

Morris water maze apparatus. The Morris water maze consisted of a cylindrical tub of ivory-coloured Perspex™ (polymethyl methacrylate) (117 cm diameter; 30 cm depth) that was filled with water ($26 \pm 1^\circ\text{C}$ temperature) up to 11 cm below the rim. The water was rendered opaque by the addition of white, non-toxic paint. The pool was divided into four quadrants of equal area arbitrarily called northeast, southeast, southwest and northwest. A circular platform (10 cm diameter) made of transparent Perspex was submerged 1 cm below the water surface, its centre being 30 cm from the perimeter, in the middle of one quadrant (the target quadrant). The platform was covered with white gauze for the purpose of providing a firm grip. The tub was elevated 37 cm above the floor and was surrounded by a wall (~52 cm away) to the north and east, a curtain (~56 cm away) to the west, and a surgical screen (~70 cm away) to the south, behind which the experimenter and home cages were located during trials. Two- and three-dimensional visual cues were positioned around the tub, 64 to 92 cm from its rim. Four 250-W quartz halogen lamps (GE Lighting Canada, Oakville, Ontario, Canada) were positioned on the floor in the four corners of the arena and aimed at the ceiling to indirectly illuminate the water surface. A closed-circuit television camera was mounted onto the ceiling directly above the centre of the pool to convey subject swimming trajectories and parameters to an electronic image analyser (HVS Image Ltd, Twickenham, Middlesex, UK), which extracted and stored the *X-Y* coordinates of the subject's position at sample points every 0.01 s.

Morris water maze procedure. On each day, subjects were moved to the procedure room 30 min prior to testing. Each subject was placed by the tail into the water, immediately facing the perimeter, at one of the cardinal compass points (north, south, east or west), and then was allowed a maximal time of 90 s to locate the platform. Finding the platform was defined as staying on it for at least 2 s; subjects that crossed the platform without stopping (jumping immediately into the water) were left to swim. After staying on the platform for 10 s, the subject was gently picked up using a steel spatula, returned to its home cage, and allowed to warm up and dry off under a 125-W heat lamp (GE Lighting Canada). If the subject failed to find the platform in the allotted time, it was placed onto the platform for 10 s, and assigned a latency of 90 s. After each subject in the testing squad had completed one trial, the next trial was begun. The first four release points were predetermined to be quasi-random and non-sequential; the last two release points were a repetition of the first two in reverse order. At the end of the experiment, each subject had been released an equal number of times from each point. The entire procedure took four consecutive days, each subject having six training trials per day, with a 20 min inter-trial interval. On the first day (6 trials, visible phase), the platform was placed in the southwest quadrant, and had a black and yellow striped rod with a ping-pong ball affixed to the top (13 cm high, 1 cm diameter) fitted into a hole at the centre to act as a visible cue, marking its location. For the remaining three days (18 trials, hidden phase), the platform was relocated to the northeast quadrant, where it was hidden from view. A probe trial was administered 20 min after the last trial on the fourth day, when each subject was placed into the water diagonally opposite the target quadrant, and allowed 60 s to search the water, from which the platform had been removed.

Behavioural variables were quantified with the aid of HVS Water 2020 (HVS Image Ltd), and mean values on each training day were calculated for each subject. Escape

performance during training was measured by latency to find the platform (s). Spatial specificity was measured by duration of time spent in the target quadrant (% of total time, chance level = 25%) and duration of time spent within 14.5 cm of the perimeter ('thigmotaxis': % of total time, chance level = 43.5). Locomotion was measured by measuring swimming speed (cm/s) and duration of time spent floating (% of total time, movement threshold 5 cm/s). Spatial retention in probe trials was measured by the percentage of total time spent in each quadrant and the number of crossings over the platform location and over equivalent locations in the other quadrants.

Contextual and cued fear conditioning apparatus. The fear conditioning apparatus (MED Associates Inc., Georgia, VT) consisted of a test chamber (25 cm high x 30 cm wide x 25 cm deep) with a transparent ceiling, front and back, a removable grid floor of 36 stainless steel rods (3.2 mm diameter, 4.7 mm apart) connected to a constant current shock generator, and an amplifier and speaker. A 12-inch, 8-W fluorescent tube (GE Lighting Canada) illuminated the chamber interior through the transparent ceiling, and a white cloth covered the front exterior of the chamber during testing. A personal computer running automated fear conditioning software (FreezeFrame, Actimetrics Software, Evanston, IL) administered foot shocks and audible tones, recorded video images of the chamber, and monitored the activity of subjects throughout the procedure.

Contextual and cued fear conditioning procedure. Immediately prior to context and cue training, the chamber was cleaned with 70% ethanol, which left an odour during training. In the procedure room, the ceiling lights were switched off and an extractor fan was switched on. Each subject was removed from its home cage, placed at the centre of the grid floor, and left to explore the test chamber for 2 min prior to conditioning. Activity during this time was recorded as baseline (test-naïve) activity. Conditioning consisted of a single pairing of an auditory stimulus and a continuous foot shock. The tone (continuous white noise; 3600 Hz; 95 dB) was delivered 2 min after the training session started and was 30 s in duration. The foot shock (1mA scrambled) was administered during the last 2 s of the tone. The subject was removed from the chamber 30 s later and returned to its home cage.

Approximately 24 h later, each subject was returned to the chamber and monitored for 5 min without any tone or foot shock being delivered. The activity of each subject was recorded at 0.25 s intervals using the FreezeFrame automated fear conditioning software (Actimetrics Software), which can detect minute movements of grooming, sniffing, turning and rearing. The mean activity during the context exposure was calculated, divided by the mean baseline activity, and used as a measure of contextual fear conditioning. Two hours later, the context was altered by cleaning the chamber with 1% acetic acid, covering the grid floor with a sheet of white Perspex, inserting two sheets of transparent Perspex into the chamber to give it a prism shape, and switching on the ceiling lights and switching off the extractor fan in the procedure room. Each subject was placed into the altered chamber, and allowed 3 min for exploration, after which the conditioning tone of 3 min duration was delivered. The mean activity during tone delivery was calculated, divided by the mean activity in the altered context (prior to the presentation of the conditioning tone), and used as a measure of cued fear conditioning.

Statistical methods. Subject means for the three days of hidden platform training in the Morris water maze were subjected to a 4 (strain) * 3 (day) two-way analysis of variance (ANOVA), with strain as a between-subjects factor and day as a repeated measures factor. Data from Morris water maze visible platform and probe trials, and from contextual and cued fear conditioning tests, were subjected to one-way ANOVA between strains. When the ANOVA detected significant strain or day effects, pairwise differences between means for a given variable were evaluated using Tukey's *post hoc* multiple comparison test, with significance set at $P < 0.05$. ANOVA did not detect sex effects in any of the behavioural tests, so data from males and females were pooled and analysed together. All statistics were calculated using MINITAB for Windows 13.32 (Minitab Inc., State College, PA, USA) and cross-checked against the results obtained independently using STATISTICA for Windows 5.5 (StatSoft, Tulsa, OK, USA).