# Why Do We Love?
# Professor Robin May
### Wednesday 22nd April

Romantic love is one of the most powerful and universal human experiences, shaping art, culture, behaviour, and even the course of history. But its existence is an evolutionary enigma. Far from being a prerequisite for successful reproduction, romantic love is at best a bonus and at worse a barrier…so why do we love at all?

## The Neuroscience of Romantic Love

Romantic love is a complex motivational state driven by specific neural circuits. Neuroimaging studies, particularly those using functional MRI, have consistently shown that romantic love activates the brain's reward and motivation systems rather than the cortical regions associated with rational thought or emotional regulation.

One of the most important regions is the ventral tegmental area (VTA), a dopamine-rich structure that plays a central role in reward, craving, and reinforcement learning. When individuals view photographs of their romantic partners, the VTA shows strong activation, similar to patterns observed when people take addictive drugs. This suggests that love is deeply tied to the brain's reward circuitry.

Another key region is the caudate nucleus, which is involved in goal-directed behaviour and habit formation. Romantic love often produces intense focus, heightened energy, and a drive to pursue the beloved—behaviours consistent with caudate involvement. The nucleus accumbens, a hub for reward anticipation, also becomes active, reinforcing the motivational pull of the partner.

Interestingly, the prefrontal cortex (PFC)—responsible for judgement, impulse control, and critical thinking—tends to be downregulated during early-stage romantic love. This may help explain why people in love often overlook flaws, take risks, or idealise their partners.

## Oxytocin and the Chemistry of Love

Oxytocin, sometimes known as the "bonding hormone," is released during physical touch, sexual activity, childbirth, and breastfeeding. A wealth of evidence indicates its importance in parenting behaviour in mammals: mice lacking oxytocin fail to nurse their newborn pups, whilst exposing ewes to oxytocin results in them forming a parental bond with unrelated lambs. But some of the most compelling data comes from studies of prairie voles, small rodents that form monogamous pair bonds. Unlike closely related vole species, prairie voles exhibit partner preference, shared nesting, and biparental care, forming strong partnerships that last for life.

Research has shown that prairie voles have high densities of oxytocin and vasopressin receptors in reward-related brain regions. When these receptors are blocked, pair bonding does not occur. Conversely, artificially stimulating these receptors can induce bonding even in the absence of mating.

This has led to intense investigation of whether oxytocin may underpin pair bonding in humans too. However, volunteer studies have demonstrated that oxytocin's effects are more subtle. Exposure to oxytocin does not appear to predispose humans to be romantically 'receptive' (despite what some perfume advertisements would have you believe!), although it does seem to help cement existing relationships by reducing individuals interest in new potential romantic partners.

## Love as a Potential Addiction

Although romantic love is typically viewed as positive, in some circumstances it can be exceptionally damaging; for example, for those who find themselves repeatedly drawn back to an abusive partner. This apparently counter-intuitive behaviour may be partly explained by love's 'addictive' properties.

The same neural systems activated by love—particularly the VTA and nucleus accumbens—are involved in substance use disorders. Contact with a loved one (especially early in a relationship) activates reward circuits similar to those stimulated by psychoactive drugs or high-calorie foods. And when a relationship ends, people often undergo symptoms akin to substance withdrawal: distress, rumination, loss of pleasure, and even physical discomfort.

However, for those suffering from 'love addiction' or post-relationship heartbreak, there is a slight ray of sunshine in that strategies used to treat substance addiction, in particular cognitive behavioural therapy, have shown some promise in treating love addiction too. And finally, it's worth remembering that a host of data has shown that people who are in love (or at least, who find themselves in stable romantic relationships) have better health and longer lives than those who remain single.

So, as Tennyson said, it is indeed probably better to have "loved and lost, than never to have loved at all".

## Further Reading


1. **Aron, A., Fisher, H., Mashek, D. J., Strong, G., Li, H., & Brown, L. L. (2005).** Reward, motivation, and emotion systems associated with early-stage intense romantic love. *Journal of Neurophysiology, 94*(1), 327–337.
2. **Fisher, H. E., Aron, A., & Brown, L. L. (2006).** Romantic love: A mammalian brain system for mate choice. *Philosophical Transactions of the Royal Society B, 361*(1476), 2173–2186.
3. **Young, L. J., & Wang, Z. (2004).** The neurobiology of pair bonding. *Nature Neuroscience, 7*(10), 1048–1054.
4. **Insel, T. R., & Young, L. J. (2001).** The neurobiology of attachment. *Nature Reviews Neuroscience, 2*(2), 129–136.
5. **Acevedo, B. P., Aron, A., Fisher, H. E., & Brown, L. L. (2012).** Neural correlates of long-term intense romantic love. *Social Cognitive and Affective Neuroscience, 7*(2), 145–159.

6. **Burkett, J. P., & Young, L. J. (2012).** The behavioral, anatomical and pharmacological parallels between social attachment, love and addiction. *Psychopharmacology, 224*(1), 1–26