MORRIS WATER MAZE EXPERIMENT

The Morris Water Maze is a commonly used paradigm for learning and memory. In the class it will give us a chance to handle animals, give injections, and acquire data that can be analyzed later. You should already be familiar with this paradigm from the two assigned readings.

We will essentially be trying to replicate the results of Cahill et al (2000). They found impaired consolidation of spatial memory by blocking adrenalin. The theory is that stressful events are often worth remembering; stressful events cause the release of adrenalin from the adrenal glands and these facilitate memory consolidation.

The Morris Water Maze represents both a test of learning and memory and a stressful event, because rats are immersed in room temperature water. Rats are excellent swimmers, but they aren't particularly fond of the water. Immersing them in water gets the adrenalin pumping; you will make that adrenalin irrelevant to the brain by injecting propanolol, a drug that is an antagonist for the beta-adrenergic receptor. Importantly, the drug is given after the training trials, and so theoretically can only affect the consolidation of the memory, not the rats' performance in the task or appreciation of the sensory events that form the "data" for the memory.

The basic paradigm is taken straight from Cahill.

DAY ONE. Rat receives six training runs in the water maze. Note the platform is in the East quadrant of our maze. The six starting points are indicated with tape. Place the rat in the water at one of the maze starting points. (Use all 6 points once, do it randomly but avoid the one closest to the platform at the start.) PLACE THE RAT IN THE WATER, DO NOT DROP THE RAT. Start your clock. Record how long it takes the rat to stand on the platform. If the rat does not do so in 60s, guide the rat to the platform with your hand. Record the time on the data sheet and whether assistance was require. After 10s on the platform, remove the rat to a holding cage for 30s. Begin a new trial.

After the sixth trial, inject the rat with 10mg/kg, 2mg/ml propranolol or the same volume of saline. Dry the rat with a towel (do not scrub the rat, just get the excess water off of it). Begin the next rat.

DAY TWO (one week later in our case). Rat receives a retention test. Place the rat in the water at the start point, and let the rat swim for 60s (platform removed). Run the watch whenever the rat is swimming within a 1 foot radius of the platform's former location (you'll have to estimate), and stop the watch when the rat leaves that area. Obviously, you'll need one watch running the 60s and one keeping the "time in the circle". Record the total time in the circle, then remove the rat and dry.

YOUR TASK. You will run 6 rats: 3 naïve rats will be given their 6 training runs, and 3 experienced rats will be given their test runs. For the naïve rats, you will be informed which drug to provide each, saline or propranolol. For the experienced rats, you will be "blind" to their treatment from the previous week. At the start of the day, you will have to mix up the propranolol solution as follows:

Measure out 50 mg (0.05 g) on the fine scale; tare a piece of weighing paper
Add powder to a 25 mL volumetric flask
Add saline up to the line
Stir on stirrer

Add solution to an injection bottle

You are injecting 10 mg/kg body weight. A rat that is 340 g, for example, gets 3.4 mg of propranolol (weigh the rat before the training begins). Since you've made 50 mg/25 mL, or 2 mg/ml, or 1 mg/half mL, you need .5 mL for every mg of drug. That's .5 X 3.4 = 1.7 mL. Cap a 3 mL syringe with a blue needle (5/8 inch) and withdraw 1.7 mL from the injection bottle. CHANGE NEEDLES. (Keep the old needle for acquiring drug for next rat, but use fresh, sharp needle for each injection.) Injections are subcutaneous.

After the last trial, wrap the rat in a towel exposing the animal's back. Grab some neck skin between your fingers and slide the needle in below the skin. Inject. Return the rat to the cage.