1-4-1-2

Dr Ali Rashidy-Pour

• Labs

Laboratories of Electrophysiology and animal behaviors

Main activity

The main activity of these laboratories is study the neural basis of learning and memory at the molecular, cellular and system levels using molecular, cellular and electrophysiological methods.

Laboratory of Electrophysiology

-

Director

Ali Rashidy-Pour (Ph.D, Professor of Neurophysiology)

Email: rashidy-pour@sem-ums.ac.ir

Colleagues and Students:

Abbas Ali Vafaei (Ph.D), Associate professor of physiology

Email: aavaf43@sem-ums.ac.ir

Hossain Miladi-Gorgi, PhD student of physiology

Roghayeh pakdel, MSc of Physiology

Hassan Sadeghi. BSc of Veterinarian

Main activities

The principal research interest of this laboratory is to study the cellular mechanisms which underlie neuronal function that focused on the critical role of the hippocampus and other brain area in neuronal plasticity. Also we focus particularly on a remarkable form of synaptic plasticity known as ***long-term potentiation or LTP on hippocampus, single unit recording and field potential from brain nucleus*** are

involved in processes of learning and memory.

Labs of animal behavior

Director:

Abbas Ali Vafaei (Ph.D), Associate professor of physiology

Email: aavaf43@sem-ums.ac.ir

Main Colleagues:

Ali Rashidy-Pour (Ph.D, Professor of Neurophysiology)

Email: rashidy-pour@sem-ums.ac.ir

Hossain Miladi-Gorgi, PhD student of physiology

Roghayeh pakdel, MSc of Physiology

Hassan Sadeghi. BSc of Veterinarian

Lab. of spatial memory

Main Goals

The main goal of this lab is testing the effects of drugs and various conditions, particularly stress on various aspects of cognitive functions in experimental subjects including rats and mice. Presently we use Morris wate maze, T-maze and passive avoidance, and Fear conditioning system for testing different kinds of learning and memory in rodents.

Morris Water Maze

The **Morris water maze** is one of the most widely used tasks in behavioral neuroscience for studying the psychological processes and neural mechanisms of spatial learning and memory. The basic task is very simple. Animals, usually rats or mice, are placed in a large circular pool of water and required to escape from water onto a hidden platform whose location can normally be identified only using spatial memory (Fig. 1). There are no local cues indicating where the platform is located. Conceptually, the task derives from *place cells* that are neurons in the hippocampus which identify or represent points in space in an environment (O'Keefe, 1976).

It was developed by Richard Morris at the University of St Andrews in Scotland and first described in two publications in the early 1980s (Morris, 1981; Morris et al., 1982). Place navigation in the water maze is now often used as a general assay of cognitive function (Brandeis et al., 1989), for example for testing the impact of various disturbances of the nervous system (e.g. animal models of stroke (Nunn et al., 1994), aging (Gallagher and Rapp, 1997-6), neurodegenerative disease (Hsiao et al., 1996), or the potential impact of novel therapeutic drugs (D'Hooge and De Deyn, 2001). The task has also inspired computational neuroscientists and roboticists interested in navigation (Krichmar et al., 2005).

We use EthoVision® 3.1 for recording of animal behavior in Morris water maze. It is the renowned video tracking system for the automation of behavioral experiments, used at up to a thousand research institutes, universities, and companies around the globe.

EthoVision® 3.1 allow us to automate the Morris water maze test in order to obtain highly accurate and reliable test results.

1- Automatically calculate and analyze parameters related to learning and memory, such as time needed to find the hidden platform.

2- Analyze behavior in relation to zones, such as time spent in a specific quadrant.

3- Start and stop trials automatically, for instance stop the trial when the animal has found the hidden platform.

4- Choose the size and color of the water maze that fit the need of your research.

References

O'Keefe, J. (1976). Place units in the hippocampus of the freely moving rat. *Exp. Neurol.* **51**:78-109.

Morris, R. G., P. Garrud, J. N. Rawlins, and J. O'Keefe. (1982a). Place navigation impaired in rats with hippocampal lesions. *Nature* **297** (5868):681-683.

Morris, R. G. M. (1981). Spatial localisation does not depend on the presence of local cues. *Learning and Motivation* **12**:239-260

Brandeis, R., Y. Brandys, and S. Yehuda. (1989). The use of the Morris Water Maze in the study of memory and learning. *Int J Neurosci* **48** (1-2):29-69.

Nunn, J. A., E. LePeillet, C. A. Netto, H. Hodges, J. A. Gray, and B. S. Meldrum. (1994). Global ischaemia: hippocampal pathology and spatial deficits in the water maze. *Behav Brain Res* **62** (1):41-54.

Gallagher, M., and P. R. Rapp. (1997). The use of animal models to study the effects of aging on cognition.. *Annual Review of Psychology* **48**:339-370.

Hsiao, K., P. Chapman, S. Nilsen, C. Eckman, Y. Harigaya, S. Younkin, F. Yang, and G. Cole. (1996). Correlative memory deficits, Abeta elevation, and amyloid plaques in transgenic mice. *Science* **274** (5284):99-102.

D'Hooge, R., and P. P. De Deyn. (2001). Applications of the Morris water maze in the study of learning and memory. *Brain Research. Brain Research Reviews* **36** (1):60-90.

Krichmar, J. L., A. K. Seth, D. A. Nitz, J. G. Fleischer, and G. M. Edelman. (2005). Spatial navigation and causal analysis in a brain-based device modelling cortical-hippocampal interactions.. *Neuroinformatics* **5**:197-222.

T. maze

Our fully automated T-Maze systems for mice and rats are configured for rewarded alternation tasks and can also be configured for acoustic discrimination tasks. In the delayed alternation task, in which a delay is introduced between trials, the memory of the animal is tested (Working-Memory performance).

Each T-Maze consists of two choice arms and one start arm mounted at a square center – a start compartment is optional. Both choice arms are equipped with food cups with integrated infrared sensors – optional software-controlled pellet dispensers can be used to deliver the reward. Manual doors are included – automatic doors are available on request. All mazes are available as table-top systems or with an optional aluminum base.

The animal is released from the start position and allowed to select one of the choice arms. Criterion is left-right spatial alternation or an acoustic stimulus (application of WAV files). The T-Maze control software package provides predefined standard paradigms. Choice accuracy is presented in a results table together with time-based results parameters such as response latency.

Passive avoidance

Passive avoidance is fear-motivated tests classically used to assess short-term or long-term memory on small laboratory animals (rat, mice).

Basically, passive avoidance working protocols involve timing of transitions, i.e. time that the animal takes to move from the white compartment to the black one after a conditioning session -in which the entry into the black compartment is punished with a mild inescapable electrical shock is carried out.

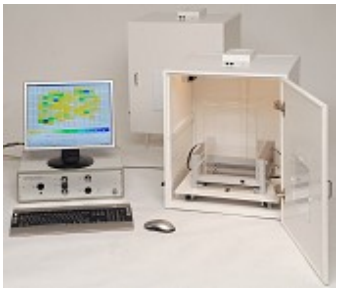
We use two models of "Passive Avoidance Apparatus" purchased from Ugo Basal Company. One for rat and other for mice.

Fear Conditioning

In this lab we investigate Fear and Auditory conditioning of rats under different conditions and drugs treatment. We use TSE Fear Conditioning System which is is a widely used and proven multi-purpose system for studying contextual and cued fear in mice and rats. In classical fear conditioning, a behavioral

paradigm based on associative emotional learning, the subject is given a cue, usually an auditory signal, followed by an electric shock. Alternatively only an electric shock can be given. In the subsequent retention trial the animal is tested for its fear of both the context and/or the auditory cue.

The TSE Fear Conditioning System Advanced allows the free definition and storage of experimental designs. The user-defined sequence of stimuli (including light and noise stimuli) is applied in up to 8 measuring stations that are controlled by a single PC. The comprehensive graphical and numerical evaluation of the animal's fear response over the course of the experiment includes calculation of freezing frequency and duration as well as a variety of other essential evaluation parameters such as activity, hypoactivity & hyperactivity times, number of rearing events, average speed or % area explored by the animal.



Lab. of Anxiety Study

-

In this lab we investigate the effects of various drugs and conditions on anxiety-like behaviors of mice and rats. We used two modles:

A- Light-Drak Test

B- Elevated Plus Maze

Light-Dark Test

The Light-Dark test is based on a conflict between the innate aversion to brightly illuminated areas and the spontaneous exploratory behavior in response to a novel environment. If given a choice between the illuminated compartment versus a dark safe area, rodents spontaneously prefer the dark area. Anxiolytic compounds increase the duration of time spent in the light compartment and the number of transfers between compartments while anxiogenic compounds work in the opposite way.

B- Elevated Plus Maze

The Elevated Plus Maze test is one of the most widely used models for testing unconditioned anxiety in small rodents. It is based upon their natural aversion to heights and open spaces which is decreased by anxiolytically effective drugs. Four arms are arranged in the shape of a cross ("Plus"). Two arms have surrounding walls ("closed arms"), the other arms have no walls ("open arms"). A small ledge prevents the animal from falling off the open arm.

Lab. of motor activity and exploration

The main aim of this lab is to study the generanl motor activity and also motor corrdination in various conditions. We use two system: TSE InfraMot - Activity System and Harward Rotarod system.

-

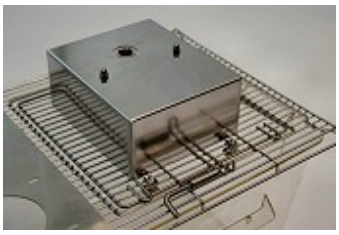
TSE InfraMot - Activity System

The TSE InfraMot system is designed to register total activity of one or more subjects by sensing the body-heat image, i.e. infrared radiation, and its spatial displacement over time. The system is especially suited for long-term circadian studies - a large number of measuring places can be monitored with a single computer. The sensor assembly is designed to be mounted on top of a home cage but it can also be configured for any other arena such as an operant cage. The wide-angle infrared detector allows rearing events to be included in the activity data - movements with a duration of only a few milliseconds

can be reliably detected. The sensor units are easily removed for cleaning purposes.

The system comes with the LabMaster software for setting up the experiment design and for recording and evaluating trial data. The software records total counts during user-defined time intervals. The measured data can be exported into Excel or other standard databases.

As an integral part of our modular LabMaster research platform (Link), the InfraMot units can also be combined with the measurement of numerous other physiological and behavioral parameters such as liquid & food consumption, wheel running behavior or/and metabolic performance.



Harvard RotaRod *Advanced*

RotaRod System is a flexible tool for studying motor coordination or fatigue resistance in rats and mice. The apparatus basically consists of a rotating drum whose surface is designed to provide grip. Separating panels divide the drum into individual lanes. We provide standard models for 5 mice and for 4 rats. The rat unit can also be upgraded with a drum suitable for mice. Motor speed for drum rotation is controlled electronically. Each RotaRod Advanced is supplied complete with a control unit & PC interface. A user-friendly Windows softwareallows you to define, store and run automatically speed profiles with up to 100 steps per profile. Within each step the initial speed, final speed as well as time for linear acceleration/deceleration can be defined according to your choice / requirements. All RotaRod Advanced units are also equipped with a programmable reverse rotation mode. Stored results data