Sex on the brain: Orgasms unlock altered consciousness

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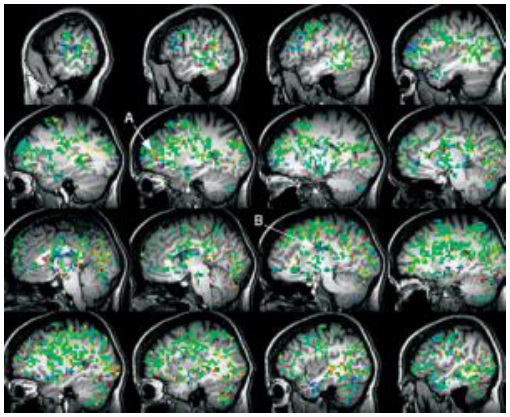
Our intrepid reporter performs an intimate act in an fMRI scanner to explore the pathways of pleasure and pain



Brain stimulation (Image: Barry Komisaruk)

Enlarge image

WITH a click and a whirr, I am pulled into the scanner. My head is strapped down and I have been draped with a blanket so that I may touch my nether regions - my clitoris in particular - with a certain degree of modesty. I am here neither for a medical procedure nor an adult movie. Rather, I am about to stimulate myself to orgasm while an fMRI scanner tracks the blood flow in my brain.

My actions are helping Barry Komisaruk at Rutgers University in Newark, New Jersey, and colleagues to tease apart the mechanisms underlying sexual arousal. In doing so, not only have they discovered that there is more than one route to orgasm, but they may also have revealed a novel type of consciousness - an understanding of which could lead to new treatments for pain (see Top-down pain relief).

Despite orgasm being a near-universal human phenomenon, we still don't know all that much about it. "The amount of speculation versus actual data on both the function and value of orgasm is remarkable," says Julia Heiman, director of the Kinsey Institute for Research in Sex, Gender and Reproduction in Bloomington, Indiana.

It is estimated that one in four women in the US has had difficulty achieving orgasm in the past year, while between 5 and 10 per cent of women are anorgasmic - unable to achieve orgasm at all. But without precise data to explain what happens during this experience, there are few treatment options available for women who might want help.

Komisaruk is interested in the time course of orgasm, and particularly when an area of the brain called the prefrontal cortex (PFC) becomes active. The PFC is situated at the front of the brain and is involved in aspects of consciousness, such as self-evaluation and considering something from another person's perspective.

Komisaruk's team recently found heightened activation in the PFC during female climax - something not seen in previous studies of the orgasm. Surprisingly, this was also the case in individuals who can achieve orgasm by thought alone. With fantasy and self-referential imagery often reported as being part of the sexual experience, Komisaruk and colleagues wondered if the PFC might be playing a key role in creating a physiological response from imagination alone. That is why I am here.

Komisaruk instructs me to tap my thumb with my finger for 3 minutes, then to simply imagine my finger tapping my thumb for the next 3 minutes as fMRI tracks where blood is flowing in my brain. Immediately after, I follow the same cycle with Kegel exercises - brief

squeezes of the pelvic floor muscles - and then clitoral touches. I'm then asked to self-stimulate to orgasm, raising my free hand to indicate climax. Despite the unique situation, I am able to do so without too much trouble.

Over 30 areas of my brain are activated as I move from start to finish, including those involved in touch, memory, reward and even pain (see "Orgasm snapshot"). As Komisaruk expected, the imagined clitoral touches and Kegel exercises activated the same brain areas as real ones, albeit with somewhat less blood flow. The PFC, however, showed more activation when touches and pelvic squeezes were imagined compared with those that were real. He suggests this heightened activation may reflect imagination or fantasy, or perhaps some cognitive process that helps manage so called "top-down" control - the direct regulation by the brain of physiological functions - of our own pleasure. The team presented their results at the Society for Neuroscience annual conference in San Diego in November 2010.

However, when Janniko Georgiadis at the University of Groningen in the Netherlands, and colleagues, performed similar experiments they found that the same brain region "switched off" during orgasm. Specifically, they saw significant deactivation in an area of the PFC called the left orbitofrontal cortex (OFC).

Altered state

Georgiadis argues that the OFC may be the basis of sexual control - and perhaps only by letting go, so to speak, can orgasm be achieved. He suggests this deactivation may be the most telling example of an "altered state of consciousness" and one not seen, as yet, during any other type of activity.

"I don't think orgasm turns off consciousness but it changes it," he says. "When you ask people how they perceive their orgasm, they describe a feeling of a loss of control." Georgiadis suggests that perhaps orgasm offsets systems that usually dominate attention and behaviour. "I'm not sure if this altered state is necessary to achieve more pleasure or is just some side effect," he says. It is possible that the inability to let go and reach this altered state may be what prohibits individuals with anorgasmia from reaching climax.

There may be a simple explanation for the discrepancies between Georgiadis's and Komisaruk's work - they may represent two different paths to orgasm, activated by different methods of induction. While participants in Komisaruk's studies masturbated themselves to orgasm, those in Georgiadis's were stimulated by their partners. "It is possible there is a difference between someone trying to mentalise sexual stimulation as opposed to receiving it from a partner," says Georgiadis. Perhaps having a partner makes it easier to let go of that control and achieve orgasm. Alternatively, having a partner may make top-down control of sensation and pleasure less necessary to climax.

"This kind of research is incredibly useful," says Heiman. "Orgasm is tied into the brain's reward system and likely other important systems as well. There is much we can learn about the brain, about sensation, about how pleasure works and probably much more from this one physical response."

Komisaruk agrees. He hopes to one day use neurofeedback to allow women with anorgasmia to view their brain activity in real time during genital stimulation. The hope is that this feedback may help them to manipulate their brain activity to bring it closer to that of an orgasmic pattern of activity. He also believes that further study of the orgasm - and the PFC's role - will offer much needed insight into how we might use thought alone to control other physical sensations, such as pain. "There's a lot of mystery in this one intense human experience that is just waiting to be figured out," he says.

Orgasm snapshot

Click here to see what Kayt Sukel's brain looks like at the moment of orgasm. The scan is a sagittal section, essentially a profile shot, that shows one moment in time in different "slices" through the brain.

The coloured dots represent blood flow. Cooler colours show less blood flow and less activation. Warmer colours mean more activation.

You can see from the extent of activity that an orgasm is a whole-brain experience. Activation in the prefrontal cortex (A) is clearly visible, as well as activity in the anterior cingulate cortex (B), thought to be involved in the experience of pain.

Top-down pain relief

The orgasm is a strong analgesic. With brain-activation studies of orgasm showing unique patterns of activation in regions implicated in attention, self-awareness and consciousness, researchers believe its study may also help with the control of pain.

"Orgasm is a special case of consciousness," says Barry Komisaruk at Rutgers University in Newark, New Jersey. "If we can look at different ways of inducing orgasm, we may better understand how we can use top-down processing to control what we physically feel."

People who suffer from chronic pain conditions can be coached to relieve some of their symptoms through such top-down techniques, says Kenneth Casey at the University of Michigan in Ann Arbor. That is, they can use high-level mental processes to modulate what they feel physically. "The placebo effect is an easy example of practical top-down control. You believe you are taking a pill that will help and somehow it does," he says. "In my experience, simply telling a patient that the pain they are experiencing is not harmful has an analgesic effect."

Researchers from Stanford University in California recently showed that individuals were able to control pain by watching real-time activity of a brain area called the rostral anterior cingulate cortex (ACC) and then mentally adjusting it. The ACC is also activated in orgasm.

A better understanding of what these brain areas are doing in situations of pain and pleasure, Komisaruk argues, may open the door for improved top-down techniques to modulate both.

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