Love and addiction: the devil is in the differences: a commentary on “The behavioral, anatomical and pharmacological parallels between social attachment, love and addiction.”

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In their review in the current special issue, Burkett and Young (2012) describe the striking similarities that are observed between attachment and addiction. The idea of love as an addictive drug has been described in art and literature across the ages, as well as by modern scientists (Insel 2003; MacLean 1990). Recent advances have demonstrated that both attachment figures and drugs of abuse are highly rewarding stimuli that lead to long-term changes in physiology and behavior, often utilizing the same neural substrates. The review is thorough and intriguing; however, focusing too narrowly on the similarities between attachment and addiction may hinder our broader understanding of their individual biology as well as their interactions. Indeed, there are significant ways in which addiction and attachment differ, and these merit consideration. Although a full review and discussion of these differences is beyond the scope of this commentary, we provide examples in each neurobiology and behavior.

There is compelling evidence that drugs of abuse and social partners activate and alter common neurotransmitter systems (as reviewed in Burkett and Young 2012). For example, repeated amphetamine and pair bonding each increase dopamine D1 receptors (D1R) in the nucleus accumbens (Aragona et al. 2006; Liu et al. 2010). However, only amphetamine leads to accumulation of Δ FosB (Hostetler and Bales 2012), a transcription factor found in D1R-containing neurons of the nucleus accumbens that has been strongly implicated in neural plasticity following repeated natural and drug reward (Nestler 2008). This suggests that the changes in D1R following pair bonding are induced via mechanisms that are independent of addiction-related processes.

Addiction is partially characterized by a reduction in the rewarding properties of stimuli that are not the drug of abuse (Ahmed and Koob 2005). Similarly, reduced responsiveness to rewarding non-social stimuli has been observed in pair-bonded voles and maternal dams (Ferris et al. 2005; Liu et al. 2011; Mattson et al. 2001). In contrast, male titi monkeys that are housed with a pairmate show increased preference and consumption of a rewarding beverage (Ragen et al. 2012). These findings indicate that shifts in reward response following attachment are not universal, and there is a need for more research across an array of species and behaviors.

These examples are quite specific, but fundamental and significant differences are observed on a much broader scale. Addiction is atypical behavior that leads to a severe reduction in the physiological and psychological health and well-being of the individual (NIDA 2012) and exerts a significant cost to society (Mark et al. 2001; Office of National Drug Control Policy 2004; Rehm et al. 2009). While the type of attachment described by Burkett and Young may meet some criteria for addiction (Schaeffer 2009), the vast majority of attachments, including pair bonds, parent–offspring relationships, and friendships, are evolutionarily adaptive behaviors that have been selected upon to promote reproductive fitness, general health, and species-typical behaviors (Carter 1998; Ducharme and Kollar 2012; Gubernick and Teferi 2000; McGuire et al. 1992; Numan and Insel 2003; Uchino et al. 1996). Given these benefits, it is challenging to see how attachment meets criteria of a DSM-IV disorder.

The similarities and dissimilarities between attachment and addiction may be reconciled using a model that utilizes overlapping, but distinct, neurobiology and behavior (Fig. 1). We agree that neurocircuits involved in actions of drugs of abuse and addiction partially overlap with neural systems involved in social behaviors. This explains the convergence in many, but not all, characteristics of love and addiction. However, striking differences between these

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Fig. 1 Neural substrates of social attachment and addiction. Substrates of social attachment behaviors are depicted as partially overlapping squares. Substrates underlying addiction to different drugs (or other addictive behaviors) are depicted as ovals. They are also known to involve partially overlapping mechanisms. While the review by

Burkett and Young focuses on overlaps between these substrates, our commentary stresses that there are many differences. Focusing on the differences could be a more productive approach to treat individuals affected by addiction or mental disorders triggered by social stresses

behaviors should not be surprising, as even among different drugs of abuse there is a lack of similar short- and long-term effects on the brain and behavior (Fleckenstein et al. 2000; McGeehan and Olive 2003; Ramsey et al. 2008). Moreover, pharmacological interventions are not only differentially effective against different types of addictions, but even differentially effective for various individuals with addictions to the same drug (Heilig and Egli 2006). We caution that using treatments used to reduce drug craving to treat grief from loss of a loved one is a risky proposition. For example, while naltrexone is moderately effective against alcohol and opiate addictions, we would not suggest blocking endogenous opioids in subjects experiencing a bad breakup. Therefore, we propose that focusing on detailed differences, rather than on similarities between drug addiction and healthy social attachments could be a more productive avenue.

An important direction for cross-disciplinary research is to explore how different aspects of social stress and attachment influence addictive behavior. Research in humans has found that social affiliations and attachments may both promote and protect against many stages of addiction, including onset, abstinence, and relapse (Buckner et al. 2008; Charney et al. 2010; Garmendia et al. 2008; Hajema and Knibbe 1998; Homish and Leonard 2008; Hunter-Reel et al. 2009; Kelly et al. 2008; McCrady et al. 2006; McKay et al. 2005). However, human population studies often cannot determine the directional or causal role of these interactions, or the behavioral, cultural, or emotional mechanisms that may explain social influences on drug use and abuse (Hunter-Reel et al. 2009). Animal models are therefore invaluable for examining the bidirectional biological influence of attachment

on drug use and abuse (Anacker et al. 2011a, b; Hostetler and Ryabinin 2012; Liu et al. 2011). In this way, social neuroscience has the potential to provide invaluable and innovative tools for addiction biology. Research on the interaction between the social environment and drug abuse may be particularly informative for prevention and treatments. Rather than the cause of addiction, perhaps love is the drug for treating addiction.

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