ABSTRACT – INFORMATICS AND ANALYTICS CORE

The Informatics and Analytics Core (IAC) will centralize an enduring data archive and analytic tools that will allow the broader epilepsy research community to identify and validate biomarkers of epileptogenesis in images, electrophysiology, and molecular/serological/tissue studies. Beyond creating a centralized data repository, the IAC will pioneer innovative standardization/co-registration methods, fully supported by novel image and electrophysiology processing methods to extract candidate biomarkers from the diverse data. Not only will a well-curated and standardized multi-modal data set facilitate the development of models of epileptogenesis, it will also ensure that such models are statistically significant and can be validated. Based on our previous experience with similar multicenter projects, we are confident that our infrastructure will lead to success in this project.

The amount of data to be collected in these studies is unprecedented: video-EEG from animals after TBI recorded continuously for 6 months, in addition to prolonged continuous ICU EEG recordings from humans and intermittent sampling of brain images, blood, and tissue data. To analyze these data properly, it requires a diverse, accomplished group of investigators spanning neurology, neuroscience, imaging, mathematics, engineering, and computer science, as well as collecting comprehensive data in parallel from humans and animal models after TBI. The IAC will be seamlessly integrated with *Projects 1-3*, assisting in collecting data and providing analytic tools that will lead to biomarkers of epileptogenesis. By combining new data capabilities and our powerful, best-in-class, interdisciplinary team, quantitative models of epileptogenesis may be possible. These types of models will enrich preclinical trial populations, expedite interventions to prevent epilepsy after brain insults, and document epilepsy before late seizures occur. Based on previous studies, it is likely that there are reproducible changes in biomarkers, which identify the presence of epilepsy before its overt clinical expression[61,71,72].

The IAC will bring big data techniques and rigorous analysis to longitudinal data collected from humans and animal models of TBI, epilepsy, and their interaction. It will develop and implement new approaches, including novel graphical methods to visualize multivariable interactions, to quantify phenotype and molecular profiles in these disorders. A first-rate bioinformatics platform, LONI, will focus on TBI and epileptogenesis research. The tools, pipelines, and protocols developed for this proposal will be made available to the epilepsy research community, with the potential to change, long-term, the way that images, video, electrophysiology, proteomics, and metadata are analyzed in these fields. Quantitative and data mining methods will enable investigators to record and analyze gold-standard data and create a shared bioinformatics resource for epilepsy research that will live on long after the end of this project. Perhaps most importantly, the IAC will provide the technical sophistication to tease out the interaction between the complex processes studied in *Projects 1-3*, integrating multi-modal data in a way that has been beyond the capability of a single laboratory or center. The IAC will provide a lasting and open platform for standardized biomarker research in both TBI and epilepsy as well as engage with and guide the projects that, together, will lead to future clinical trial development.