

Rosenzweig et al. (1972)

Brain Changes in Response to Experience

This study is used to answer questions on:

Neuroplasticity
Localisation of function
Neurotransmitters
Animal Research

Abstract

This experiment aimed to test if an individual's environment can affect their brain development. Three laboratory rats that were raised in captivity were used in three different conditions. The first rat was placed into an enriched condition which involved a large cage with other rats and a continually changing amount of toys and objects with which the rat could engage. The second condition involved the rat being placed alone in a small cage. There were no other rats and no toys/objects. The third condition involved the rat being placed in a cage with 2 other rats, but no toys/object (this was the normal life of a laboratory rat and was used as a control rat). The rats were provided with food and water at all times and were left in the cages for a set amount of time. The experiment was repeated many times with different rats that were left in the cages from between 30 days to a few months. After the allotted time, the rats were removed from the cage, killed and their brains removed and examined. It was found that rats in the enriched condition showed greater weight and thickness in their cerebral cortex than the other conditions. They also showed more activation of the neurons responsible for producing acetylcholine. The researchers concluded that environment can play a role in affecting brain developments and a stimulating environment will likely increase efficiency in the brain.



Aim

- To test if environment and/or experiences can cause changes in the brain

Method

Participants

Rats were chosen as test subjects as their brains are easier to dissect than other animals. They are also small, inexpensive, have a large number of offspring and can be easily controlled. Rats from the same parents can be used in different conditions. Due to short lifespans, specially bred rats can be used and their genetic inheritance easily tracked.

For this experiment, three male rats from the same litter (parents) were used.

Procedure

The first rat was placed in an enriched environment. This consisted of a large cage with a lot of space to move about. 11 other rats were also in the cage. Each day, new toys and playthings were placed in the cage so the rats had stimulation from both the objects and the other rats in the cage.

The second rat was placed in an impoverished condition. This consisted of a small cage with no toys or playthings. The rat was also alone in the cage. This means that the rat had no stimulation (no rats or toys to interact with).

The third rat was left in the normal laboratory conditions. This consisted of a small sized cage with 2 other rats.

All the rats were given access to food and water at all times.

The experimenters repeated this experiment many times using different lengths of time and different rats. Sometimes the rats were left in the cages for a few days, sometimes for a few months.

After the correct time period, the rats were removed from the cages and killed. Their brains were then removed and examined for changes.

The level of acetylcholine in the brains was also examined.

Results

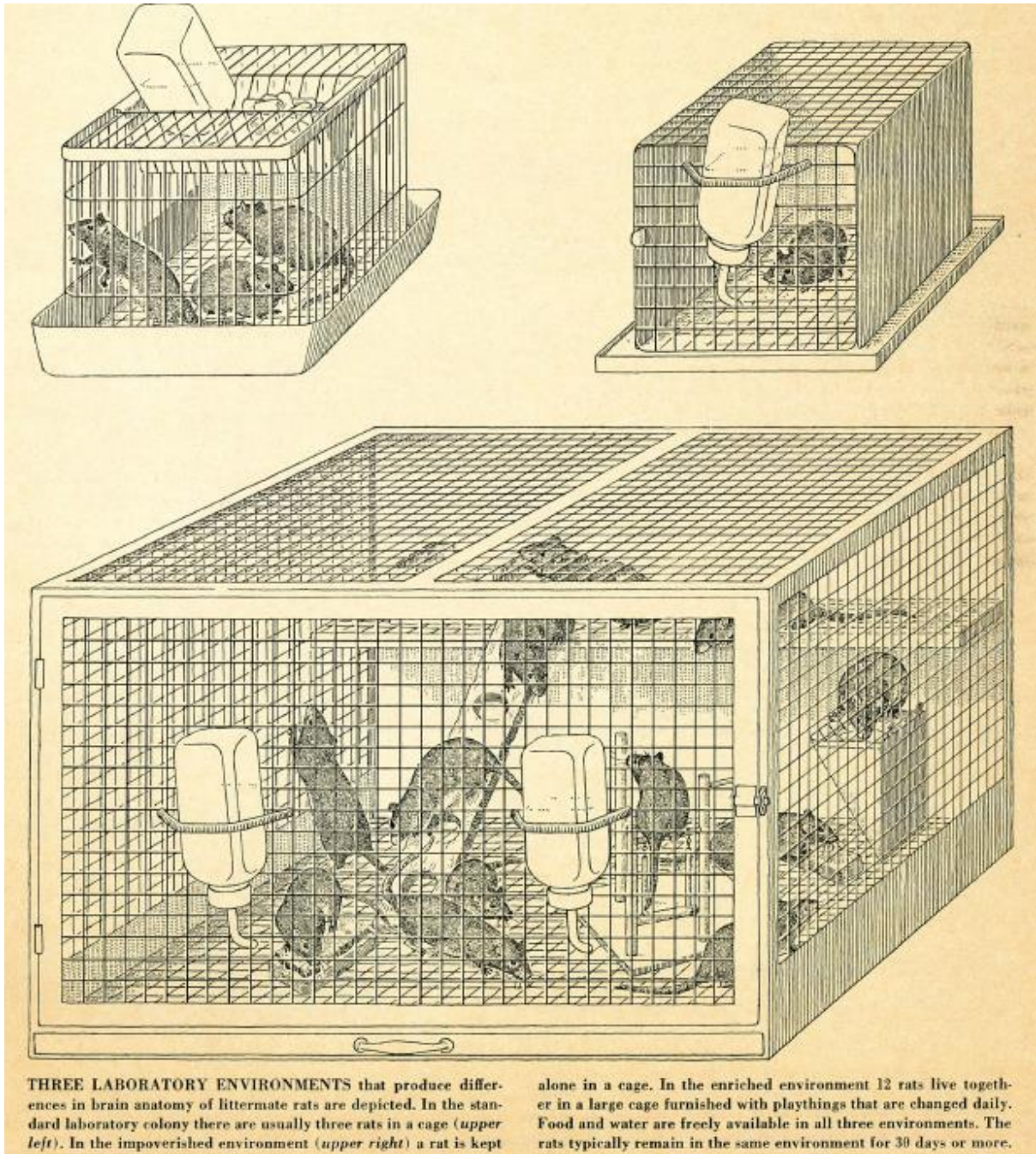
The cerebral cortex in the brains of the rats in the enriched condition was heavier than the other conditions

The thickness of the cerebral cortex in the brains of the rats in the enriched condition was greater than the other conditions.

There was greater activity of the neurons responsible for acetylcholine in the brains of the rats in the enriched condition. This is associated with problem-solving as animals given problem-solving tasks show greater development of acetylcholine.

Conclusion

Having access to stimulation such as other individuals, a variety of objects and problem-solving situation can cause developmental changes in the brain. This likely increases the capacity/efficiency of the brain.



Evaluation

Generalisability

- Rats were used in the experiment, not humans. Despite the physiological similarities to the human brain, humans have more complex lives than rats.

Reliability

- The experiment was repeated many times on many different rats.
- Extraneous variables were very controlled as the environments were easily maintained.
- The researchers who conducted the dissection followed a standard procedure and were blind as to which rat they were dissecting to avoid any bias.
- A control group (the laboratory rats) was used so that the researchers had a 'baseline' brain with which to compare both conditions.

Application to life

- Knowing that natural (see validity below) and stimulating environments can affect brain development can help with the raising of human children. They should have access to new experiences, problem-solving situations and physical objects to improve their brain development.

Validity

- By using different amounts of time in the cages, the researchers could assess how much the brain changes over time.
- The unnatural setting of the cage could have affected brain development. Researchers followed up this study by examining the brains of mice kept in natural environments. The mice were caught in the local area and kept in huge pens with dirt, grass, rocks, plants and wood. It was found that these mice had even greater increases in cerebral cortex weight and thickness.

Ethics

- The rats were not mistreated during the experiment and, although they were killed for examination, it was done humanely.
- The experimenters followed all the ethical guidelines regarding animal research as laid out by their ethics committee.

