ACKNOWLEDGEMENTS

I would like to acknowledge the members of the Voytek lab for their support over the past 4 years. I feel lucky to have been able to spend this time learning from them and debating the nuances of our research and academia in general. Foremost, I’d like to thank my advisor, Brad Voytek, for his multifaceted mentoring and for nurturing a fun and enriching lab environment. I was especially lucky to join the lab along with 3 other PhD students who have worked alongside me and helped me brainstorm. Tammy Tran often gave helpful advice for with my writing and control analyses, Tom Donoghue has helped make me a much better python programmer, and Richard Gao taught me a lot as we debated about the intricacies of spectral analysis. I also want to thank former post docs Erik Peterson and Roemer van der Meij for their mentorship and advice specifically in programming and signal processing, respectively. Furthermore, I thank the undergraduate researchers for their work in pursuing ideas similar to this thesis: Yimeng Yang, Sunny Pasumarthi, Jenny Hamer, and Andrew Washington.

I would also like to acknowledge generous funding from the National Science Foundation Graduate Research Fellowship program and the Frontiers of Innovations Scholars Program at UC San Diego.

The introduction, in part, is an adaptation of the material that appears in: Cole SR, Voytek B. (2017) Brain oscillations and the importance of waveform shape. *Trends in Cognitive Sciences, 21*(2), 137-149. The dissertation author was the primary investigator and author of this paper.

Chapter 1, in full, is a reprint of the material as it appears in: Cole SR, van der Meij R, Peterson EJ, de Hemptinne C, Starr P, Voytek B. (2017) Nonsinusoidal oscillations underlie pathological phase-amplitude coupling in the motor cortex in Parkinson’s disease. *Journal of Neuroscience, 37*(18) 4830-4840. The dissertation author was the primary investigator and author of this paper.

Chapter 2, in full, has been submitted for publication of the material as it currently appears in: Cole SR, Voytek B. (2018) Cycle by cycle analysis of neural oscillations. *bioRxiv*. The dissertation author was the primary investigator and author of this paper.

Chapter 3, in full, has been submitted for publication of the material as it currently appears in: Cole SR, Voytek B. (2018) Hippocampal theta bursting and waveform shape reflect CA1 spiking patterns. *bioRxiv*. The dissertation author was the primary investigator and author of this paper.