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Love on the Brain: How Neuropeptides Are Shaping Our Love Lives

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How Neuropeptides Are Shaping Our Love Lives

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One of Oberlin's most surprising (although heavily rumored) statistics is the remarkable number of Obie-to-Obie marriages—I've heard anywhere from 50 to an eyebrow-raising 80 percent. If this is the case, Oberlin seems to be an excellent place to find love. So, what exactly is stirring inside all of these Obies? Why do we feel love at all, and how is it maintained?

William Shakespeare once wrote, "Love looks not with the eyes, but with the mind, and is therefore winged Cupid painted blind." Although Shakespeare lived and wrote well before the dawn of modern neuroscience, his writing encapsulates the sentiment of what it means to be in love. Namely, the experience of love emanates not from a higher power, but from the all-powerful organ that is your brain.

Psychologists traditionally differentiate love into two categories: romantic love and companionate love. Romantic love is most associated with the first stage of love and involves strong feelings of desire for a specific person (also known as the "honeymoon phase"). This form of love is strongly tied in a physiological way to the release of the neurotransmitter dopamine. Companionate love generally follows after romantic love, and revolves around a mutual care and understanding of each other. The switch from romantic love to companionate love is typically thought to facilitate long-term relationships and involves another set of neuropeptides: oxytocin and vasopressin.

Ever feel a rush of excitement when you spot your crush at one of the infamous Oberlin house parties? Well, that surge of emotion—sometimes referred to as "butterflies"—is frequently attributed to the release of dopamine, a neurotransmitter that activates reward circuits in your brain. Neurotransmitters are tiny chemical messengers that, when released from the tip of a neuron, can affect another neuron by binding to its receptor. In this case of dopamine, its release triggers feelings of pleasure and reward that help explain the excitement we experience when we're around people that we like!

To better understand how romantic love manifests in the brain, fMRI brain scans of Rutgers and Stony Brook University college students were taken as they looked either at pictures of people they were romantically in love with, or similar photographs taken of people they were acquainted with. The results of this experiment found that early stage romantic love was heavily attributed to subcortical reward regions of the brain that are dopamine-rich. Additionally, the study found that looking at pictures of romantic partners engages neural systems that deal with motivation to acquire a reward. Thus, early-on romantic love can be characterized as a motivational state that can lead to euphoria, describing why we might go out of our way to be around that special someone.

While it makes sense that the dopamine-induced desire propels us to begin dating and fall in love, it seems many Obies are in it for the long haul. So what keeps us together as we sober up from the excitement of new love? On top of the connection between dopamine activation and feelings of romantic love, fMRI research has demonstrated that levels of activation in specific brain regions may be correlated with amount of time spent in love. In particular, it was found that those who had been in love for a longer time showed a reduction of dopamine activity in their posterior cingulate, an area associated with obsession, but significantly higher activation in the ventral pallidum, an area linked to attachment. These findings are consistent with self-reports which suggest that partner-based obsession subsides early on in the relationship, but feelings of attachment, commitment, and intimacy—hallmarks of companionate love—grow as the relationship persists. Although dopamine continues to be important throughout your relationship, the transition from romantic love to companion love is attributed to two famous pair-bonding neuropeptides: oxytocin and vasopressin. It is the activities of this dynamic duo that are responsible for feelings of attachment (seen in areas like the ventral pallidum) that enable you to put up with (and even still like!) your partner after the obsession of early love passes.

Oxytocin and vasopressin are dual hormones and neuropeptides that are produced in the paraventricular nucleus of the hypothalamus (found at the base of your brain) and subsequently released by the posterior pituitary. Oxytocin is most typically associated with female reproduction: specifically, it plays a pivotal role in childbirth and child-rearing by helping to expel the baby from the uterus, signaling for milk ejection, and creating a loving and nurturing bond between mother and infant. Oxytocin is also heavily involved in relationships, however, and is released during skin-to-skin contact in both males and females and fosters feelings of contentment and closeness after sex (hence its nickname: "the cuddle hormone"). Vasopressin, on the other hand, is more often associated with social behavior in males (specifically aggression toward other males). To better understand how the two hormones relate to companionate love, neuroscientists have turned toward an unassuming subject: the vole.

Voles, a small type of rodent, appear all over studies of love. Of particular interest to researchers are the prairie vole, the montane vole, and the meadow vole. Despite the fact that these types of voles share over 99% of their genetic material, they differ from each other in mating behavior: while the prairie vole forms monogamous relationships (one of only 3% of mammals to do so), the montane and meadow voles are only ever interested in a one-night stand. Differences in mating patterns are thought to arise due to subtle variations in neuroendocrine function between the species. By uncovering the mechanisms that account for these differences, neuroscientists hope better understand why it is that humans often form and maintain long-term relationships. So what do the voles reveal?

It turns out, when prairie voles have sex, oxytocin and vasopressin are released. Once released, these hormones are able to activate receptors in brain regions associated with reward and reinforcement—namely, the ventral pallidum and the nucleus accumbens—suggesting a reason why prairie voles maintain a single relationship for life. If oxytocin and vasopressin are blocked, however, prairie voles' relationship becomes a short-lived fling (similar to the montane vole). Conversely, if given an injection of hormone but kept from mating, prairie voles still prefer their partner over another. On the other hand, if given an injection of hormones, montane voles do not act differently. This is due to the fact that reward regions in their brain do not contain receptors for oxytocin and vasopressin, so long-term relationships are not associated with pleasure for them.

Extrapolating from this, in another vole-related experiment, researchers implanted a vasopressin receptor gene from the monogamous male prairie vole into a meadow vole. As a result of this genetic transfer, originally polygamous meadow voles began exhibiting coupling behavior, like prairie voles. Translating this research to humans, it is postulated that people, like monogamous prairie voles, have oxytocin and vasopressin receptors in areas of the brain that deal with reward. Thus, continuous activation of receptors within these pathways overtime is thought to create memories of a partner that are rewarding, thereby reinforcing the relationship.

A common perspective—and fear—surrounding relationships is that romance fades with time. Although some early aspects of love may dissipate (such as obsession with a romantic partner), research suggests that even couples who have been together for years can still experience the intensity, engagement, and sexual interest of romantic love. Thus, transition from romantic to companionate love doesn't mean a loss in passion; rather, it creates a relationship in which passion exists in tandem to attachment. In other words, Oberlin students have got it pretty good.