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The Athlete's Way

How Pleasant Touch Sends Feel-Good Vibes up the Spine

A "feel-good" spinal pathway sends pleasant touch signals from skin to brain.

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Reviewed by Gary Drevitch



KEY POINTS

- Pleasant touch sensations make humans and other social animals feel safe and nurtured from infancy to old age.
- Not experiencing pleasant touch during early stages of development can have negative consequences later in life.
- A specialized spinal cord pathway driven by PROK2 neuropeptides sends pleasant-touch-only sensations from the skin to the brain.

Loving touch is vital for healthy [brain development](#) and emotional well-being.

Previous research has established that slow, caressing, "af-



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ffective" touch plays a crucial role in early childhood development. But any form of physical affection that evokes pleasant touch sensations (cuddling, hugging, holding hands, caressing, soothing pats, etc.) tends to make us feel safe, nurtured, and supported at every stage of life. On the flip side, neglect and the absence of affection can exert a harsh **lifelong toll**.

Experiencing bodily pleasure from pleasant touch promotes bonding and healthy attachment across the human lifespan. Tragically, institutionalized neglect or unloving parents have resulted in many newborn babies and infants missing out on the benefits of pleasant touch sensations during key stages of psychosocial development.

For example, Romanian infants placed in orphanages for so-called "irrecoverable children" during Nicolae Ceaușescu's reign from 1967 to 1989 were left alone in their cribs and deprived of skin-to-skin contact from a young age. In the 2000s,

development and increased risk of psychosocial issues during adulthood ([Sheridan et al., 2012](#)).

Despite researchers identifying a correlation between caregiving that involves pleasant touch sensations and healthy psychosocial development, the neural mechanisms that drive this phenomenon in social animals (like humans and mice) are unclear.

How Pleasant Touch Sends Feel-Good Signals From Skin to Brain

New research ([Liu et al., 2022](#)) in mice sheds light on the neural basis of pleasant tactile sensations and shows how gentle caressing sends hedonic, feel-good signals from the skin to the brain. These findings were published on April 28 in the peer-reviewed journal *Science*.

"Pleasant touch (e.g., cuddling, caressing, and patting) encodes positive hedonic information that facilitates emotional bonding, affiliative behavior, and the well-being of social animals," the authors write in their abstract. "Despite its profound importance, how pleasant touch information is encoded and transmitted from sensory neurons to the spinal cord remains unknown."

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Because experiments that involve depriving any social creature of affection are cruel, scientists who investigate the neural underpinnings of pleasant touch use animal models and strive to conduct their experiments in the most humane and cruelty-free ways possible. For this first-of-its-kind study, Washington University School of Medicine researchers in St. Louis created a nurturing space, where mice were gently stroked with a soft brush in a way that evoked pleasant touch sensations.

According to the researchers, one of the most challenging aspects of this study was designing experiments that made animals feel safe and unthreatened. Typically, mice instinctually view human touch in laboratory settings as a threat and display avoidance behaviors, but the researchers overcame these hurdles.

"If an animal doesn't know you, it usually pulls away from any sort of touch because it can view it as a threat," senior author Zhou-Feng Chen said in a [news release](#). "Our difficult task was to design experiments that helped move past the animals' instinctual avoidance of touch." Chen is the director of WUSTL's [Center for the Study of Itch and Sensory Disorders](#).

hand of a dying person is a very powerful, comforting force. Animals groom each other. People hug and shake hands. Massage therapy reduces pain and stress and can provide benefits for patients with psychiatric disorders," Chen notes.

Pleasant Touch Sensations and Itchiness Travel Different Pathways

During a series of complex experiments, the WUSTL researchers pinpointed a specific neural circuit and neuropeptide called *prokinectin 2* (PROK2), dedicated solely to sending feel-good signals from the skin to the brain via a hard-wired spinal pathway.

Interestingly, when the researchers blocked the ability of PROK2 to send these signals up the spine, animals who'd previously shown a preference for seeking out gentle stroking in a specific location within their habitat lost interest in visiting this locale. However, unpleasant skin sensations like itchiness could still reach the brain, which suggests that pleasant skin sensations have their own dedicated spinal pathway.

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This research indicates that the mammalian central nervous system has pleasant touch-specific neurons and a peptide (PROK2) that transmits feel-good-only signals up the spine. In contrast, another dedicated pathway uses itch-specific cells and other neuropeptides to send unpleasant sensations related to itchiness.

Prokinectin 2 (PROK2) and Its Spinal Receptors (PROKR2) Are Crucial

The latest (2022) research from Liu et al. advances our understanding of how a specific neuropeptide and its receptors in the spine transmit pleasant-touch-only sensations. As Chen sums up, "In these experiments with mice, we have identified a key neuropeptide and a hard-wired neural pathway dedicated to this sensation."

"Collectively, we identify PROK2 as a long-sought neuropeptide that encodes and transmits pleasant touch to spinal PROKR2 neurons," the authors conclude. "These findings may have important implications for elucidating mechanisms by which pleasant touch deprivation contributes to social avoidance behavior and mental disorders."

with other neural circuits. Someday, PROK2-based therapies might be used to treat mental health issues characterized by touch avoidance or impaired social development, such as autism spectrum disorder.

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