THE HARTWELL FOUNDATION

2009 Individual Biomedical Research Award

Review of Proposed Research

Investigator: **Boris I. Gramatikov, Ph.D.**
Assistant Professor
Department of Ophthalmology

Institution: **The Johns Hopkins University**

Proposal: **Pediatric Vision Screening Instrument for Early Detection of Amblyopia ('Lazy Eye')**

Dr. Gramatikov proposes to develop a noninvasive, automated and rapidly administered screening instrument for early identification of children at risk for amblyopia. The disorder occurs when the brain and eyes do not work together properly, causing poor transmission of the visual image to the brain. Amblyopia is commonly referred to as “lazy eye” because vision is reduced as result of one eye not receiving adequate use during early childhood. The disorder affects about 1-5% of the population. The most common cause is strabismus, where the eye muscles fail to properly align the eyes. Other causes include astigmatism, near or far sightedness (especially if there is a large difference in the refractive power between eyes and one eye is favored), and cataracts in the lens. The disorder is usually treated effectively with glasses and completely reversible when early intervention is available. Pediatricians prefer that all children be screened for vision and amblyopia risk factors by age four. Unfortunately, most children are detected too late because of poor access to healthcare, which could easily be overcome if a widely available and robust screening methodology for early detection existed outside of specialty centers. Most large-scale screening approaches for children rely on taking photos of their eyes, which depends on the specialized training of lay personnel and requires expert interpretation to eliminate false positives. The Gramatikov hand-held pediatric vision screener seeks to overcome these limitations by relying on a novel computer-aided analysis of light polarization in an inexpensive and an easy-to-use format. Ideally, the device will detect binocular eye fixation and thus eye alignment from a distance of about 12 inches. In principle, the device will project a circle of polarized near-infrared light onto the area of the retina responsible for sharpest vision in each eye (fovea) and analyze the returned signal for polarization changes induced by the retina, a technique referred to as retinal birefringence scanning. A major technical hurdle is that less than 0.1% of the light entering the eye through the pupil will be reflected by the retina as the signal, compared with a large amount of contaminating optical noise created by light reflected from the lids, cornea (clear front surface of the eye), and the white sclera of the eyes. Moreover, the birefringence from the cornea is seven times as much as the retina and varies in amount and orientation from eye to eye. If Dr. Gramatikov is successful, his vision screening device will overcome the recognized technical problems, providing a robust method for early identification of children with amblyopia.