A hypothetical experimental method to disprove the De Novo protein synthesis hypothesis of memory consolidation.

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Hypothesis:

The de novo protein synthesis hypothesis of memory consolidation suggests that synthesis of protein in the brain correlates to memory formation and consolidation. Therefore, inhibiting that protein synthesis would inhibit the plastic changes needed in the brain to form new memories.
In order to disprove this hypothesis, the experiment must conclude that memory consolidation still occurs without the need of new protein synthesis. We can conduct this experiment by observing the performances of groups of rats around a maze. One group will be administered with a type of protein synthesis inhibitor called Cycloheximide and other will be a control group (with no PSI administered). If the rats injected with the PSI show no significant drop in performance (compared to the control group) after a number of training runs around the maze, then the de novo hypothesis can be refuted.

Methods:

Study design: Between groups.

Independent Variable: The type of injection, in this case, is Cycloheximide (a PSI).

Dependent Variable: The time it takes for the rats to complete the maze.

This experiment will be conducted between two randomly assigned groups of 20 rats. The walls of the maze will be high enough so that the rats can not peek over the wall. Both groups of rats will undergo a few training runs (first round,3-5 runs) first to get them acquainted with the maze. At the end of the maze, there will be a food item so that the rats receive a positive reinforcement each time for completing the maze. This is done to ensure that the rats are not wasting time being distracted inside the maze. The time taken during the training runs for both groups will be recorded. After the training run, the experimental group will be injected with Cycloheximide. Both groups (experimental and control) will now be subjected to ten runs (second round) of the same maze and their performances will be recorded for the second time. The data collected from the two rounds will be used to plot a Time-taken(y-axis) vs Experimental Rats (x-axis) graph. The data collected from the two rounds will also be used to plot a Time-taken(y-axis) vs Control Rats (x-axis) graphs. An average time for completion during the second round for each group will also be calculated.

Possible results:

If the graph for second round turns out to be significantly above the graph for first round for the experimental group (i.e most of the experimental rats took more time to complete the maze in the second round after being injected with PSI) and the average time taken in the second round for the experimental groups is significantly higher than the control group then the results would fail to disprove the hypothesis since that would show that PSI caused decline in protein synthesis ,and as a result, inhibited memory consolidation. On the contrary, if both graphs do not show a disparity and the average times for both groups in the second round is similar then our experiment would be able to successfully disprove the hypothesis, showing that memory consolidation still occurs without the need of new protein synthesis.

References:

Gold, P., & Wrenn, S. (2012, May 17). Cycloheximide impairs and enhances memory depending on dose and Footshock intensity. Retrieved March 09, 2021, from https://www.sciencedirect.com/science/article/pii/S0166432812003312?casa_token=JunefdmrNowAAAAA%3A7k7y1ShEH6CKLPSlxRlvmqAxq3Lq_bxdTjpZaEyhc6jsudLYCbA0wOn8-M-YRNDiQ1j9n5_iBw