Hormone alters male brain networks to enhance sexual and emotional function

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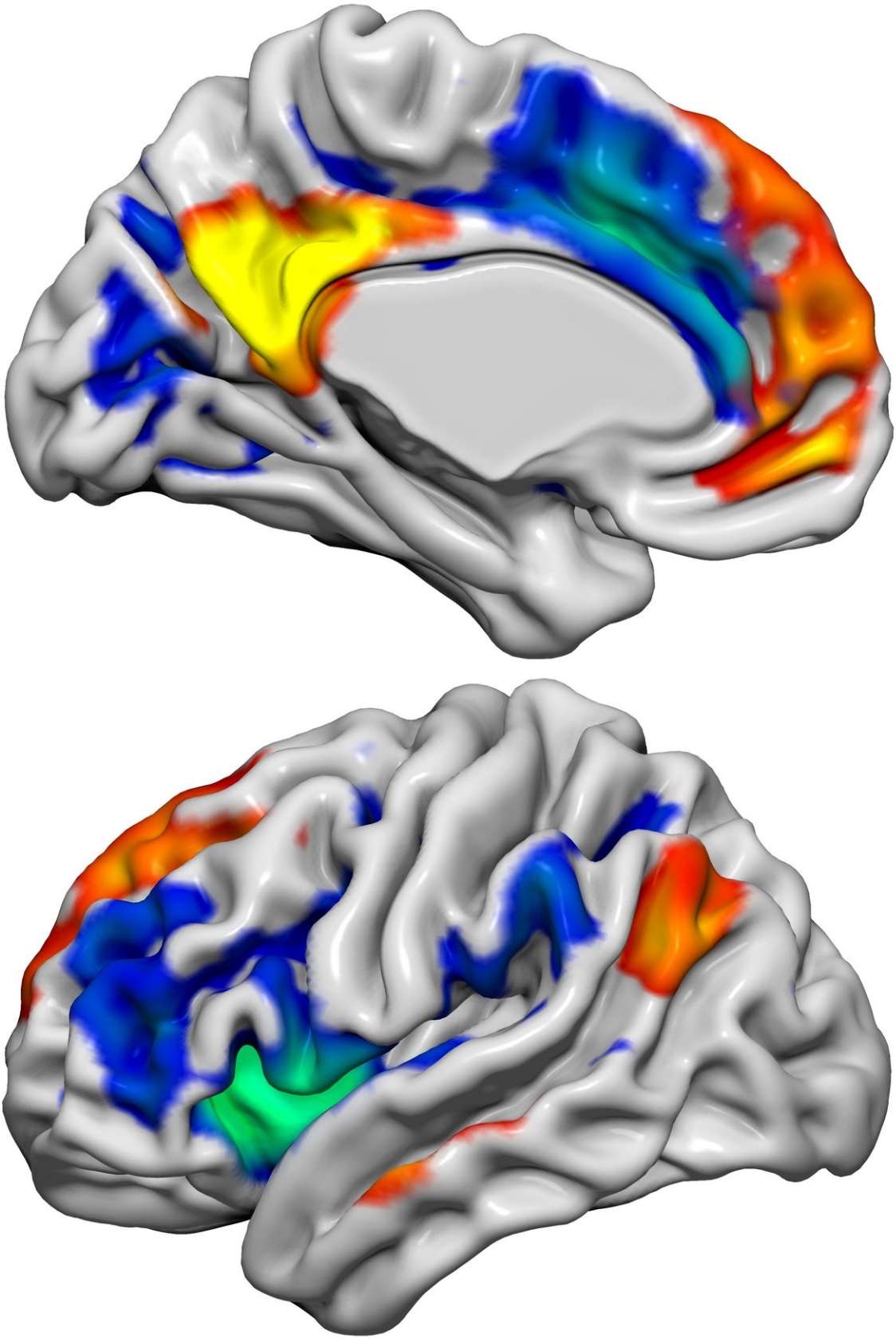

The Default Mode Network (red/yellow) and the Salience Network (blue/green) which have important roles in social and emotional function. These two networks in the brain were altered when the volunteers received the hormone kisspeptin, and this was associated with changes in brain activity linked to sexual aversion and sexual arousal. Credit: Imperial College London

Scientists have gained new insights into how the 'master regulator' of reproduction affects men's brains.

In a new study, scientists from Imperial College London investigated how a recently discovered hormone called kisspeptin alters brain activity in healthy volunteers.

The hormone, known as the master regulator of reproduction, not only has a crucial role in sperm and egg production, but may also boost reproductive behaviours.

In the new research, the scientists investigated how the hormone affects the brain when it is 'at rest'. So-called resting brain activity is the state our brain enters when not concentrating on a task, and is akin to a car ticking over in neutral. Studying this 'neutral', resting state is crucial for understanding what happens when the brain is active, and the car accelerates. Furthermore, studying the resting brain allows scientists to examine large brain networks they know are abnormal in various psychological disorders, and see if certain hormones or drugs can affect this.

In the study, published in the *Journal of Clinical Investigation Insight*, the hormone was shown to change activity in key brain networks at rest,

which was linked to decreased sexual aversion, and increased brain activity associated with sexual arousal. The scientists also observed that the hormone boosted several networks in the brain involved in mood and depression.Professor Waljit Dhillo, an NIHR Research Professor and senior author of the study from Imperial's Department of Medicine said: 'Although we have previously investigated how this hormone affects the brain when it is in an active state, this is the first time we've demonstrated it also affects the brain in its baseline, resting state. These insights suggest the hormone could one day be used to treat conditions such as low sex drive or depression'.

Dr. Alexander Comninos, first author of the study and honorary senior lecturer at Imperial, said: "Our findings help unravel the many and complex roles of the naturally-occurring hormone kisspeptin, and how it orchestrates reproductive hormones as well as sexual and emotional function. Psychosexual problems, such as low sex drive, affect up to one in three people, and can have a devastating effect on a person's, and a couple's, wellbeing. These findings open avenues for kisspeptin as a future treatment for these problems, although there is a lot of work still to be done."

In the new study, funded by the National Institute for Health Research and the Medical Research Council, the researchers gave 29 healthy men an infusion of kisspeptin while assessing brain activity in a MRI scanner. Once in the MRI scanner, the volunteers were shown a number of themed images—sexual images (such as pornography), negative images (such as a car crash), and neutral images (such as a cup). The researchers monitored the volunteers' brain activity while they looked at the images, as well as measuring their resting brain activity.

During the experiments, conducted in collaboration with NIHR Imperial Clinical Research Facility and the Imanova Centre for Imaging Sciences, the volunteers were also asked to complete questionnaires to assess

various behaviours such as sexual aversion (eg. by scoring words such as 'frigid' and 'unattractive' depending on how they felt at that moment).

The research team also asked the same volunteers to complete the scans and tests while receiving a placebo infusion. The volunteers did not know whether they were receiving the hormone or the placebo at each visit. This enabled the scientists to directly compare the volunteer's normal brain activity and behaviour with their responses while receiving the hormone.

The results revealed the hormone altered activity in specific resting brain networks. An increase in this activity was linked to less aversion to sex and greater brain activity in areas involved in sexual arousal.

Specifically, the researchers found the hormone altered activity in the Default Mode Network and Salience Network, which have key roles in social and emotional processing. The hormone was also found to boost key mood connections in the brain, and this increased activity in key mood centres when presented with negative images such as those of car crashes. Furthermore, the hormone was also shown to decrease negative mood in these volunteers.

Dr. Comninos concluded: "We have conducted previous studies that showed kisspeptin can activate specific brain areas involved in sex and emotions. However, this study enhances our knowledge of the hormone even further. Our findings suggest it can actually influence entire networks in the brain even when we are not doing anything, and this is linked to subsequent sexual and emotional function. Taken together, these findings provide the scientific basis to investigate kisspeptin-based treatments in patients with psychosexual and mood disorders, which are both huge health issues, and frequently occur together".

The team are now hoping to further investigate how kisspeptin affects

sexual behaviours, and translate this work into patients with psychosexual and mood disorders.

Provided by Imperial College London