
Discuss the effects of neurotransmitters on human behaviour.

Ans. Neurotransmitters are the chemical messengers of the brain that influence human behaviour. Their levels are found to fluctuate as humans engage in various behaviours. The question, however, is how do they influence behaviour? Are neurotransmitters released simultaneously when behaviour is performed such that they correlate with behaviour that is actually shaped by the environment? Or are they themselves the causes of human behaviour? To answer this question, experimental studies delineating causal relationships have been performed with both humans and animals. Animal studies have the edge of enabling highly controlled environments that help isolate the effects of strictly the targeted neurotransmitter on a specific behaviour. This is exemplified in the study conducted by Martinez and Kesner.

In the study, researchers aimed to investigate the effect of the neurotransmitter acetylcholine (ACh) on the behaviour of spatial memory retrieval. Rats were trained to go through a maze at the end of which they would receive food as a reward. Upon completion of the training, some of the rats were injected with an ACh antagonist scopolamine that reduces levels of ACh in the brain. Some of the other rats were injected with physostigmine, an ACh agonist that increases ACh levels. Finally, a third group of rats served as the control which did not receive any injection. Researchers measured how fast rats could run the maze post their respective treatments. Results showed that rats who received physostigmine ran the maze faster than the other two groups of rats. It was concluded that ACh plays an important role in creating the memory of a space such as a maze.

By manipulating a clear cause in the form of the independent variable (IV) - levels of ACh and measuring an effect, the dependent variable (DV) - time taken to complete the maze, researchers established a causal relationship between the neurotransmitter ACh and the behaviour of memory. Of course though, there is the question of how well these findings would generalise to humans, given that human brains are far more complex than rats. Human brains have a more intricate system of neurotransmitter interactions and a greater variety of neurotransmitters, making direct comparisons challenging. The role of ACh in humans has been established through studies which have shown that injecting humans with scopolamine helps them perform virtual spatial tasks better under contolled conditions. Nevertheless, there are far too many socio-cognitive factors such as emotional state of the individual, stress level, the social context in which a spatial task is performed, etc. which can mediate or even supersede the relation between ACh and spatial memory in humans, in real settings. This also brings about the question of how reductionist it can be to assume that neurotransmitters are the only factors underlying behaviours in humans.

One of the many studies that are seemingly based on this assumption is the study by Crockett et al. that investigated the effect of the neurotransmitter serotonin on prosocial behaviour in humans. In this experiment using a repeated measures design, participants were subject to problems involving moral judgments. In one condition, they were administered citalopram, a serotonin agonist that blocks the reuptake of serotonin, prolonging its effects. In another condition, they were administered placebo. Employing a double-blind design, participants were kept unaware about the type of substance administered to them. The moral dilemmas involved scenarios such as deciding between diverting a trolley to another track to save five people on its path, resulting in the death of an innocent individual in the diversion. Results showed that when serotonin levels were increased, participants found personal harm less acceptable and that is how prosocial behaviour was enhanced. For example, in the aforementioned example, diverting the trolley to the single person became a less likely choice in the first condition. It was concluded that serotonin modulates reactions of emotionally salient situations to the brain such that causing harm to others is judged as unacceptable.

Relating this experiment to the argument on reductionism, it is apparent that having been done in a controlled setting, it managed to do away with those other variables that could have impacted moral judgement in a more everyday situation. The artificiality of the moral dilemmas, devoid of the anxiety and pressure felt if they were to occur in actuality failed to capture the impact of emotions, prosocial behaviour and perhaps also, the functioning of serotonin. Undeniably, the manipulation of citalopram administration, coupled with intra-individual comparisons across conditions established increased serotonin as the cause of prosocial behaviour with participant variables such as prosociality in personality under control. However, given that moral judgments in real life could be influenced by not only emotions but also social pressure to act prosocially and possibility of social consultation before taking a decision, only a holistic approach would serve to uncover the effect of serotonin in prosocial behaviour after accounting for all other variables.

Regardless of whether neurotransmitters share a causal relationship with behaviour or not, their impact on behaviour is shown to have the potential to treat some mental disorders. Even if they are only correlational to behaviour, their modulation through pharmacological interventions can lead to significant improvements in symptoms for conditions such as depression, anxiety, and schizophrenia. This suggests that while the exact mechanisms may still be under investigation, targeting neurotransmitter systems can provide valuable therapeutic benefits. A demonstration of this was done in the study by Freed et al.

These researchers aimed to investigate whether patients of Parkinson's disease could benefit from the transplantation of dopamine producing cells in their brains. Dopamine is a neurotransmitter that is known to play a role in the regulation of movements and patients of Parkinson's disease, who have a deficit of this neurotransmitter, primarily suffer from uncontrollable tremors in their muscles. In the study, patients were randomly divided into two groups - one that received transplantation of dopamine stem cells and the other which underwent sham surgery. Results showed that there was not only an increased growth of dopamine producing cells in the brains of the former group but also a significant reduction in symptoms of Parkinson's disease. It was concluded that dopamine does regulate movements in the body and that successful growth of dopamine cells via transplantation is a potentially beneficial treatment for Parkison's patients.

In conclusion, neurotransmitters significantly influence human behaviour through their roles as chemical messengers in the brain. Experimental studies in both animals and humans have demonstrated causal relationships between specific neurotransmitters and behaviours. For example, acetylcholine has been linked to spatial memory in rats, and serotonin has been shown to enhance prosocial behaviour in humans. Despite the reductionist approach often employed in such studies, which may overlook the complexity of human behaviour influenced by multiple factors, the modulation of neurotransmitters has proven beneficial in treating mental disorders. This suggests that while neurotransmitters may not be the sole determinants of behaviour, they play a crucial role in behavioural regulation and offer potential therapeutic avenues for conditions like Alzheimer's, depression, anxiety, schizophrenia, and Parkinson's disease.

(word count = 1163)

Whatsapp : +919892507784 for psychology classes

E-mail : jyotika@excellingpsychology.com for other queries

Lesson prepared by:

Jyotika Varmani (M.A. Psychology Honours, NET, SET, PGDHE)

CIE A-levels Psychology Teacher - Modern College, Mauritius

CIE A-levels Psychology Subject Expert - Podar International, Mumbai

8+ years experience in private tutoring for CIE, IB, AQA, Edexcel Psychology

Owner of 'Excelling Psychology' online

Visit Jyotika Varmani's complete profile at -

https://www.teacheron.com/tutor-profile/1KH