NASA SBIR 2015 Phase I Solicitation

H12.01 Measurements of Net Ocular Blood Flow

Lead Center: GRC

Participating Center(s): JSC

The goal of this SBIR call is the development of rapid and accurate hardware to characterize the net blood flow to and from the eye. Due to limits on instrumentation, most of the literature on ocular blood flow to date has emphasized measurements that only partially characterize the net flow, such as minimum and maximum velocity in a single retinal arterial vessel or choroidal thickness in the vicinity of the fovea. However, there is significant spatial and interindividual variation in these ocular structures, for example, in choroidal and retinal thickness and in arterial and venous branching structures. Consequently, there are likely to be new insights to be gained from examining the choroid and retina from a bulk perspective. Recent advances in high-quality imaging, such as those based on wide-field Optical Coherence Tomography or high-resolution angiography, have allowed increased depth of penetration at high resolution for unparalleled accuracy in choroidal and retinal measurements that extend well beyond the posterior pole of the eye. The ready availability of computational resources renders it straightforward to capture and analyze the entire time history of ocular hemodynamics.Â

This SBIR solicits novel hardware that can quantify net ocular blood flow in the retina. Measurements of interest include the temporal history of the following:Â

- Maps of choroidal and retinal thickness, which include near- and far-field contributions.
- Net volume of the choroid and retina.
- Net volumetric blood flow to and from the choroid and retina.
- Pressures and net luminal areas at the entrance and exit of the choroid and retina.

Measurements must be presented in physical units, such as blood flow in milliliters per minute. The measurement system must also process the raw data, either in a real-time or post-processing mode. Data analysis capabilities should include the calculation of the overall time-averaged mean values, as well as the mean waveform over a cardiac cycle. It would be of significant interest if comparable measurements were made simultaneously of intraocular pressure, reference arterial pressure (systemic, brachial and/or ophthalmic artery), fundus pulsation amplitude, and/or heart rate.

Phase I Deliverables - Concept of hardware capable of producing some or all of the above measurements.

Phase II Deliverables - Prototype hardware and data from a pilot study.Â