Area of brain controlling the body's response to exercise identified

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The part of the brain which prepares our bodies for exercise, and controls our circulation and breathing while we exercise, has been identified by Oxford researchers.

A team from Oxford's Department of Physiology, Anatomy and Genetics has identified the brain location which is most active when we anticipate exercise: the periaqueductal grey area (PAG), the small-celled grey matter adjoining or surrounding the cerebral aqueduct and the third ventricle in the midbrain.

The findings were revealed in Washington, DC on 29 April during the 120th annual meeting of the American Physiological Society.

The team was able to look deep into the brain because Oxford is a leading centre in the use of deep brain stimulation, in which electrodes are implanted inside the brain to treat problems including Parkinson's, chronic pain and dystonia (a neurological disorder characterized by involuntary muscle contractions resulting in twisted movements and abnormal postures).

With the fully-informed consent of patients who have been treated with the electrodes and so have them in place in their brain long-term, researchers can use those electrodes to measure electrical activity in different parts of the brain once they have recovered from surgery. To identify the area of the brain associated with exercise, the team asked twelve such patients to perform light exercise. Their brain activity was

measured both when they knew exercise was imminent, and then during exercise.

The results revealed that anticipation of exercise, with associated increases in heart rate, blood pressure and pulmonary ventilation, is associated with an increase in PAG activity. If the PAG is electrically stimulated when the subject is resting then blood pressure increases. This suggests that this portion of the brain is directly involved in the neurocircuitry of the brain's central command system before the actual onset of movement. During exercise itself, PAG activity further increases.

For almost 100 years researchers have looked for the brain's 'central command' system, whose role includes controlling the body's cardiorespiratory response to exercise. Animal studies and functional imaging studies have provided clues to the location of this system, but the underlying electrophysiological activity has never been measured until the Oxford research.

However, 'as to this bigger question in neuroscience about finding the "central command" area of the brain, we're still not there,' says Professor David Paterson, who presented the findings at the conference. 'PAG is an important site, but we have not conclusively proved whether it is the "central command" area of the brain – so the 100-year search for answers continues.'

Source: University of Oxford