Demographic data indicates that the number of post-stroke subjects increases every year. In Poland, every 8 minutes someone suffers a stroke, this results in more than 60 000 cases per year. Stroke is the third cause of death, after heart diseases and cancer, and the leading cause of permanent disability in people over 40 years of age. Aphasia, i.e., the combination of speech production and/or speech comprehension difficulties and hemiparesis are the most common effects of strokes. Only in 25% of treated cases does aphasia therapy lead to full restoration of language functions. This fact inspires researchers to create new therapeutic methods.

The literature reports that patients with damage to the left hemisphere of the brain and aphasia display problems in processing of rapidly changing auditory information. However, this ability appears to be crucial for effective use of speech. Moreover, based on our preliminary experience, we know that these difficulties in rapidly changing information processing can be reduced with auditory training. The application of such a training resulted in improvement of speech comprehension in subjects with aphasia. For this purpose, in the Laboratory of Neuropsychology of the Institute of Experimental Biology PAS the *Dr. Neuronowski*® software was designed. *Dr. Neuronowski*® aims to improve: (1) the processing of rapidly changing sounds, (2) speech, (3) memory, (4) attention and (5) selection of information. It turns out that memory, attention, and the ability to select information, are all also disrupted in post-stroke subjects and often do slow down the therapeutic process.

In this project we would like to verify the effectiveness of the recently created computer tool *Dr. Neuronowski*® compared to available multimedia speech therapy programs that focus on reducing speech difficulties only. Furthermore, the aim of the project is to understand, using electrophysiological and neuroimaging methods, changes that occur in brain activity after applied trainings.

Forty aphasic subjects will be recruited to this study. They will initially undergo a broad assessment included the processing of rapidly changing sounds, language competence, memory, attention and the ability to select information. Preliminary diagnosis will be extended by EEG, fMRI and DTI methods. Then, patients will be randomly divided into two groups. Group 1 will be trained with the computer program *Dr. Neuronowski*®, Group 2 will practice with the use of commercially available multimedia speech therapy programs. Both trainings will include twenty four 45-minute sessions, 3 times a week, for 8 weeks. Then, post-training assessment will take place in order to verify if any of the applied trainings cause any improvement of the functions listed above. In addition, EEG, fMRI and DTI measurements will be repeated as well, to see brain activity changes after each of used therapeutic methods. Finally, a follow up assessment 3 months after training completion will be performed to investigate the stability of the eventual improvements achieved directly after training.

As a result of the project, we expect to obtain new knowledge about effective methods of rehabilitation of subjects with aphasia.

We suspect that both applied treatment methods will improve the cognitive functioning of patients. Likewise, we believe that the *Dr. Neuronowski*® software will contribute to greater improvement than the training in multimedia speech games, due to the variety of trained functions available in the *Dr. Neuronowski*® software. In addition, we expect that *Dr. Neuronowski*® will also contribute to broader neuroplastic changes compared to that obtained in the second group.

We expect that the results of the project will allow us to answer the questions about effective therapeutic methods for patients with aphasia and will help us to better understand the changes that are occurring in the damaged brain as a consequence of various mental exercises.