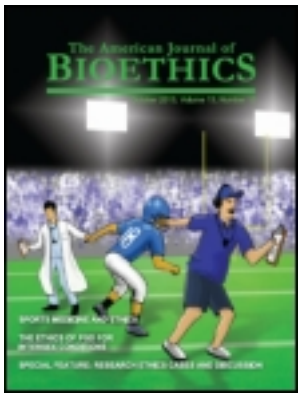

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If I Could Just Stop Loving You: Anti-Love Biotechnology and the Ethics of a Chemical Breakup

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Target Article

If I Could Just Stop Loving You: Anti-Love Biotechnology and the Ethics of a Chemical Breakup

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"Love hurts"—as the saying goes—and a certain amount of pain and difficulty in intimate relationships is unavoidable. Sometimes it may even be *beneficial*, since adversity can lead to personal growth, self-discovery, and a range of other components of a life well-lived. But other times, love can be downright dangerous. It may bind a spouse to her domestic abuser, draw an unscrupulous adult toward sexual involvement with a child, put someone under the insidious spell of a cult leader, and even inspire jealousy-fueled homicide. How might these perilous devotions be diminished? The ancients thought that treatments such as phlebotomy, exercise, or bloodletting could "cure" an individual of love. But modern neuroscience and emerging developments in psychopharmacology open up a range of possible interventions that might actually work. These developments raise profound moral questions about the potential uses—and misuses—of such anti-love biotechnology. In this article, we describe a number of prospective love-diminishing interventions, and offer a preliminary ethical framework for dealing with them responsibly should they arise.

Keywords: love drugs, neuroenhancement, anti-love biotechnology, domestic abuse, pharmacology, ethics, wellbeing

> "My love is as a fever . . . past cure I am . . ." (Shakespeare, Sonnet 147)

INTRODUCTION

A Cure for Love?

The idea of an anti-love remedy—or a "cure" for love—is as old as love itself. References may be found in the writings of Lucretius (see Fitzgerald 1984), Ovid (Ovid and May 2010), Shakespeare ([1623] 1975), and many others, and are tightly linked to the notion that love or infatuation—under certain conditions—can be just like a serious illness: bad for one's physical and mental health and, in some cases, profoundly damaging to one's overall well-being. George Bernard Shaw ([1911] 1986) famously called love one of "the most violent, most insane, most delusive, and most transient of passions" (34) and even mocked the idea that modern marriages should be based on so volatile and fleeting an emotional foundation.

Ancient cures for love included phlebotomy, exercise, bloodletting, avoidance of rich foods or wine, and drinking plenty of water (Babb 1941). According to the more recent *Harry Potter* stories, a love potion "antidote" may be brewed from Wiggentree twigs, castor oil, and the extract of a Gurdyroot.[1] While these examples are clearly prescientific or, in the latter case, simply made up, they point to a conception of love as something that is *rooted in the body*—a physical, biologically based phenomenon, susceptible to being treated or even stamped out by the various ministrations of a doctor (or a wizard as the case may be).

Modern neuroscience goes a step further, and traces love's roots to the brain, and even to specific biochemical pathways modulated by various hormones and neurotransmitters. In 2008, two of the present authors (Savulescu and Sandberg) outlined a comprehensive argument for the "neuroenhancement" of love and relationships, which focused on the potential use of biochemistry to help *maintain* authentic and well-suited relationship bonds that might otherwise needlessly break down (for more recent discussions see Earp 2012; Earp, Savulescu, and Sandberg 2012; Earp, Sandberg, and Savulescu 2012; Savulescu and Sandberg 2012). The following year, writing in *Nature*, neurobiologist Larry Young

1. As shown in the video game adaptation of *Harry Potter and the Half Blood Prince* (Rowling 2005). See the Harry Potter Wiki at http://harrypotter.wikia.com/wiki/Love_Potion_Antidote

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Box 1. What is love?

As the Oxford English Dictionary would have it, love is "a strong feeling of affection" sometimes with "sexual attraction." To poets like Charles Burkowski, "Love is a fog that burns with the first daylight of reality." Ambrose Bierce takes a more cynical view: "Love, n. A temporary insanity curable by marriage."

Love, then, has different meanings—and there is no authoritative definition to which we can appeal. As Karin Weis states, "Love is not a uniform phenomenon. There are countless variations on the forms [pair-based] relationships can take [and] just as diverse as the appearances of love are the theories of love that try to fathom it" (see Sternberg and Weis 2006, 2–3).

In this article, we focus primarily on a psycho-biological account of love. This account suggests that the complex feelings, motivations, and interpersonal attachments that one would typically associate with the word "love" are actually grounded in, and in fact emerge from, a suite of neurochemical and behavioral subsystems that evolved to promote the reproductive success of our ancestors (e.g., Kenrick 2006). How, precisely, these underlying systems relate to "higher order" conceptions (and subjective experiences) of love is not yet fully understood—but it is clear by now that they *do* relate. Thus, while we do not claim that "love" is *reducible* to brain-states—at least not in any straightforward, non-trivial way—we will attempt to defend the view that brain-level, neurochemical interventions can *affect* feelings of love, in roughly systematic ways, according to a wide range of conceptual definitions.

As a consequence of this approach, when we refer to "everyday" or folk experiences and understandings in this article, we will use words like "love," "devotion", and "attachment" more or less interchangeably. When describing neurochemical subsystems associated with love, however, we will employ a more precise and consistent scientific nomenclature.

(2009) planted a seed for the modulation of love in the opposite direction—raising the possibility of a chemical "cure."

Young presented a view of love as "an emergent property of a cocktail of ancient neuropeptides and neurotransmitters" (148)—a view that we shall largely adopt for the purposes of this article (see Box 1)—and then went on to speculate that "drugs that manipulate brain systems at whim to enhance or *diminish* our love for one another may not be far away" (emphasis added). In other words, something like an "anti-love" potion may be shifting from the world of medieval alchemy and children's fairy tales to genuine medical science.

The first whiffs are already in the air. As reported in the Israeli newspaper *Haaretz* (Ettinger 2012, 1), "Psychiatric drugs are being given to ultra-Orthodox yeshiva students . . . at the request of rabbis . . . and marriage counselors" as a way of suppressing sexual feelings, so that the "patients" may find it easier to comply with rigid Orthodox norms about love and human sexuality. A Christian man suffering from what he described as Internet "sex addiction"—a condition he felt was ruining his marriage—was recently prescribed oral naltrexone[2] to control his urges (Bostwick and Bucci 2008). And American sex offenders are sometimes offered "chemical castration" (through the ingestion of anti-androgen drugs) as a condition for parole (Gooren 2011).

These cases—already fraught with difficult moral questions—involve the rather clumsy and "low-level" use of pharmacology to target the bodily sex drive, and hence are capable of only indirect modification of a person's "higher order" feelings of love or attachment. Yet emerging biotechnologies may soon make it possible to intervene in love's inner sanctum in markedly more direct and consequential ways, generating even thornier ethical conundra. In this article, we sample some of the latest neuroscience research that may lie along the path toward a biochemical "cure" for love, and offer a preliminary ethical framework for dealing with such technology should it happen to arise.[3]

Perilous Loves

Why seek out a cure for love? In her article "When Love Hurts: The Story of an Abused Woman," journalist Susan McClelland (2006) shares the tragic account of one Canadian newlywed's struggle to leave an abusive relationship. Rob, the woman's partner, "wore big pewter biker rings on every finger" and after one trifling incident early in their marriage "started smashing [her] in the face with his knuckles. He grabbed [her] hands and bent them backward, breaking one of [her] fingers" (1). The young woman—Bonnie—recounted later on: "I was in shock. I was stunned. But I didn't leave. A few hours after the incident, Rob broke into tears and told me how sorry he was. I loved

2. A pharmaceutical normally used to treat alcohol dependency.

3. Some of what follows is necessarily speculative. But as Decamp and Buchanan (2007) point out, this does not "make the discussion fruitless" (538). Instead, preemptive deliberation "may help *shape* the technological development" of nascent biochemical research in a beneficial way, whether from an ethical, pragmatic, or sociopolitical perspective. Moreover, it may be "more prudent to explore a range of possible issues, some of which may not arise, than to be overtaken by events owing to the failure to think ahead" (Decamp and Buchanan 2007, 538). We add that as an intellectual exercise, reflecting on plausible "future" outcomes can help to clarify and simplify the underlying moral equations involved, which might in turn more effectively ground our ethical judgments regarding analogous cases in the present day.

him so much [that] I believed him when he said it wouldn't happen again."

Bonnie's experience of feeling intense love[4] for her abuser is far from unique. Clinical psychologist Joseph Carver (2007) has even used the notion of "Stockholm Syndrome"[5]—by which a victim forms a strong emotional bond with her attacker as a way to cope with ongoing trauma—as a framework for explaining certain cases of long-standing domestic violence. In these cases, the abused partner is reluctant to end the relationship, and may actually defend the aggressor when others try to intervene. Similarly, Stanton Peele and Archie Brodsky (1974; 1975) have argued that harmful relationships can be literally addictive for some individuals, leading them to chase constantly after momentary highs of emotion only to crash back down into inevitable despair. Peele and Brodsky (1974) use the term "interpersonal heroin" to illustrate their point.[6]

Needless to say, battered men and women do sometimes manage to break free from their violent relationships, but their *love* for their partner may not abate, even months or years after the breakup. This can result in long-term suffering, interfering with or even precluding future emotional bonds, as a recent posting from an Internet support group illustrates:

> About 10 months ago I broke up with [my abusive partner], but I am unable to get over him. I have tried to date other men but I always . . . end up [breaking things off] with them, just wishing I was back with my high school boyfriend. I know he is a terrible person . . . but I am unable to have other relationships . . . I'm scared that I'll never be able to be in love again. (TEENADVOCATEDAN 2009)

"Love hurts"—as the saying goes—and a certain degree of pain and difficulty in intimate relationships is unavoidable. Sometimes it may even be *beneficial*, since, as it is often argued, some types (and amounts) of suffering can lead to personal growth, self-discovery, and a range of other essential components of a life well lived. But at other times, love can be downright dangerous. Either it can trap a person in a cycle of violence, as it did for Bonnie, or it can prevent a person from moving on with her life or forming healthier relationships, as it did for the woman in the second example. There are other cases of potentially problematic love as well:

- Romantic love for someone other than one's spouse.
- Unrequited love that leads to despair or suicidal thoughts and behaviors.[7]
- Delusive love, as in erotomania.[8]
- Spurned love that leads to violence or other harmful acts, such as abuse of children during a marital separation.
- An older person's uncontrollable sexual attraction for a child.
- Incestuous love.[9]
- Love for a cult leader.

4. A reviewer for this article writes: "This is Bonnie's experience—how she conceptualizes what she feels. However, a psychiatrist or psychologist may say that what she feels is not actually love but an obsessive attachment to the abuser, or an emotional allegiance from the perspective of a criminologist, [or] a mental disorder." This is undoubtedly true: One person's "love" may certainly be thought of as insanity by someone else—or a delusion, or none of the above. But who gets to lay claim to the meaning of the word? A psychiatrist (for example) may wish to *define* "true" love as being something intrinsically healthy, positive, and good for one's well-being; and on such a definition, we would have to conclude that Bonnie was mistaken about her own feelings, or was using the word "love" incorrectly. Yet other definitions abound. The philosopher Simon May (2011), for instance, conceives of "true" love as something that can sometimes be destructive, even to the point of death. Our own conception is discussed in Box 1. Yet whatever position one takes on the question of labeling, the moral analysis remains essentially the same. Are the feelings harmful? Why? In virtue of what? And how might they best be tempered or resolved? As we have argued elsewhere (Earp, Wudarczyk, Foddy and Savulescu, unpublished), treatments designed to diminish problematic forms of interpersonal attachment "should hinge on considerations of harm and well-being rather than on definitions of disease"—or, indeed, on definitions of love. See Box 1 for further discussion.

5. The term "Stockholm Syndrome" was first used by criminologist Nils Bejerot to describe the emotional allegiance felt by a number of hostages—bank employees—toward their captors in an armed hold up of a Swedish bank in 1973. Rather than rejoicing at their eventual freedom, some of the hostages resisted the aid of government officials and actually defended the criminals who had held them captive over a six-day period. See Alexander and Klein (2009) for more information.

6. See also Burkett and Young (2012) for a more recent neuroscientific account of love-as-addiction.

7. Baumeister, Wotman, and Stillwell (1993) reported that 93% of males and females have been previously rejected by an object of passionate love and that 95% rejected someone who had such feelings for them. Romantic rejection has several negative mental health consequences: it sometimes results in homicide and suicide (e.g., Meloy and Fisher 2005; Wilson and Daly 1992) and regularly leads to clinically diagnosable depression (Mearns 1991).

8. Erotomania "is a rare disorder in which an individual has a delusional belief that a person of higher social status falls in love and makes amorous advances towards him/her" (Kennedy et al. 2002, 1). The individual himself or herself may (or may not) feel "in love" with this high-status person in return.

9. We do not mean to imply that incest is inherently harmful: If two adults who are closely related to each other wish to have concensual sex, especially if they take measures to avoid pregnancy (given a higher chance for genetic defects in any resulting offspring), then it is not clear, on utilitarian grounds, *ceteris paribus*, that there would be anything wrong with their doing so. Indeed, even if they did not use birth control, being at a higher than average risk of producing offspring with a genetic disorder does not normally constitute (moral or legal) grounds for a prohibition on having sex. Older couples and couples with heritable disabilities, for example, are free to have unprotected sex, and suggestions that they should be barred from doing so would be met with considerable skepticism. However, many cases of incest involve sex between parents (or step-parents) and younger children, which would introduce a much greater risk for exploitation and harm. These are the cases we mean to bring to mind. See Kasemset (2009) for an interesting discussion on incest between consenting adults.

This list is not exhaustive, of course, and one cannot fail to appreciate that other possible versions of it might not accord with progressive intuitions. In the 1950s in America, for example, "interracial love" would undoubtedly have been included as a "perilous love" meriting serious concern. "Homosexual love" probably finds itself at the top of the list in certain conservative religious circles still today. And "intercaste" love might be a contender in parts of modern India. We address these complicating factors in our ethical discussion below, as well as at some length in a separate paper (Earp, Sandberg, and Savulescu, in press).

If one focuses, however, on just the first set of examples for the time being, it would seem uncontroversial to assert that the feeling of love or attraction might very well result in harm, either for the person himself or herself, or for other vulnerable people such as a spouse or a child. In the case of love for a cult leader, the love might seem beneficial to the individual, but has the potential to be quite hazardous considered from other perspectives (i.e., from the perspective of the individual's friends or family). So it may be reasonable to ask—at least in an exploratory way—whether and how these perilous feelings of love could be diminished, so that the likelihood of the possible harms attending them (domestic violence, child abuse, suicide, jealous murder, adultery, and so on) would likewise be reduced or mitigated.

We do not suppose, of course, that some single pill might ever be invented that could make a person "fall out of love" or be "cured" of love or in any other way reduce or diminish "love" considered as a unitary concept or a monolithic phenomenon. Anti-love biotechnology, just like love itself, is a many-splendored thing—or at least a multifaceted thing. Accordingly, biochemical interventions designed to dampen the ungovernable urges of someone with pedophilia, for example, would likely be very different from—and work on the brain in a different way than—comparable interventions designed to help an abuse victim sever the emotional connection she has with her abuser. Likewise, a love "vaccine" that works to prevent unwanted love might differ in meaningful ways from a love "antidote" designed to quell an existing love, which might differ in turn from a memory-erasing[10] drug that could help someone recover from a prior love.

Given this heterogeneity, we will organize our excursion through the relevant scientific research around certain biopsychological subsystems associated with "love" more broadly construed. While we do not attempt any hard-and-fast classifications—neither of the interventions we discuss, nor of the "types" of unwanted love that they could plausibly "treat"—we do want to give a coherent enough sense of the current (and near-future) neuroscience to make our more general claims about anti-love biotechnology plausible, and to highlight the urgency of the ethical project we undertake in the subsequent pages.

We shall ultimately argue that the individual, voluntary use of anti-love biotechnology (under the right sort of conditions) could be justified or even morally required. That is, in some cases, to deny its use would be inhumane. Our analysis, we believe, has ramifications for the current debate on human enhancement and the limits of medicine; on the relationship between drug-based interventions and respect for individual autonomy; and on the role of well-being in discussions about biomedical treatment.

THE SCIENCE OF A CURE FOR LOVE

A Brain's-Eye View of Love

In order to explore the neurochemistry of any love-diminishing intervention, we need to begin by understanding love itself from the perspective of the brain.[11] From this perspective, love is a "complex neurobiological phenomenon" that has been wired into our biology by the forces of evolution. "Relying on trust, belief, pleasure, and reward activities" concentrated in the limbic system (Esch and Stefano 2005, 175), love's ability to bring together (and keep together) human beings—from prehistoric times until the present day—has played a key role in the survival of our species.

In terms of natural selection, the human adult pair bond seems to have developed from earlier structures involved in sustaining the attachment between mothers and their infants (Young 2009). This "adaptive workaround" (Eastwick 2009) may have been driven by the heightened importance—over generations of human evolution—of paternal investment in offspring with increasingly large and more complex cerebrums. These burgeoning baby brains took longer to reach maturity than their more ancestral counterparts, leaving the infant vulnerable and underdeveloped for extended periods of time. If parents fell in love and remained together at least during this fragile period for their offspring, their own genetic fitness would be enhanced (Fisher 1992).

10. The use of memory-erasing drugs to purge a prior relationship from one's mind was dramatized in the 2004 Focus Features film *Eternal Sunshine of the Spotless Mind*, starring Jim Carrey, Kate Winslet, and Kirsten Dunst. For a thorough and very interesting discussion of the "morality of memory" as dealt with in this film, see Chistopher Grau's 2006 essay in *The Journal of Aesthetics and Art Criticism* 64(1): 119–133. While the possibility of memory erasure is clearly pertinent to our discussion of anti-love biotechnology, a full analysis would take us too far afield of our focus on lust, attraction, and attachment—that is, the predisposing affective factors for potential (harmful) relationships, as well as the psychological "glue" holding together current (harmful) relationships. Accordingly, we mention memory erasure only in passing here. Of course, if one had already "cured" herself of her emotional attachment to—for example—an abusive partner (perhaps by using one of the interventions we explore in this essay), there would seem to be less of a need for deleting him from her mind as well. For these and other reasons, we will leave the science and ethics of memory-modification to other writers (e.g., De Jongh et al. 2008; Glannon 2006; Henry, Fishman, and Younger 2007; Liao and Sandberg 2008; Liao and Wasserman 2007; Parens 2010).

11. To set the foundation for our new arguments in the present article, we have adapted a handful of sentences in this brief introductory segment—as well as in our later discussion of oxytocin—from section 7 of Earp, Sandberg, and Savulescu (2012). The copyright for this material is retained by the authors.

Underlying human love, then, is a set of basic brain systems for lust, attraction, and attachment that have evolved among mammals. Helen Fisher and her colleagues (Fisher 1998; Fisher et al. 2002) have argued that the lust system promotes mating with a range of promising partners; the attraction system guides us to choose and prefer a particular partner; and the attachment system fosters long-term bonding, encouraging couples to cooperate and stay together until their parental duties have been discharged. These universal systems are hypothesized to form a biological foundation on which the cultural and individual variants of sexual, romantic, and longer term love are built (Gottschall and Nordlund 2006; Jankowiak and Fischer 1992).

Anti-Love Interventions: Lust, Attraction, Attachment

The three emotion-motivation "subsystems" proposed by Fisher and colleagues—lust, attraction, and attachment—provide a useful[12] way for us to organize the various neurochemical interventions that that might one day be used (or are currently available) to undermine potentially harmful forms of love. Fisher and colleagues (2002; see also Fisher 2000; Fisher 2004) have argued that these subsystems are characterized by discrete yet interrelated behavioral repertoires, neural circuits, and changes in hormone levels.

The lust system (libido or sex drive), for example, is distinguished by craving for sexual gratification and is largely associated with the hormones estrogen and testosterone in both men and women. The attraction system promotes focused attention, intrusive or obsessive thoughts about the object of desire, feelings of exhilaration, and so on, and is associated primarily with adrenaline, dopamine, and serotonin. And the attachment or pair-bonding system inspires feelings of calm and security, fosters a range of relationship-protective behaviors, and is associated mainly with the neuropeptides oxytocin and vasopressin.

These systems can and do function somewhat independently in humans and other mammals. In other words, it is possible to be attached to one person, attracted to someone else, and in lust with another—or, as Fisher and colleagues (2002, 414) state:

> Men and woman can copulate with individuals with whom they are not "in love"; they can be "in love" with someone with whom they have had no sexual contact; and they can feel deeply attached to a mate for whom they feel no sexual desire or romantic passion.

At the same time, the underlying hormonal and neural circuitry involved across subsystems is subject to a considerable degree of interactive overlap. For example, testosterone can stimulate the production of vasopressin; oxytocin can modify activity in dopaminergic pathways; and serotonin can alter the synthesis, secretion, and function of several other neurotransmitters (see Fisher 2000, 97).

Given this interconnectedness, chemical interventions designed to target one system may have effects on another, or may lead to a cascade of hormonal changes manifesting at the psychobehavioral level in unpredictable ways, including in ways that might vary considerably from person to person. Lynch (2004) predicts that sophisticated nanobiochips and advances in brain imaging will allow for the development of so-called "neuroceuticals," or highly efficient synthetic neuromodulators that could target specific subreceptors in well-defined neural circuits. But this sort of finely tuned technology is still on the horizon: indeed, it may be a matter of decades before Lynch's prognostications can be verified.

In what follows, therefore, we constrain ourselves (chiefly) to the comparatively "messy" interventions that seem most likely based on existing neuroscientific knowledge and present or near-future means of chemical administration. Some of the drugs we will discuss make an appearance in more than one category—lust versus attraction versus attachment—and where we *are* being more conjectural than descriptive, we will try to make this clear in the text.

Anti-Lust Interventions

Interventions acting on the lust subsystem are already available. We gave three examples in the introduction: antidepressant medications (especially SSRIs), androgen blockers, and oral naltrexone—normally prescribed to treat alcohol dependency. Here we add such household names as tobacco and alcohol, as well as a range of other medications with reduction of libido among their potential side effects. These include almost all blood pressure pills, pain relievers containing butalbital as well as opiates such as morphine and hydrocodone, statin cholesterol drugs, certain acid blockers used to treat heartburn, the hair loss drug finasteride, and seizure medications including gabapentin and phenytoin (Cohen 2009; Ruan 2007). With the exception of androgen-reducing drugs used specifically for "chemical castration" (see discussion below), the negative effect of these chemical substances on a person's sex drive is typically neither intended nor desired. Yet as we illustrated earlier with the case of "off-label" antidepressant use by Orthodox yeshiva students, this need not necessarily be so.

With regard to mechanism, libido-reducing effects commonly follow from direct or indirect regulation of testosterone levels. Focusing on this hormone as the most important determinant of sexual desires and actual behaviors, particularly in men (Cunningham et al. 1990), a number of

12. If fairly arbitrary: There are a number of equally plausible "biological" theories of love we could draw on to give our analysis structure, with a great deal of overlap between them. Douglas Kenrick (2006), for example, has proposed that "love is a set of decision biases that evolved to serve genetic interests"; Phillip Shaver and Mario Mikulincer (2006), like Fisher, argue for three systems, but call them "attachment, caregiving, and sex"; David Buss (2006) considers love a universal adaptation that "evolved in the course of evolution to solve problems of reproduction"; and Leckman and colleagues (2006) exchew the term "love" altogether and refer instead to the "conscious subjective experience that arises from bonding and attachment, and that also exerts an influence on them" (as summarized by Weis 2006, 4).

studies have measured the effects of testosterone reduction on problematic sexual thoughts or activities, such as intrusive erotic fantasies[13] or compulsive exhibitionism. Rösler and Witztum (1998), for example, report that long-acting analogues of gonadotropin-releasing hormone (such as triptorelin) can inhibit the secretion of luteinizing hormone, which in turn interferes with the synthesis and release of testosterone. In their study, they showed that the administration of triptorelin led to a reduction in pedophilic sexual fantasies and urges among some men. Likewise, Amelung and colleagues (2012) examined the combined effects of androgen deprivation therapy and group psychotherapy on a small sample ($n = 15$) of "self-identifying, help-seeking pedophiles," and reported a reduction of paraphilic sexual behaviors, an increase of risk-awareness and self-efficacy, and a decrease of offense-supportive cognitions (176).

Side effects of these sorts of treatments are a serious concern. In an observational study, Kreuger and Kaplan (2001) administered oral flutamide (an antiandrogen drug normally used to treat prostate cancer) followed by intramuscular injections of leuprolide acetate (which downregulates testosterone-triggering hormones) to hospitalized patients struggling with a range of paraphilic conditions. These included pedophilia, voyeurism, public masturbation, compulsive use of prostitutes and peep shows, tendency to commit rape, and unwanted masochistic desires. Kreuger and Kaplan reported positive outcomes in a number of cases, and concluded that leuprolide acetate "shows promise as a treatment for paraphilias" (409). Yet complications occurred in every one of the 12 cases described: One patient experienced nausea and vomiting; some lost the ability to ejaculate or have an erection altogether; others showed a complete absence of sexual feeling or interest and became severely depressed; and every patient subjected to prolonged treatment suffered bone mineral density loss, putting them at risk for osteoporosis.

Another problem with androgen-reducing interventions is that their effect on a person's libido is generally global rather than selective. So while someone might wish to reduce only harmful or ill-directed lust—toward, for example, a prepubescent child, or an unattainable object of desire—current biotechnology is not sensitive enough to deliver on these sorts of person-specific[14] goals.

Anti-Attraction Interventions

Interventions affecting the attraction system are somewhat more hypothetical. Although some blunt chemical instruments may already exist, the nature of what makes a partner attractive in the first place is little understood and is likely to be highly variable. Insofar as they could be shown to work, anti-attraction drugs might reduce the obsessive thoughts characteristic of early-stage romantic relationships, or the chance that an initial spark of attraction would lead on to longer term attachment. Whether it would be possible to block attraction to particular individuals or groups remains to be seen—although the Westermarck effect (see below) does seem to indicate that the brain is capable of selective negative sexual imprinting and hence the preclusion of romantic desire for an otherwise eligible individual.

Research by Marazziti and colleagues (1999) suggests that the brain mechanisms involved in romantic attraction may overlap substantially with those involved in obsessive–compulsive disorder (OCD): Obsessive thinking and preoccupation with the tiniest details are distinctive of both phenomena, and both seem to turn on alterations occurring at the level of the serotonin (5-HT) transporter protein. In their study, participants who had recently fallen in love—still in the intense first stage of a relationship, but prior to intercourse—showed levels of the platelet 5-HT transporter similar to those of a sample of OCD patients, with both groups showing lower levels than healthy controls. As the authors concluded, "It would suggest that being in love literally induces a state which is not normal" (743). Indeed, retesting the lovers at 12–18 months revealed that serotonin levels had returned to baseline—at which point their "obsessive ideation regarding the partner" had disappeared as well (Marazziti et al. 1999, 744).

Given the findings of Marazziti and colleagues, it stands to reason that drugs used to treat OCD might dampen at least the obsessive aspects of a nascent amorous relationship. Patients with OCD respond most reliably to 5-HT (serotonin) reuptake inhibitors (SSRIs; e.g., Montgomery 1994; Zohar and Insel 1987), a class of antidepressants whose diminishing effect on the sex drive we have already discussed. They can also lead to "emotional blunting" of higher order feelings involved in romantic attraction. Partially, this may be due to the interference of SSRIs with the release of dopamine (Miura et al. 2005), which can in turn decrease the dopamine-fueled feelings of euphoria typical of early-stage romantic attraction. Other emotion-blunting effects are described by Adam Opbroek and colleagues (2002), who noted that 80% of their SSRI-using patients "reported less ability to cry, worry, become angry or care about others' feelings" (quoted in Parker-Pope 2006, 1).

These findings and others like them led Meyer (2007) to spell out the implications for interpersonal connections. The "overall lack of emotional stimulation" produced by SSRIs, she wrote, "may produce a blandness that overwhelms the

13. Erotic fantasies, of course, are unlikely to be problematic per se; it is when they are intrusive, unwanted, and interfere with a person's higher order goals and needs for daily functioning that they may become a more serious issue.

14. In the Kreuger and Kaplan (2001) study, Patient 1 reported that his sadistic sexual obsession with prepubescent boys was wiped out both during and after the 10-month treatment with drugs (in conjuction with group therapy), while he retained otherwise normal sexual functioning and an interest in consensual sexual relationships with adult males. Likewise, Patient 2 reported a decrease in exhibitionism but a retention of "normal heterosexual interest and functioning" (414). So in at least some individual cases, drug treatment and therapy may be able to selectively "knock out" the problematic sexual thoughts and urges, leaving a "healthy" libido intact (assuming accuracy of self-reports in these instances). While this outcome is still not person-specific, it does potentially relate to discrete classes of persons (i.e., prepubescent boys), or classes of behaviors (i.e., public displays of genetalia).

romantic relationship" (395). Arguing in a similar vein, Graham (2010) concluded: "Aside from ruining your sex life, antidepressants could also be responsible for breaking your heart" (20). For someone seeking to detach romantically, of course, this sort of outcome might be at least partially the point.

Another approach to blocking interpersonal attraction might derive from the Westermarck effect. Westermarck ([1891] 1921) observed that people living in close proximity during the first years of their lives become desensitized to each other as potential sexual partners.[15] Although the exact mechanism underlying the Westermarck effect remains unknown, it might involve learning certain olfactory cues (Schneider and Hendrix 2000; Weisfeld et al. 2003) and could undoubtedly involve other learning mechanisms as well. Some research indicates that there is a sensitive period for the imprinting to take place (Luo 2011), which raises the intriguing possibility that the right treatments (pharmacological or contextual) might reopen this period (Hensch and Bilimoria 2012), allowing for negative sexual marking of a present partner. While such an occurrence would likely not remove companionate feelings, it could presumably reduce feelings of attraction and sexual desire. Clearly, such an intervention is not currently feasible, and whether it will become so is a matter of speculation.

Anti-Attachment Interventions

There is very little concrete evidence that existing technologies could completely sever a long-term human pair bond, although (in many cases) such a breakdown in attachment occurs gradually through natural processes (see Earp et al. 2012; Savulescu and Sandberg 2008). There is, however, compelling evidence for such a possibility in other mammals with analogous mating habits, as demonstrated by Insel, Young, Wang, and collaborators (e.g., Insel and Young 2000; Insel, Young, and Wang 1997; Wang et al. 1999) in their seminal experiments with voles.[16]

As these researchers (and many others) have emphasized, several of the brain regions associated with long-term attachment in voles, humans, and other socially monogamous mammals are rich in receptors for the hormones oxytocin, vasopressin, and dopamine. These now-familiar neuromodulators are released through sex, touch, orgasm, and breastfeeding, and seem to play a major role in both the formation and maintenance of adult and mother–infant pair bonds. Specifically, oxytocin and vasopressin "contribute to the processing of social cues necessary for individual recognition," while dopamine plays a reinforcing role by signaling reward (Young and Wang 2004, 1048).

In voles, two closely related species employ either a monogamous or a polygamous mating strategy, and the difference appears to depend heavily upon the expression of oxytocin and vasopressin, as well as on the distribution of their receptors in the brain. Critical studies involved manipulating these levels directly in the monogamous prairie vole species. Infusing oxytocin into the brains of the females, and vasopressin into the brains of the males, was shown to facilitate pair bonding even in the absence of actual mating (Cho et al. 1999; Insel and Hulihan 1995; Williams et al. 1994; Winslow et al. 1993).

This effect can also be reversed. In one study, injecting female prairie voles with either an oxytocin or a dopamine antagonist caused them to lose their monogamous tendencies—that is, they failed to show any partner preference as a function of copulation (Liu and Wang 2003). As Larry Young described the findings in colloquial terms: "They will not bond no matter how many times they mate with a male or how hard he tries to bond. They mate, it feels really good, and they move on if another male comes along" (quoted in Tierney 2009, 1). Likewise, pair-bonded male prairie voles injected with a dopamine[17] blocker—at a specific site in the nucleus accumbens—failed to show characteristic mate-guarding behaviors and became more receptive to interactions with novel females (Aragona et al. 2005).

It has not yet been shown conclusively that human attachment relies on the same hormonal machinery as that used by voles, but it does seem plausible that such a system would be highly conserved (Donaldson and Young

15. The typical case involves siblings—who do indeed commonly fail to find each other sexually appealing—but has also been observed with unrelated children raised together in Israeli kibbutzim. The same phenomenon is seen in arranged marriages in which child daughters are reared together with their husbands-to-be, as well as in marriages of patrilateral parallel cousins. This negative sexual marking effect has also been observed in animal-rearing experiments, and may constitute an evolved unconscious strategy to reduce inbreeding (Markus, Rantala, and Marcinkowska 2011).

16. Aragona and Wang (2009, 1–2) provide a useful introduction to these cuddly creatures (internal citations removed): "Prairie voles are small rodents ... distributed primarily in the grasslands of the central United States. [They] are among the minority of mammalian species (3–5%) that show a monogamous social organization. ... This species was initially identified as monogamous by field studies which showed that male–female pairs travel together, share a nest with one or more litters of pups, and aggressively repel unrelated intruders from their territory. Further, male prairie voles show high levels of parental care, and it has been suggested that both parents are necessary for pup survival which selected for highly enduring pair bonds. Indeed, the pair bond is so stable that a surviving member of the pair will not accept a new mate even if the other member of the bond is lost." While traditional laboratory animals such as rats and mice do not show pair-bonding behaviors, voles—who retain their monogamous characteristics even in captivity—have been described as an "excellent model system" for studying human-analogous attachment and processing of social information (Aragona and Wang 2004, abstract).

17. While oxytocin and (to a much lesser degree) vassopressin get most of the attention in studies on pair bonding and attachment—especially in humans—they do not act in isolation. As we stated earlier, oxytocin and vassopressin seem to support the recognition and processing of social cues, while dopamine is needed to associate those cues with positive feelings. As Liu and Wang (2003) have shown, the concurrent activation of oxytocin and D2-type dopamine receptors within the nucleus accumbens is required for pair-bond formation—at least in female prairie voles.

2008; Fisher, Aron, and Brown 2006). Oxytocin is released in other animals by stroking, and in humans by frequent partner hugging, which also reduces stress (Light et al. 2005). Administering oxytocin to humans enhances recognition of social information, but not nonsocial information (Rimmele et al. 2009), and it increases the subjective experience of attachment security in males with insecure attachment patterns (Buchheim et al. 2009). By contrast, lowered levels of oxytocin can interfere with bonding, at least between mothers and their infants, as is seen in babies delivered by cesarean section (e.g., Nissen et al. 1996). We are not aware of any studies directly measuring the effects of oxytocin, vasopressin, or dopamine blockers on romantic attachment in adult humans, although the converging evidence we have been discussing points to a clear prediction.[18]

Finally, recent work on the anatomical, neurochemical, phenomenological, and behavioral parallels between love and addiction suggests that treatments aimed at the latter may one day be used to address the former as well (see Earp, Wudarczyk, Foddy, and Savulescu, unpublished). Going well beyond the conceptual foundation laid down by Stanton Peele and Archie Brodsky in the 1970s—as referred to in the introduction—James Burkett and Larry Young (2012) recently reviewed nearly 400 studies across a range of disciplines to show that "social attachment may be understood as a behavioral addiction, whereby the subject becomes addicted to another individual and the cues that predict social reward" (abstract).

Noting that all known drugs of abuse cause the release of dopamine within the nucleus accumbens—and comparing the specific dopaminergic effects of, for example, cocaine use with those of maternal and romantic pair bonding—Burkett and Young (2012) concluded that the mechanisms governing the formation (and maintenance) of social bonds overlap both anatomically and functionally with those involved in drug addiction. Further investigation into the parallel addiction–attachment functions of the opioids (endorphin, enkephalin, and dynorphin), corticotropin-releasing hormone, and oxytocin and vasopressin corroborated this view.

The implications for anti-love biotechnology did not escape Burkett and Young (2012). "These observations," they wrote, "suggest that treatments used in one domain may be effective in the other." For instance, "treatments used to reduce drug cravings may be effective in treating . . . a bad breakup" (16).

THE ETHICS OF A CHEMICAL BREAKUP: A PRELIMINARY FRAMEWORK

Taken together, these findings show that it may soon be possible to block or degrade feelings of love, lust, attraction, and attachment using pharmacological and other strategies—what we are calling "anti-love" biotechnology. Indeed it is already possible to achieve some of these effects, albeit in a rather blunt and haphazard way. Assuming that advances in neuroimaging, neurobiology, brain modeling, and drug delivery continue to hone the effectiveness (and target specificity) of love-diminishing interventions, we may one day find ourselves with an array of pills, biochips, and neuroceuticals that could successfully "treat" problematic passions—perhaps even at a low cost and with limited side effects. Having conjured these powers of some Bizarro Cupid, we would need to ask ourselves: *Should* we use them?

It depends. As Thomas H. Murray (2007) has written, biomedical interventions in general entail a "moral diversity" of possible outcomes: "There are many different means of [intervention], working through a variety of intermediary states, towards a multiplicity of ends." Different cases will yield different answers, then, and "no single ethical principle or distinction will be a reliable guide through this complex thicket" (513).

Anti-love biotechnology is no exception. As we noted at the beginning of this article, there are a number of instances of what would seem to be "obviously" harmful forms of love or attraction—the domestic abuse example; pedophilia; love that might lead to adultery, suicide, or murder; love for a cult leader; and so on—and for these types of love, we suggested that there might be at least a prima facie argument for intervention of some kind. However, we also noted more contentious examples such as interracial love, homosexual love, and intercaste love, none of which seem problematic from a socially liberal mind set, yet which are the very sorts of love-related phenomena that certain groups in society might be quite eager to stamp out if they were equipped with the right set of tools. How might we begin to make our way through this "complex thicket"?

Our first step will be to analyze a "best case" scenario for biochemical intervention—focusing on an instance of love that everyone would agree is problematic—and then proceed from there to the more controversial instances of love with our preliminary ethical framework already in place. We ask: Could there be a case in which it would be morally

18. Another, more speculative, lead for an attachment-dissolving intervention may come from Capgras's delusion (Capgras and Reboul-Lachaux [1923] 1994). In this delusion, an individual reports believing that a close spouse, sibling, or friend has been replaced by an impostor who shares identical visual features. Patients suffering from this condition are able to recognize faces, but the automatic emotional arousal to familiar faces does not ensue (Ellis and Young 1990). One explanation for this phenomenon is that "neuroanatomical pathways responsible for appropriate emotional reactions to familiar visual stimuli" have become damaged or degraded (Ellis et al. 1997, 1086). This account fits comfortably with the oxytocin–vassopressin–dopamine model of attachment, which requires the integration of social cues (including person-identification information) with a network of positive emotions. Future anti-love interventions might mirror the Capgras effect—ideally without inducing its delusive aspects—by interfering with this integration in a targeted way. Indeed, some drugs used to treat posttraumatic stress disorder (PTSD)—such as propranolol—may work in a similar manner: They do not erase the traumatic memory, but they do seem to blunt the emotional aspects of the memory, by interrupting content-emotion integration processes occurring during consolidation (or re-consolidation) in the amygdala (Glannon 2006; Liao and Sandberg 2008).

permissible or justifiable for someone to take a drug that would artificially "turn off" feelings of love, lust, or attachment that were otherwise naturally occurring?[19]

One promising contender for such a case is the example with which we opened this essay, namely, that of domestic abuse.

The Domestic Abuse Case

Everyone can agree that a feeling of very deep attachment to someone who is severely and habitually violent toward one would constitute a problematic kind of love. Does this mean, then, that there may be a role for anti-love biotechnology in this kind of relationship?

Not necessarily. First, the relationship might fall under the Stockholm Syndrome-like framework we alluded to in the introduction, in which the abused individual does not actually want to leave the relationship. She might have reformulated the violence in her mind in a way that seems to make it justified, or that feels even meaningful to her within the emotional coping strategy she has adopted. Alternatively, she might simply believe that a certain amount of violence is acceptable, as long as it is offset by other aspects of the relationship that she values to a greater degree.

In such a situation, one would have to ask: Who is it that would be administering the anti-love intervention? It wouldn't be the person herself, since she does not want it—at least not at the conscious level of her own reasoning—so it seems that it would have to be some other individual or group of individuals effectively forcing the treatment on an unwilling target.[20]

This is obviously a difficult situation. On the one hand, if love really can make a person "lose her mind"—if it induces a state that is "literally not normal," as concluded by Marazziti and colleagues (1999)—then (at least in theory) there could be an argument for overruling the person's decisions and intervening against her will. As one of us has recently argued (Savulescu 2013, 53):

> It is paternalistic to act to restrict the liberty of a competent individual in his or her best interests. [Yet even John Stuart] Mill . . . recognized that it was appropriate to restrict liberty when an individual was not in possession of relevant information about what she or he was doing [or when the individual's autonomy was otherwise compromised in a serious enough way]. This is sometimes called soft or weak paternalism—acting in the best interests of an individual where that individual's decision-making capacities are impaired.

Of course, one would have to provide very strong evidence that the person was genuinely incompetent to make decisions on her own behalf, and one would have to be sure that she was at risk of suffering serious and unambiguous harm if left to her own devices. On the other hand, the potential for even a "soft" paternalistic overreach seems fairly substantial: In general, people should be quite cautious about assuming that they know better than someone else what is in her own best interests, all things considered. Thus we still might not have found a perfectly cut-and-dried scenario for purposes of anchoring our anti-love ethical framework.

A better case, then, might derive from the specific account of abuse we shared from the article by the journalist Susan McClelland (2006)—the one concerning the woman named Bonnie. As we learned, Bonnie loved her husband so much that she believed him when he said that the violence he had subjected her to "wouldn't happen again." But that is not the end of the story:

> Life became hell after that. For the next two months the abuse was nonstop. Rob kept me in a constant state of terror. I'm not a drinker, but he'd toss a rum and Coke in my face and say drink. He'd punch me in the stomach or kick me in the thigh if I didn't. I started walking on tiptoes around him, fearful of everything I'd say and do. . . . He dislocated my shoulder several times. He'd lift me up by the ankles and bang my head against the floorboards in the living room. (1)

With such a monster in the house, why didn't Bonnie file for divorce? A part of her wanted to leave, she claimed, but

> another part of me hesitated. . . . He'd cry and show such remorse that I'd forget my own pain. He'd become romantic and sweet, and I'd fall in love with him all over again. (1)

From the way Bonnie describes her feelings here as well as throughout the rest of the article, it becomes apparent that she *knows* she needs to leave the relationship—that she has a second-order desire to leave it—but that her first-order romantic bond is standing in the way of her actual ability to do so. If the administration of anti-love biotechnology could ever be justified in the context of human relationships, then, this would seem to be a maximally promising scenario:

1. The love in question is clearly harmful and needs to dissolve one way or another.
2. The person would conceivably want to use the technology—and if she did want it, there would be no problematic violations of consent.
3. The technology would help the person follow her higher order goals instead of her lower order feelings.

19. Note that this is a narrow question; it addresses moral permissibility only. In other words, it leaves to the side a wide range of other, broader ethical concerns that the existence of anti-love biotechnology would inevitably bring about. Indeed, "there are a whole host of ethical issues surrounding accessibility and availability to these technologies, informed consent, . . . the concept of harm (and benefit)," and so on, as a reviewer of this article rightly observes. We do not disagree. However, much of this "host" of ethical issues applies to any new drug or technology, and we do not wish to recapitulate the entire debate on such matters in this initial article on the subject. Instead, we wish to "zoom in" on a single moral question that seems to us to be especially pertinent, and give it the detailed attention, in this article, that we believe in deserves.

20. An analogous case would be the "love for a cult leader" example, at least in this respect.

An Objection and Some Fine-Tuning

A similar logic would seem to apply to someone with uncontrollable—and unwanted—sexual desire for (say) young children; or to someone falling unwillingly (yet irresistibly) for an individual other than his spouse; or to someone desperately, and unrequitedly, in love, who had no prospect of ever having her feelings returned and who was therefore descending into utter despair. In each of these sorts of cases, the personal, voluntary use of a love-diminishing intervention would seem to be at least potentially justified.

Someone might object that there is an important distinction to draw, however, between simply trying to diminish love—which may indeed be justified in these kinds of cases—and using a biochemical intervention, specifically, to do it. The argument would be that a person who is suffering from a harmful or a dangerous kind of love should first make a point of overcoming her feelings using what one might call "traditional" or non-biomedical methods. These could include focusing on the loved one's faults,[21] creating physical distance between the loved one and oneself, deleting all of her e-mails, and spending less time looking at her pictures on Facebook.

This is a sensible suggestion. If for no other reason, these less invasive methods should be preferred—or at least tried first—on the grounds that they would probably be safer and have fewer unpredictable side effects than drug-based or other "high-tech" interventions—at least for the foreseeable future. Furthermore, they would arguably preserve the greatest opportunity for dealing with (and learning from) the so-called "bigger picture" or "real life" issues that were contributing to the problem in the first place. This sort of approach would emphasize what Eric Parens (2013) calls "engagement" over mere "efficiency" (5).

However, it is equally important not to be dogmatic about rejecting a possible intervention just because it is new or unfamiliar or comes in the form of a pill. In some cases, it might be possible that "traditional" methods simply wouldn't work: Perhaps the person doesn't have the strength or the willpower to tackle those "bigger picture" issues without the help of a chemical ally. Hence, we add a further item to our list of ethical boundary conditions. In some cases:

4. It might not be psychologically possible to overcome the perilous feelings without the help of anti-love biotechnology.

Together with the first three conditions, this fourth consideration would seem to create the strongest possible moral justification for the use of an anti-love intervention of the sort we described earlier. First, it would be clear that the love was harmful and that it was right for it to end—so contentious cases like homosexual love or intercaste love would be treated with extreme caution (see later discussion). Second, the intervention would be undertaken with the consent of the individual—so that the risk of paternalistic overreach would be minimized, and confined to "traditional" methods of intervening (as in the Stockholm Syndrome case, as well as the "cult leader" scenario). Third, the biotechnology would help the individual pursue her higher order, longer term plans or goals—so autonomy would be respected or even enhanced.[22] And fourth, the intervention would be necessary to bring about this outcome—that is, "traditional" methods would have already been exhausted.

Is the "Necessity" Requirement Necessary?

The four boundary conditions we have just introduced set a very high bar for the use of anti-love biotechnology across a range of cases. In fact, it might be reasonable to argue that we have set the bar too high. In particular, it seems that the fourth requirement (necessity) could be considered potentially too stringent. Consider:

What if it were possible to diminish a harmful love-attachment without using any newfangled technology, but simply much harder to do so? What if the emotional suffering incurred by the use of "traditional" methods was severe and protracted enough that the instrumental value of that pain (for personal growth, self-discovery, etc.) seemed doubtful to the individual concerned? What if this were so even if he could not know for sure that some deeper life-insight would not be gained through "sticking it out"? Should we nevertheless maintain that he must not swallow the pill?

Philosophers will disagree. So-called bioconservatives would probably remind us here that even great and seemingly unbearable suffering can impart unforeseeably important lessons, and that one should be very careful about turning to drugs to solve one's problems. "With suffering comes understanding," they might intone (Parens 2013, 5).

Bioliberals, on the other hand, would be likelier to point out that "traditional" methods aim at changing our brain chemistry just as much as drugs do, only indirectly and sometimes less effectively. "Sometimes suffering is just suffering," they would add, before going on to suggest that such fruitless pain should be eliminated by whatever means the individual judges for himself are best. As Parens (2013) has summarized this type of view:

> If pharmacological and ["traditional"] means can both achieve the same end—improving how one experiences herself and the word—then it is irrational and perhaps inhumane to prefer the more strenuous and expensive means. It's irrational *not* to take a shortcut when improving human well-being is the destination. We should be slower to imagine that suffering leads to growth and understanding, and quicker to remember that sometimes it just crushes human souls." (5, emphasis added)

21. As Ovid advised long ago in his *Remedia Amoris*: "Tell yourself often what your wicked girl has done, and before your eyes place every hurt you've had. Impress your mind with whatever's wrong with her body, and keep your eyes fixed all the time on those faults." See Ovid and May (2010).

22. Niklas Juth (2011) asks: "Can enhancement technologies promote individuals' autonomy?" And answers: "*Yes*. In general plans require capacities in order for them to be put into effect and enhancement technologies can increase our capacities to do the things we need to do in order to effectuate our plans" (36).

No one would deny that there can be great value in experiencing the world "as it really is"—in its heartbreak and agony as much as in its multitude of joys. Yet as Christopher Grau (2006) argues, even if it could be shown that human beings had some sort of existential duty to experience pain along with happiness, this duty would not be absolute. Instead, it "can be trumped by the horribly debilitating effects of severe trauma and, in such cases, it would be quite cruel to deny relief to the person who is suffering" (133).

We will not attempt to identify the precise point at which romantic traumas should be considered "debilitating" enough[23] to warrant the use of an anti-love pill to shut off feelings of love or attachment. Of course, no universal line can be drawn in the sands of human suffering. To return again to Bonnie's case, however, we expect that she would have been justified in "curing" herself of her love for Rob long before he began to "bang [her] head against the floorboards in the living room."

Contentious Cases: What About Homosexual Love?

Thus far, we have argued that the individual, voluntary use of anti-love biotechnology (under certain conditions) might indeed be morally justified, and that, in specific cases, to deny its use would be positively inhumane. But what about the more contentious examples, such as homosexual love or intercaste love? We have already stated that these instances of affection should be treated with extreme caution, and we wish to underline this point again here. On a first-pass assessment, it should seem obvious that any attempt to repress normal and healthy sexual feelings (or attractions to someone of a different perceived "caste")—pharmacologically or otherwise—should be regarded as seriously misguided. If inflicted on someone else, and certainly if inflicted on a child, such efforts become positively immoral and must never be allowed. However, what if one could be assured that the individual in question was indeed a mature adult, competent to make decisions with respect to his own best interest? What if he believed—however absurdly, from a secular perspective—that his same-sex attractions (for example) were serving to undermine his cherished relationship with a divine entity,[24] or were otherwise preventing him from achieving his higher order plans and goals?

Offering a clinical psychologist's perspective on this question, Haldeman (1994) emphasizes the need to remember the relevant social and historical context. Here we focus on example of same-sex love:

> Given the extensive societal devaluation of homosexuality and lack of positive role models for gay men and lesbians, it is not surprising that many gay people seek to become heterosexual. Homophobic attitudes have been institutionalized in nearly every aspect of our social structure, from government and the military to our educational systems and organized religions. . . . The appropriate focus [for psychology, therefore, is] what reverses prejudice, not what reverses sexual orientation. (226)

Ideally, that is, the religious individual whose same-sex attractions put him into conflict with his beliefs and values would manage to *integrate* his sexual orientation with his spirituality in a functional and coherent way. If at all possible, this should be accomplished, as Haldeman states, "by resolving anti-gay stigma internalized from negative experiences in family, social, educational, and/or vocational contexts." But what should be permitted in the case of an individual who, "after careful examination of the aforementioned factors, still feels committed to an exploration of changing sexual orientation or of managing sexual identity"?

Certainly one should feel free to *persuade* such an individual to abandon his sexuality-modifying intentions, especially if they seem to stem from internalized social pressure, from ignorance, from capriciousness, or from an underdeveloped moral sense. But if one takes seriously the principle of respect for autonomy, as we think one should, one must ultimately defer to the person's own judgment about the proper relationship between his sexual feelings and his considered values in the context of identity and self-creation. As noted by the gender theorist Kristina Gupta (2012):

> Gender and sexuality are not fixed internal essences which are then expressed outwardly, but rather are complex states of "becoming" produced through the "intra-action" of internal and external factors. Rejecting a priori neurotechnologies designed to alter, for example, sexual orientation would only serve to naturalize [those variables]. (2)

In other words, while ethicists (as well as others in society at large) have a sober obligation to contest and to try to mitigate invidious social pressures stemming from closed-mindedness, superstition, bigotry, and hate, they must also respect the autonomous decision of each individual to engage in her own process of "becoming" who and what she seeks to be, in accordance with her personal goals and values. Therefore, we must conclude that even in the controversial case of homosexual love, it may be possible to justify the use of anti-love biotechnology in certain cases.[25]

23. Or dangerous enough, for oneself or others (i.e., children in the case of pedophilia).

24. Hard-line atheists might wish to insist that such a person is *by definition* irrational (or otherwise mentally incompetent), but this would be a very difficult argument to defend.

25. Of course, affording such a power would seem to cut both ways. What if a homosexual person, comfortable with her sexuality and perhaps committed to a homosexual relationship, happened to fall in love with a person of the opposite sex? Our arguments suggest, equally, that she should be entitled to reject this value-inconsistent "straight" love, and even attempt to alter it through biochemical means. And what about "intercaste" love? We have yet to finish that discussion. In this case, too, we think that the "harm" associated with the love in question is a function of problematic social norms, not the love itself. Thus, the goal should be to change these norms over time, rather than the feelings of love experienced by any individual person. Nevertheless, if an individual's love-based suffering in the here-and-now is severe enough—even if that suffering is due exclusively to unjust social pressures—there may be instances in which diminishing the love could be permissible,

CONCLUSION

The science of love and sexuality is still in its very infancy. However, as our understanding of the biological and neurochemical bases of lust, attraction, and attachment in human relationships continues to grow, so will our power to intervene in those systems—for better or for worse. Accordingly, we have offered a preliminary ethical framework for managing the use of present and near-future anti-love biotechnology responsibly, and have emphasized the importance of autonomy and consent in considering whether (or when) to address instances of "perilous love" through pharmacological means.

Our analysis centered on a "best case" scenario for justified intervention: the domestic abuse case, specifically of the kind involving Rob and Bonnie. Our framework also seems to apply to further cases in which the potential for harm is clear and uncontroversial—that is, pedophilic love (including pedophilic-incestuous love), adulterous love, and unrequited love, granting certain conditions. The Stockholm Syndrome case and the case of love for a cult leader are more complex (since the need to diminish harm in these relationships might be outweighed by the need to respect the autonomy and judgment of the individuals actually at risk), but we have argued that if mental incapacity could be unambiguously shown, and if the risk for harm were great enough, then intervention might be justified in these cases as well.

Finally, we addressed the ideologically polarizing case of homosexual love and, to a lesser extent, intercaste love as well. We observed that the putative "harm" involved in such attractions seems to stem from questionable social and/or religious pressures rather than from the love itself. Accordingly, we have highlighted the dangers of coercion in such cases, as well as the moral impermissibility of using anti-love biotechnology technology on children. However, we also acknowledged that some mature adults may seek to modify their own sexual natures in a process of self-creation, and we suggested that they should be entitled to do so.

Anti-love biotechnology, as with any new technology, might be used for good or for ill. But by thinking through the ethical factors involved, we can hope to guide its eventual use more toward the former than the latter. For however wonderful it can feel to be in love, this most central of human emotions can also be, as Shaw wrote, an "insane" and "delusive" passion—and a dangerous one as well. Our aim in this article has been to show that when it *is* dangerous, we may have good reasons to escape its powerful thrall . . . even if this would require the swallowing of a pill. ■

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