

Navigation related structural change in the hippocampi of London taxi drivers

Maguire et al (2000)

Research question

Does the structure of your brain change in response to environmental demand?

The aim was to find out whether changes in the brain could be detected in those with extensive navigation experience.

The hypothesis:

Based on research suggesting that the role of the hippocampus is to facilitate spatial memory (navigation).

That the hippocampi in London Taxi drivers will be structurally different to the hippocampi in non-taxi drivers.

Method

Natural experiment: Independent Design: Participants: 2 groups Group 1: 16 right handed, male taxi drivers, average age 44, all licensed more than 18 months, average time as taxi driver 14.3 years. Group 2: 16 right handed, male, age matched, non taxi drivers.

IV: London Taxi driver (brain) or Non taxi driver (brain)

DV: Structure and volume of hippocampi

Procedure: Stage 1: MRI scans of brains of 50 healthy, right handed, male, non taxi drivers aged 33 - 61 were analysed to establish a comparison database of 'average hippocampi' (analysis by Voxel Based Morphometry (VBM)).

Stage 2: MRI scans of brains of 16 taxi drivers and of 16 matched controls were analysed by VBM and compared to this database.

Control: The expert conducting the analysis did not know whether MRI scan was of taxi driver brain or not.

Ethics: Participants applied to be included in the study. Fully informed consent was gained. All had healthy general medical, neurological and psychiatric profiles.

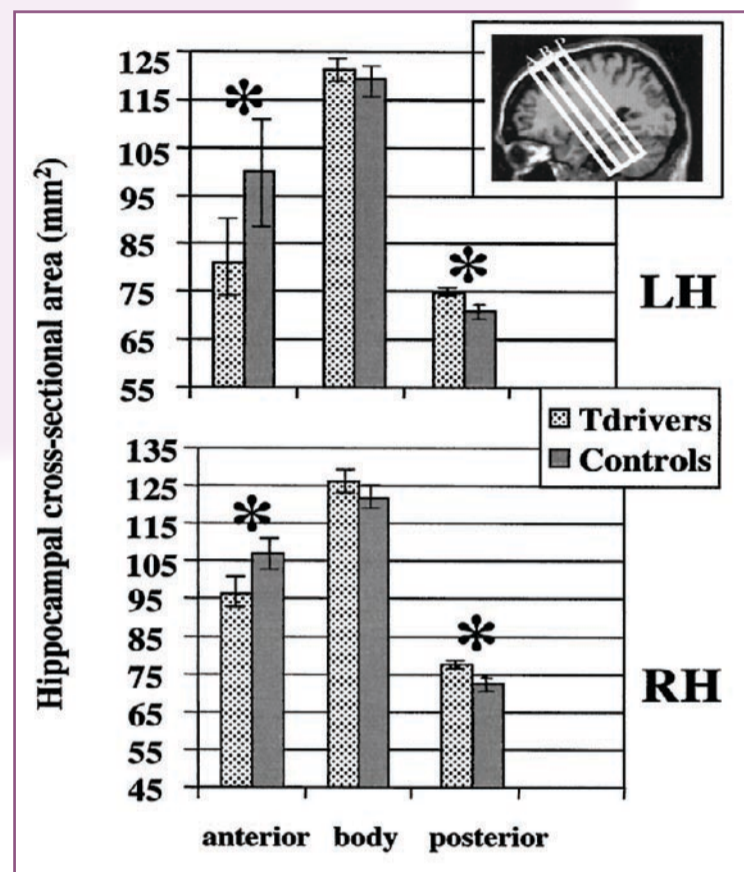
Findings:

- Increased volume of grey matter in both the right and left hippocampi in taxi driver brains (Fig 1)
- Correlational analysis found that the volume of the right posterior hippocampus increased as the length of time as taxi driver increased (Fig 2)
- Taxi drivers had greater volume in the posterior hippocampus but non taxi drivers had greater volume in the anterior hippocampus indicating a redistribution of the grey matter in the hippocampus.

Conclusions:

- That the structure of the brain changes in response to environmental demand
- That the mental map of the city of London is stored in the posterior hippocampi in taxi drivers
- That normal activity can induce changes in the structure of the brain and that this has many implications for rehabilitation after brain injury.

Findings Fig 1



Findings Fig 2

