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## Neurological Institute

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Dear Nord Grant Committee Members,

We propose to develop an educational app, titled "**Neuroimaging in Neurology App (NiNA)**", at Case Western Reserve University (CWRU).

# NEUROIMAGING IN NEUROLOGY

## Background:

Neuroimaging techniques, namely computed tomography (CT) and Magnetic Resonance Imaging (MRI), are playing an increasingly crucial role in the diagnosis and treatment of neurological disorders of the brain and spine. Traditional teaching methodologies have inherent limitations when used for training medical students and Residents in the knowledge and interpretation of various neuroimaging techniques. For example, the printed books do not allow dynamic interaction, such as scrolling and manipulation, with the images and associated text. On the other hand, software based teaching can overcome these limitations and allow enhanced learning with higher engagement of students.



Mobile computing and devices have revolutionized everyday computing, including teaching, delivery and consumption of educational programs and products. Whether it is eBooks, apps or online education platforms like Coursera, on-the-go education on mobile devices has drastically changed the way students learn new knowledge. Among all these newer methodologies, app based education is the most frequent medium used for mobile education, as exemplified by high numbers and diversity of apps in this category.

The digital book "[Neuroimaging in Neurology](#)", is a collection of more than 2,100 images depicting the complete spectrum of neurological disorders. This novel educational tool allows the student to view labels, arrows, and highlights, which point out the key clinical features of each image, or turned them off as desired! The result is an ideal way to learn neuroanatomy and recognize common neurological conditions seen on neuroimaging.

## Goals:

NiNA will have the all the content of the digital book "Neuroimaging in Neurology", and new content (e.g. perfusion imaging), organized into three main sections:

- I. **Normal Imaging:** For all of the images, the native scan is first shown without labels or pointers. However, all the pages are interactive and have buttons or embedded "hot spots" to point out the anatomy. For the MRI and CT scan slices, if the user touches any part of the image, the anatomic name of the structure will appear. For the MRA, MRV and Conventional Angiography images, the native picture will again appear first. Each image is accompanied by a series of blue buttons, each with a labeled structure. By touching a blue button, the structure named on the button will be highlighted on the image in a bright color.
  - a. MRI of the Brain
  - b. MRI of the Spine
  - c. Magnetic Resonance Angiography (MRA)
  - d. Magnetic Resonance Venography (MRV)
  - e. CT of the Brain
  - f. Conventional Angiography

- II. **Audio over PowerPoint Slideshows-** The PowerPoint presentations are an alternative way to review normal imaging and learn normal neuroanatomy:
  - a. Normal MRI brain slices (sagittal, axial and coronal anatomy)
  - b. Normal CT brain slices
  - c. Normal MRA anatomy of both the extracranial and intracranial circulations.
- III. **Common and Classic Conditions-** The third and largest section of app will have the collection of conditions most commonly seen in Neurology and Neurosurgery, organized into 10 sections: Degenerative, Demyelination, Developmental and Congenital, Herniation, Hydrocephalus, Infectious/Granulomatous, Metabolic, Peripheral Nerve, Spinal, Stroke, Trauma and Tumor.

#### **Methodology:**

NiNA will be developed using four technologies: React Native, SQLite, XCode/iOS SDK, the Android SDK.

React Native is an open-source framework for developing the user interface and behavior of the app. Notably, it allows simultaneous development for iOS and Android platforms. In addition, React Native generates native code – our app will run with the responsiveness and performance expected of native iOS and Android applications.

SQLite is an open-source database that we will use to store the key information required for Sections I and III of the app. For instance, each normal anatomy image in Section I will have one database entry per clickable brain region. Each entry will contain the coordinates of that particular brain region in the image, the name, and the description of that brain region. The React Native code will use the database to generate the pages of the app. This will allow us to add content in the future by simply modifying the database. New content will be integrated simultaneously into both iOS and Android versions of our app.

Development for iOS using React Native requires XCode and the iOS SDK. This requires Apple hardware. We will initially focus our effort on releasing the iOS version of this app. We anticipate that the Android version (which requires the Android SDK) will be released afterwards with minimal modifications to the code.

#### **Outcomes:**

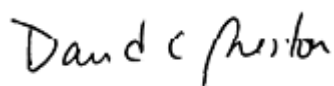
NiNA will be published on Apple and Android platforms *and made available free of cost to everyone*, which will students at CWRU, and worldwide, to learn Neuroimaging on-the-go and more effectively. With permission from Nord grant committee and CWRU, we will explicitly acknowledge the grant support by displaying the CWRU logo and subtitle “*NiNA was developed with support of Nord Grant at Case Western Reserve University (CWRU), Cleveland*” in the opening page of the app.

#### **Team:**

Dr. David Preston, MD (PI) is the Professor and Residency Program Director of Neurology at CWRU. He is also the lead author and copyright holder of the digital book “Neuroimaging in Neurology”.

Dr. James Liao, PhD (Co-I) is a final year medical student (MSTP) at CWRU and creator of the [PhotoSplit](#) app.

Dr. Deepak K. Gupta, MD (Co-I) is a final year Neurology Resident at CWRU and has educational research experience, including a funded project by American Academy of Neurology.



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Vice Chair and Professor  
Department of Neurology, CWRU



Anthony J. Furlan, MD  
Chair and Professor  
Department of Neurology, CWRU

**Budget:**

We seek the Nord grant as our novel educational project closely aligns with the goals and mission of University Center for Innovation in Teaching and Education (UCITE).

*We aim to make the app available free of cost to everyone and thus would like to fund this project from an educational research grant, for example the Nord Grant of CWRU.* In addition, there are no such funds available from the department of Neurology.

We request a total amount of \$4025, which will be used to buy computers, iPads and Android tablets, for development and testing of the iterative versions of the app. This cost will also cover the modest fees associated with publishing the app on Apple and Android platforms.

- MacBook Computers (2) - \$2,500
- iPads Mini (1) – \$500
- iPad Air (1) - \$500
- Android Nexus Tablet - \$400
- iOS app Publication Fee - \$100
- Android app Publication Fee - \$25
- Total - \$4025