

Rogers & Kesner (2003)

As Described by John Crane in His InThinking Webpage

Background information

In the hippocampus, there is a high concentration of acetylcholine receptor sites. Researchers have therefore questioned the role of this neurotransmitter in the consolidation of memories.

Aim, procedure and results

The aim of the study was to determine the role of acetylcholine in the formation of spatial memory.

Rogers & Kesner wanted to determine the role of acetylcholine in memory formation and retrieval. They had 30 rats acclimate to a Hebb Williams maze by placing food in one of the corners. Once the rats were familiar with the maze - and no longer were afraid of the environment - the experiment could begin.

The rats were randomly allocated to one of two conditions. The rats were either injected with scopolamine or with a saline solution ten minutes before running the maze. **Scopolamine** blocks the acetylcholine receptor sites and thus inhibits any response. The saline solution was a **placebo injection**. This was done to make sure that the fact of getting an injection alone was not responsible for a change in memory. An injection could result in an increase in adrenaline which would be a confounding variable. The injections were made directly into the hippocampus.

Encoding of memory was assessed by the average number of errors made on the first five trials of Day 1 compared to the last five trials of Day 1, whereas the average number of errors made on the first five trials of Day 2 compared to the last five trials of Day 1 was used to assess retrieval.

The findings were that the scopolamine group took longer and made more mistakes in the learning of the maze - that is, there was a higher average number of mistakes made on the last five trials on Day 1. However, it did not appear to have an effect on retrieval of memories that had already been created. It appears that acetylcholine may play an important role in the consolidation of spatial memories.

Evaluation

- The researchers used a rigorously controlled experiment with a **placebo condition** to avoid the effect of confounding (extraneous) variables.
- The study is able to establish a cause-and-effect relationship; however, it is a reductionist approach to understanding memory. There are several different types of memory and the process of memory consolidation is very complex.
- The research could one day lead to the development of treatments for people suffering from dementia or Alzheimer's disease.
- Biologists believe that animals can serve as models for human physiology and behaviour; however, there are questions about the extent to which findings can be generalized to humans.

Agonists and antagonists

When discussing the process of neurotransmission, biologists refer to chemicals as agonists or antagonists, depending on what they do the pre- or post-synaptic receptor site.

All neurotransmitters are agonists for receptor sites. They are referred to as endogenous agonists since they are biologically already part of our nervous system. So, acetylcholine is an agonist for ACh receptor sites. Drugs can also be agonists. Since they are external to our system, they are referred to as exogenous agonists. For example, nicotine is an agonist for ACh receptor sites and in the short term appears to have some positive effects on memory. (It should be noted, however, that long-term use of nicotine has a negative effect on memory!)

Antagonists are drugs that block the receptor site and do not allow the neurotransmitter to do its job, so no action potential is sent down the neuron. For example, scopolamine is an antagonist for ACh. Not all antagonists block receptor sites on the post-synaptic neuron. SSRIs like fluoxetine, for example, block receptors sites on the pre-synaptic neuron and prevent the reuptake up serotonin as a treatment for depression.

For IB exams starting in 2020, you may be asked an SAQ on either agonists or antagonists. The study by Rogers and Kesner can be used to answer both questions. Can you see why?