INSTITUTE OF ZOOLOGY and BIOMEDICAL RESEARCH
JAGIELLONIAN UNIVERSITY

On behalf of our Institute we invite you to join us for the next Distinguished Lecture.
On April 10th 2017 (Monday) we welcome

Dr. **John S. Pezaris**

from Massachusetts General Hospital, Harvard Medical School (Boston, USA),

for a lecture

The thalamic visual prosthesis project

Location:
Institute of Zoology and Biomedical Research,
ul. Gronostajowa 9
Lecture room 0.14 (ground floor)

Time: 2 p.m.

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Dr. John S. Pezaris has a background in computer science and electrical engineering with degrees from MIT, and in neurophysiology with a doctorate from California Institute of Technology, and post-doctoral experience at Harvard Medical School. He currently leads a research laboratory in the Neurosurgery Department at Massachusetts General Hospital with an appointment at Harvard Medical School. He will be visiting the University of Athens for Spring 2017 as a Fulbright Scholar. His work has been published in journals including Nature Neuroscience, PNAS and Scientific Reports.

"The fundamental idea we are pursuing is to provide restoration of sight to the blind. We hope to accomplish this by implanting multi-wire electrodes in the lateral geniculate nucleus (LGN), the part of the thalamus that relays signals from the retina in the eye to the primary visual cortex at the rear of the head. In leading causes of blindness, the eye ceases working as a light-sensitive organ, but the remainder of the visual system is largely intact. By sending signals from an external man-made sensor such as a digital camera into the brain through carefully implanted electrodes in the LGN, we hope to provide a crude approximation to normal vision and restoration of sight to the blind.

It is important to understand that we do not anticipate restoring vision that is in any way close to normal. Our best guess is that a visual prosthesis will provide the patient with an improvement in their quality of life, being able to navigate more easily through familiar and perhaps unfamiliar surroundings. We hope that it will allow the patient to distinguish and identify simple objects, perhaps even help recognize people. But, it is important to understand that these hopes are some time to come. There is a tremendous amount of work to be done before we have even the crudest initial experimental device temporarily implanted in a human."

http://sight2blind.org

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Abstract

The field of visual prosthetics has concentrated primarily on two targets for stimulation, the retina and the primary visual cortex. The lateral geniculate nucleus of the thalamus, the relay station between these two areas, has been largely ignored because of the difficulty of surgical approach. The development of deep brain stimulation techniques for addressing pathologies of the midbrain has opened surgical access to the thalamus, and motivates a reconsideration of targets for visual prosthetics.

With this background, we have performed experiments in an animal model to demonstrate a proof of concept for a visual prosthesis based on thalamic microstimulation, followed by experiments in a computer model to set basic engineering parameters for a thalamic visual prosthesis, in turn followed by experiments with both sighted humans and monkeys to assess design performance. In this presentation we will review the compelling motivation for the thalamic approach, review the experimental results thus far, and provide a preview of future work.

Selected publications

1. **J. S. Pezaris and R. C. Reid, "Demonstration of artificial visual percepts generated through thalamic microstimulation," Proceedings of the National Academy of Science, 104:7670-7675, 2007.**

2. **M. Vurro, A. M. Crowell, and J. S. Pezaris, "Simulation of thalamic prosthetic vision: reading accuracy, speed, and acuity in sighted humans," Frontiers in Human Neuroscience, 10.3389/fnhum.2014.00816**

3. **Killian NJ, Vurro M, Keith SB, Kyada M, Pezaris JS, "Perceptual learning in a non-human primate model of artificial vision," Scientific Reports, 10.1038/srep36329**