

Oxytocin

A Joint Statement From Ascend And
Medical Institute

 Ascend



Medical Institute
for Sexual Health

Summary

Modern neuroscience is helping us to understand how our brains are intricately involved with our sexual behaviors. Developing technologies are ever-increasing our ability to unfold the mysteries of neurochemicals and brain structures that interplay with sexual behaviors. With a better understanding of how sexual decisions are made and reinforced, we are better able to help youth avoid the potentially negative consequences of casual sex from a medical and scientific perspective.

Oxytocin is a powerful neurochemical that has received a lot of attention in recent years. In an attempt to make the scientific research on Oxytocin usable for the average person who lacks a medical or science background, Oxytocin has been simplified to descriptors like the “love hormone” or “cuddle drug.” It has received credit beyond its due for being the “glue” that holds a marriage together, when wisdom whispers that it takes much more than one chemical to make a marriage work. Many of the misconceptions and misunderstandings regarding oxytocin have some basis in scientific research, but over-simplification of technical research findings, or drawing definitive conclusions based on emerging science can lead to inaccurate distortions. In addition, it is important to recognize that neurochemicals rarely act in isolation and human response to relational or environmental stimuli usually involve a myriad of interconnected factors.

The better understanding that educators have regarding oxytocin, other neurochemicals, and brain function; the better able they are to condense and simplify teachings without losing the scientific basics. However, the study of neuroscience is complex and complicated.

This document provides a summary of the research on oxytocin. Please be aware that research may measure oxytocin levels in the blood, urine or saliva, may focus on oxytocin receptors, may image brain areas affected by oxytocin, or may measure behavior before and after administration of oxytocin. Some studies are conducted on animals and some on humans. Many of the human subjects are male, even though we know that oxytocin often has a more significant effect on females.¹

Oxytocin appears to play a role in:

Sexual Response:

- ▶ Associated with sexual arousal in rats.²
- ▶ Linked to human sexual response and orgasm.³
- ▶ Summary: Plasma levels of oxytocin are elevated during human sexual arousal and more highly elevated during sexual orgasm in both sexes.

Maternal Bonding, Childbearing, and Breastfeeding:

- ▶ Gives rat mothers the urge to nurse their young.⁴
- ▶ Released during human labor, delivery and breastfeeding and plays a role in maternal bonding.⁵
- ▶ Summary: The role of oxytocin in childbearing, breastfeeding, and maternal/infant bonding is widely accepted.

Parental and Family Bonding

- ▶ Both parent and infant oxytocin levels increase with interactive play.⁶
- ▶ Plays a role in early formation of the familial unit.⁷
- ▶ Father bonding to their infants increase when given oxytocin.⁸
- ▶ **SUMMARY:** Recent human studies continue to support the role of oxytocin in parental bonding.

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Pair Bonding

- ▶ In normally monogamous prairie voles, oxytocin is important to pair bonding. In non-monogamous voles, oxytocin receptors are located in a different part of the brain, so although they also produce oxytocin, the hormone does not produce the same results. (2001) ⁹
- ▶ In a 2010 animal study, findings suggest that “oxytocin may facilitate the process of pair-bond formation and social relationships in marmoset monkeys.” ¹⁰
- ▶ In a human twin study in Sweden in 2012, researchers presented evidence that oxytocin is important in human pair bonding behaviors. ¹¹
- ▶ Nonverbal display of romantic love was related to the release of oxytocin in women in a 2006 California study. ¹²
- ▶ Couples that received intranasal oxytocin had more positive communication and lower levels of the stress hormone cortisol. Researchers suggested that oxytocin facilitates approach and pair bonding behavior. ¹³
- ▶ In 2012, Ruth Feldman reviewed oxytocin studies and developed a conceptual model linking the oxytocin system to parental, romantic, and filial attachment in humans. ¹⁴
- ▶ In a 2012 study, plasma oxytocin levels were measured in adults who were not romantically involved and compared with plasma levels in couples who were in the early stages of romantic attachment. Oxytocin levels were significantly higher in the new lovers compared to singles. Additionally, those new lovers with the highest oxytocin levels were still in a relationship six months later. ¹⁵
- ▶ **SUMMARY:** “A pair bond is defined as a stable relationship between members of a breeding pair that share common territory and parental duties.” ¹⁶ Oxytocin is linked to pair bonding behaviors in monogamous primates, including humans. Research does not imply that oxytocin “causes” pair bonding, but it does indicate that it might be necessary for pair bonding, at least in female, monogamous primates. Human studies are much more difficult to perform than animal studies

Adaptive Social Behavior

- ▶ Perhaps one of the more confusing aspects of oxytocin research involves what is sometimes labeled as positive or pro- social behaviors and negative or anti-social behaviors. At first look, it appears that oxytocin sometimes produces positive results and sometimes negative results in the social arena. A closer look, however, will reveal that the seemingly opposite behaviors are “adaptive” to meet the needs of the individual in the current social context. Laura Kubzansky, et al, demonstrates the positive vs negative effects in her study, “A Heartfelt Response: Oxytocin Effects on Response to Social Stress in Men and Women.” The response elicited by oxytocin is dependent upon the social situation itself. The social situation may be perceived either as a “challenge state” or a “threat state,” by the individual. In a “challenge state” the individual believes they have what it takes to meet the demands of the task, but in a “threat state” the demands are believed to exceed the resources. Therefore, people respond differently if they are “challenged”, rather than “threatened.” For example, research reveals the following results, dependent upon the social situation.
 - ▶ Couples that received intranasal oxytocin had more positive communication and lower levels of the stress hormone cortisol. Researchers suggested that oxytocin facilitates approach and pair bonding behavior. ¹⁷
 - ▶ Another study revealed that intranasal oxytocin increased envy and gloating in competitive settings, possibly stimulating the “challenge state.” ¹⁸ However, the neurochemical is also linked to pro-social behaviors like trust, ¹⁹ generosity, ²⁰ and social attachments between people, animals, ²¹ and friends.
 - ▶ Oxytocin often appears to have a role in decreasing fear, ²² but can also promote “protective behavior” (or fear) in response to aversive stimuli. ²³
 - ▶ Highly aggressive individuals, who were given intranasal oxytocin, demonstrated increased aggression toward romantic partners in an effort to maintain their authoritative position in the relationship. In this study, participants who were not prone to physical aggression did not have the same increase in aggression. ²⁴
 - ▶ Oxytocin is also released in stressful situations to help return the body to pre-stress conditions. ²⁵
- ▶ **SUMMARY:** Initially, it appears that studies reveal conflicting information about the effects of oxytocin. However, a closer look at the research shows that oxytocin has more of an “adaptive” effect on behavior. Depending on the social situation, oxytocin may produce a social or an anti-social response. One researcher describes it this way, “the administration of oxytocin may provoke a wide range of emotions and behaviors related to social behavior and parenting, such as trusting collaborators, attacking potential intruders, and competing with rivals.” ²⁶

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Common Questions Regarding Oxytocin

► Can oxytocin be “used up”?

One common misconception is that oxytocin can be “used up.” There are no studies that indicate a limit to the amount of oxytocin that a person can produce over a lifetime. Closely associated with this misconception is the misuse of “duct-tape” to represent the depletion of oxytocin as the tape loses its stickiness each time it is removed and re-applied.

► Can oxytocin receive all the credit?

Another common misconception is that our behavior is solely determined by neurochemicals, such as oxytocin. Human social behavior is much more than just the sum of our hormones. While they may play a part in our behavior and response, the human is complex and multifaceted. A variety of factors influence who we are and how we respond. In addition, personal responsibility and cognitive reasoning play important roles in behavioral decision-making.

► What is meant by the statement that “social context is important in determining the effect of oxytocin?”

One reason that it is so difficult to make definitive statements about the effects of oxytocin is because the social environment has a great impact on an individual’s response. For example, research indicates that people are more likely to trust a person they perceive as “trustworthy,” but are more suspect of a person they perceive as “untrustworthy.” Oxytocin levels are increased in both instances, but the social context is very different. The social context influences the adaptive behavior of the individual.

Conclusion and a Note to Educators

A review of the research on oxytocin in humans since 1959 shows that it is implicated in human sexual behavior, maternal and paternal bonding, pair bonding behaviors, and other social interactions. Oxytocin is a fascinating chemical that impacts human behavior, with a wide variance in its influence. It does not work in isolation, but influences and is influenced by other neurochemicals, brain functions, environmental conditions and behaviors. Scientists are still learning how oxytocin works and under what circumstances. The most recent research suggests that social context is essential in predicting the effects of oxytocin,²⁷ Scientists agree that we don’t know enough about oxytocin to make many broad generalizations or absolute statements about the neurochemical. It is becoming increasingly clear that oxytocin is more complex and complicated than originally thought. Therefore, caution should be exercised in making causative statements that cannot be backed up by research. The educator can say that there are correlations between oxytocin and certain psychosocial behaviors (such as bonding and trust), but definitive causal statements are not recommended. The educator cannot ignore the interrelationship between oxytocin, other neurochemicals and brain structures and functions that all work together to influence behavior.

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References for Joint Statement

- ¹ Cahill, Larry, "Why Sex Matters for Neuroscience," *Nature Reviews Neuroscience* AOP, published online 10 May 2006; doi:10.1038/hnr1909.
- ² Gimpl G, Fahrenholz F, "The Oxytocin Receptor System; Structure, Function, and Regulation," *Physiological Reviews* (2001)81: full text PMID 11274341.
- ³ Carmichael, M.S., Warburton, V.L., Dixen, et al, "Relationships among Cardiovascular, Muscular and Oxytocin Responses During Human Sexual Activity," (1994) *Archives of Sexual Behavior*, 23:1: 59-79.
Carmichael MS, Humbert R, Dixen J, et al, "Plasma Oxytocin Increases in the Human Sexual Response," *J Clin Endocrinol Metab* (1987) 64: 27-31 PMID 3782434.
Murphy ME, Seckl JR, Burton S, et al, "Changes in Oxytocin and Vasopressin Secretion During Sexual Activity in Men," *Journal of Clinical Endocrinology and Metabolism* (1987) 65:738-741.
Kruger THC, Haake P, Chereath D, et al, "Specificity of the Neuroendocrine Response to Orgasm During Sexual Arousal in Men," *Journal of Endocrinology* (2003) 177: 57-64
Blaicher W, Gruber D, Bieglmayer C, et al, "The Role of Oxytocin in Relation to Female Sexual Arousal," *Gynecol Obstet Invest.* 1999; 47 (2): 125-126
- ⁴ Benuck I, and Rowe FA, "Centrally and Peripherally Induced Anosmia: Influences on Maternal Behavior in Lactating Female Rats," *Physiol. Behav.* (1975) 14, 439-447.
- ⁵ Nagasawa M, Okabe S, Mogi K, Kikusui T, "Oxytocin and Mutual Communication in Mother-Infant Bonding," *Frontiers in Human Neuroscience* (2012) 6: 1-10.
Bakermans-Kranenburg MJ and Van Uzendoorn M, "Oxytocin Receptor (OXTR) and Serotonin Transporter (5-HTT) Genes Associated with Observed Parenting," *Soc. Cogn Affect Neurosci* (2008) 3 (2) 128-134.
Seltzer LJ, Ziegler TE and Pollak SD, "Social Vocalizations Can Release Oxytocin in Humans," *Proceeding of the Royal Society, B* (2010) 277, 2661-2666.
- ⁶ Feldman R, Gordon I, Zagoory-Sharon O, "The Cross-Generation Transmission of Oxytocin in Humans," *Hormones and Behavior* 58 (2010) 669-676.
Feldman R, Gordon I, Schneiderman I, et al, "Natural Variations in Maternal and Paternal Care are Associated with Systemic Changes in Oxytocin Following Parent-Infant Contact," *Psychoneuroendocrinology* (2010), doi: 10.1016/j.psyneuen.2010.01.013
- ⁷ Gordon I, Zagoory-Sharon O, Leckman JF, Feldman R, "Oxytocin, Cortisol, and Triadic Family Interactions," *Physiology and Behavior* 101 (2010) 679-684.
- ⁸ Weisman O, Zagoory-Sharon O, and Feldman R, "Oxytocin Administration to Parent Enhances Infant Physiological and Behavioral Readiness for Social Engagement," *Biological Psychiatry*, 72, 12 (Dec 15, 2012)
- ⁹ Insel TR and Young, "The Neurobiology of Attachment," *Macmillan Magazines LTD*, vol 2, February 2001.
IsHak W, Kahloon W, & Fakhry H, "Oxytocin Role in Enhancing Well-Bing: a Literature Review," *Journal of Affective Disorders* (2011), 130(1), 1-9
- ¹⁰ Smith AS, Agmo A, Bimie AK and French JA, "Manipulation of the Oxytocin System Alters Social Behavior and Attraction in Pair-Bonding Primates, *Callithrix penicillata*," *Hormones and Behavior* (2010) 57 (2), 255-262.
- ¹¹ Walum H, Lichtenstein P, Neiderhiser JM, et al, "Variation in the Oxytocin Receptor Gene is Associated with Pair-Bonding and Social Behavior," *Biological Psychiatry*, 71 (5), 419-426.
- ¹² Gonzaga GC, Turner RA, Keltner D, et al, "Romantic Love and Sexual Desire in Close Relationships," *Emotion* (2006) 6 (2): 163-179
- ¹³ Ditzen B, Schaer M, Gabriel B, et al, "Intranasal Oxytocin Increases Positive Communication and Reduces Cortisol Levels During Couple Conflict," *Biological Psychiatry* (2008) 65, 9: 728-731.
- ¹⁴ Feldman, R. "Oxytocin and Social Affiliation in Humans," *Hormones and Behavior*, 61(3), 380-391.
- ¹⁵ Schneiderman I, Zagoory-Sharon O, Leckman JF, et al, "Oxytocin during the Initial Stages of Romantic Attachment: Relations to Couples' Interactive Reciprocity," *Psychoneuroendocrinology*, 2012 Aug; 37(8): 1277-1285
- ¹⁵ Aragona BJ and Wang Z, "The Prairie Vole: An Animal Model for Behavioral Neuroendocrine Research on Pair Bonding," *ILAR Journal* 2004, Vol 45, no. 1, 35-45.
- ¹⁶ Kubzansky L, et al, "A Heartfelt Response: Oxytocin Effects on Response to Social Stress in Men and Women," *Biol Psychol.* 2012 Apr; 90(1); 1-9.
- ¹⁷ Sharmay-Tsoory SG, Fischer M, Dyash J, et al, "Intranasal Administration of Oxytocin Increases Envy and Schadenfreude (gloating)," *Biological Psychiatry* (2009) 66;9: 864-870
- ¹⁸ Kosfeld M, Heinrichs M, Zak M, et al, "Oxytocin Increases Trust in Humans," *Nature* (2005) 435: 673-676
- ¹⁹ Zak PJ, Stanton AA, Ahmadi A, "Oxytocin Increases Generosity in Humans," *PLoS ONE* 2 (11), (2007): e1128
- ²¹ Nagasawa M, Kikusui T, Onaka T, Ohta M, "Dog's Gaze at its Owner Increases Owner's Urinary Oxytocin During Social Interaction," *Hormones and Behavior*, Vol 55, issue 3, March 2009, 434-441
- ²² Walum H, Lichtenstein P, Neiderhiser JM, et al, "Variation in the Oxytocin Receptor Gene is Associated with Pair-Bonding and Social Behavior," *Biological Psychiatry*, 71 (5), 419-426.
- ²³ Gonzaga GC, Turner RA, Keltner D, et al, "Romantic Love and Sexual Desire in Close Relationships," *Emotion* (2006) 6 (2): 163-179
- ²⁴ DeWall CN, Gillath O, Pressman SD, et al, "When the Love Hormone Leads to Violence: Oxytocin Increases Intimate Partner Violence Inclinations Among High Trait Aggressive People," *Social Psychology and Personality Science* 201X, Vol.XX(X) 1-6
- ²⁵ Amico JA, et al, "Anxiety and Stress Responses in Female Oxytocin Deficient Mice," *Journal of Neuroendocrinology*, 16: 319-324
- ²⁶ Kosfeld M, Heinrichs M, Zak M, et al, "Oxytocin Increases Trust in Humans," *Nature* (2005) 435: 673-676
- ²⁷ Bartz JA, Zaki J, Bolger N, Ochsner KN, "Social effects of Oxytocin in Humans, Contest and Personal Matter," *Trends in Cognitive Sciences* (2011) 15, 7: 301-309.