Human activity in modern society is associated with the necessity to remember a great amount of information and to acquire new skills. It requires to keep a smoothly functioning memory into old age. However, with aging of the human body, memory deficits commonly appear, often due to neurodegenerative diseases. The most known condition is an Alzheimer's disease, however equally deep memory impairments can occur in people chronically abusing alcohol where it can lead to the so-called Wernicke-Korsakoff syndrome due to vitamin B_1 (thiamine) deficits. Neurological symptoms of thiamine deficiency were first described in 19th century by a German physician Carl Wernicke and include e.g. ataxia, manifested by loss of coordinated muscle movements, involuntary eyeballs movements (nystagmus) or even paralysis of oculomotor nerve and confusion with accompanying fluctuating consciousness and mental disturbances. Individuals with Wernicke-Korsakoff syndrome present numerous damages in different brain areas leading to memory processes impairments ranging from amnesia to dementia. Despite many efforts, no effective drug able to reverse degenerative changes and restore the normal cognitive and memory processes in this disease has been developed yet. Therefore, it is recommended to search for effective drugs against memory impairments, which is the main motivation for this project.

The aim of the project is to examine the influence of protocatechuic acid on memory and learning processes in normal (healthy) animals and in animals with experimentally induced Wernicke-Korsakoff syndrome. Protocatechuic acid is a compound commonly found in many plants, e.g. those used in Traditional Chinese Medicine (TCM). It has a multidirectional biological action. The most promising properties of the compound are an antiinflammatory, antioxidative and antineoplastic action. Novel findings also inform about its protective activity towards nerve cells in an Alzheimer's disease, which is a good prognosis to undertake the studies described in this project.

Research will be carried out on rats, which are an irreplaceable model for the experimental investigation of memory. Results obtained in this way can be related to humans. Animals will be divided into the three main groups: the first including normal rats, and remaining two including animals with experimentally induced Wernicke-Korsakoff syndrome by feeding with thiamine-deficient chow and administering daily injections of antivitamin B_1 (pyrithiamine). Inside the groups of animals, smaller subgroups will be formed. Each subgroup will be treated with protocatechuic acid in one of two doses (study subgroups) or water (control subgroups). In case of animals with Wernicke-Korsakoff syndrome, tested compound will be administered either after induction of the disease or already during its development, which will enable to evaluate the influence of protocatechuic acid on the rate of neurodegenerative changes progression.

The memory processes and learning ability in animals will be investigated in behavioral tests, especially in water maze labyrinth. It consists of a pool, filled with water, in which animals will be consecutively placed. During the experiments, natural aversiveness to water environment will be used. Animals placed in the water start active swimming and searching for an escape place. Such a place (transparent platform) is hidden in one of the parts of the pool and is located just under the water surface. During the first four days, animals are learning the location of escape platform using spatial cues in the surroundings. On the fifth day, the proper memory test takes place and the platform is taken out of the pool. Using a computer image analyzing system, time spend in a place previously containing a platform, the speed of swimming, distance traveled and number of times the rat crosses the previous platform position will be measured. Additionally to the water maze labyrinth, the complementary Visible Platform test will be conducted. Moreover, the Hole-Board test and the Foot Fault test will be used to assess motor activity of animals, while in the Novel Object Recognition test the short-term memory of rats will be evaluated.

After completing behavioral experiments, post mortem biochemical examination of substances representing brain transmitters in different areas of animal's brain will be conducted. Therefore, animals will be killed and selected brain structures will be dissected, e.g. cerebral cortex, hippocampus, cerebellum and hypothalamus. Neurotransmitter concentration will be quantified by the application of high performance liquid chromatography (HPLC).

Results obtained in both behavioral and biochemical part of the project will be compared using the statistical analysis methods. It will help to assess whether differences observed between the groups are statistically significant.

Realization of the project may contribute to the development of the effective prophylactic and/or therapeutic treatment of neurodegenerative diseases. Moreover, this kind of research directed to search a novel compounds protecting nervous tissue and supporting memory is particularly relevant when considering aging of the human population and a simultaneous extension of the professional activity.