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What is the Cincinnati water maze?

This is a chapter from the e-book:

Basic behavioral neuroscience in rodents.

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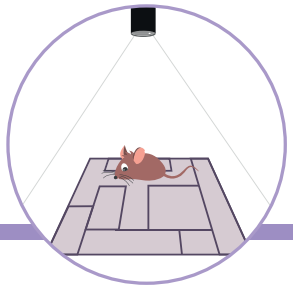
CINCINNATI WATER MAZE



The Cincinnati maze is a type of water maze that is specifically aimed at testing **egocentric spatial memory**. This maze consists of interconnected T-intersections (basically multiple T-mazes) in which the animals have to navigate from start to finish. This test requires egocentric navigational ability because of the lack of visual cues: the animal has to rely on it's own memory of the maze to make the correct choices (which is a left-or-right choice). The Cincinnati water maze is often filled with water as a motivation to escape. Motivation by food reward can be problematic if a treatment for example causes differences in body weight, appetite or reward salience.

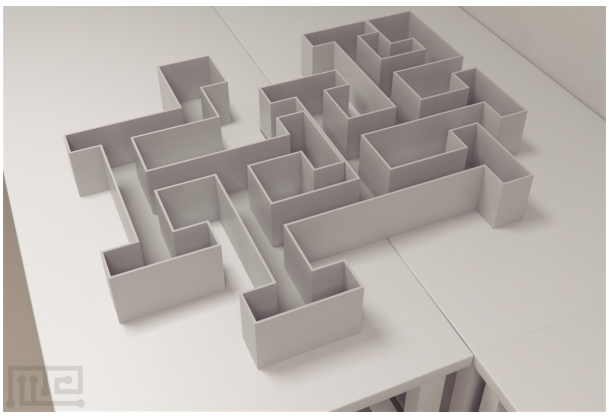
CINCINNATI WATER MAZE

Length is 120 cm
Width is 120 cm
Corridor width is ± 14 cm
Wall height is 37 cm

PROTOCOL SUGGESTION

Preparation

- Partially fill up the maze with regular tap water, the temperature should be brought up to approximately 26°C (this can take a while!). You can use non-fat dry milk, or non-toxic white paint to make the water opaque. This will improve contrast of animal to background for video recording and analysis in EthoVision XT.



A Cincinnati water maze.
Credits: He, S. and Corscadden, L. (2022). Maze Engineers.

Trial phase - 15 days, 2 trials per day

- Transport the animals, preferably in their home cages, into the testing room and allow the animals to acclimate to this room for a minimum of 30 minutes prior to starting the test.
- Remove a single animal from the home cage with your preferred handling technique: tail handling, full hand handling, tube handling and place the animal at the start of the maze.
- Allow the animals to explore the maze for 5 minutes. If the exit was not found within this time remove the animal without showing the exit, record the maximum time.

- Dry off the animal and return the animal to a holding cage and continue with the next animal.
- Perform two trials per day, leaving a minimum of 15 minutes between trials.

SETUP IN ETHOVISION XT

In EthoVision XT the correct path should be drawn throughout the arena. Incorrect arm choices should be drawn as separated zones. This process takes a little more time compared to other mazes. But once drawn, analysis can go very quick. The parameter for an arm entry must be set (in order to properly count errors). Generally this is set at head and shoulder entry into a zone, but can also be more strict such as all 4 paws (front and hind legs) enter a zone. Total errors and latency to escape are ultimately the readouts.

INTERPRETATION OF THE RESULTS

Schaefer *at al.* presents a nice overview of their outcomes with the Cincinnati maze. Over time a clear decrease in escape latency and errors can be seen, indicating a learning process. The outcomes of the two trials per day are averaged per day. A repeated measures ANOVA (with post hoc testing) can be used to determine the differences between groups per timepoint.