REM sleep cycles. *Conclusions:* It was found that by diligently applying fundamental principles and methodologies of sleep and neuroimaging science, performing all-night fMRI sleep studies is feasible. However, because the two nights of the study were performed consecutively, some sleep deprivation from Night 1 as a cause of the Night 2 results is likely, so consideration should be given to replicating the current study with a washout period. It is envisioned that other laboratories can adopt the core features of this protocol to obtain similar results.