

Freud, the libido and oxytocin

Ian Fairholm and Alex Lench are prompted by Freud's early work to seek an ambitious marriage of psychoanalysis and neurobiology

Sigmund Freud's work on the mind, particularly his method of psychoanalysis, is often thought of in terms of its subjectivity, based as it is on therapeutic techniques and a dialogue between patient and analyst. Freud's attempts to seek a psychological cause for physical symptoms were very novel for the time but remain controversial today. It is perhaps partly because so much of psychoanalytic theory seems rooted in mentalistic terminology and subjective interpretation that many forget that Freud was a qualified neuroscientist with early interests in histology and neurophysiology. The creation and development of psychoanalysis may ultimately have been Freud's lifelong work, but neuroscience and neurology were the basis of his early working life (Schultz & Schultz, 2004; Solms & Turnbull, 2011).

To many the gulf between Freud's early pioneering work, in areas such as nerve cell function and disorders of language resulting from brain injury, and his later work on such topics as dream analysis and the unconscious, seems surprising and perhaps contradictory. But even in his short monograph on the language disorder aphasia (Freud, 1891), one of his earliest published works, considerations of the nature of possible relationships between anatomical models and psychological concepts are already apparent (Marx, 1967; Solms & Turnbull, 2011). In that work Freud effectively rejects the only method available to

researchers of the time who were interested in the relationships between mind and brain, the clinico-anatomical method used to determine localisation of function (Solms & Turnbull, 2011). In short, this method assumes that by testing the psychological functions and dysfunctions of patients with localised brain lesions it is possible to determine how those lesions affect function and then, by working backwards, how different parts of the brain contribute to normal function in people without such damage. Freud was familiar with the method because he had used it himself whilst working in the field of neurology, but seemed uncomfortable with the idea that specific regions of the brain could be responsible for certain psychological functions.

It should be stressed that Freud was not denying the existence of a link between language (or indeed other psychological functions) and neurological processes. Instead, even at this stage, Freud believed that the mind was more dynamic than might be suggested by a static model that directly links specific regions with specific psychological functions in all human brains (Freud, 1891; Solms & Turnbull, 2011). In addition, Freud's belief that consciousness was only part of the human mind, and that unconscious forces also exist, suggested to him more complex workings than those proposed by the models derived from the modular clinico-anatomical method. It was these central

aspects of Freud's thinking about the human mind, and their absence from neurological theories of the time, that would eventually lead him to give up on the latter entirely and instead focus on developing a more detailed understanding of psychological processes alone.

But Freud was initially hesitant to give up on mapping the structure and functions of the human psyche to those of the human brain. In 1895, driven by his observation that mental phenomena were indeed based upon neurophysiological processes, Freud offered his 'Project for a Scientific Psychology', an attempt to marry his emerging psychoanalysis with the neuroscience of the time. The project



was never completed, apparently because it was simply too audacious at a time when neuroscience was in its relative infancy. Freud's abandonment of the project seems to reflect not so much his own dissatisfaction with it, but rather that he felt neuroscience lacked the necessary tools and knowledge to bridge the gap between the two fields (Northoff, 2012; Solms & Turnbull, 2011). Although

references

- Argiolas, A. & Melis, M.R. (2013). Neuropeptides and central control of sexual behaviour from the past to present: A review. *Progress in Neurobiology*, 108, 80–107.
- Baumgartner, T., Heinrichs, M., Vonlanthen, A. et al. (2008). Oxytocin shapes the neural circuitry of trust and trust adaption in humans. *Neuron*, 58, 639–650.
- Feldman, R., Gordon, L., Schneiderman, I. et al. (2010a). Natural variations in maternal and paternal care are associated with systematic changes in oxytocin following parent–infant contact. *Psychoneuroendocrinology*, 35(8), 1133–1141.
- Feldman, R., Gordon, I. & Zagoory-Sharon, O. (2010b). The cross-generation transmission of oxytocin in humans. *Hormones and Behaviour*, 58(4), 669–676.
- Feldman, R., Weller, A., Zagoory-Sharon, O. & Levine, A. (2007). Evidence for a neuroendocrinological foundation of human affiliation: Plasma oxytocin levels across pregnancy and the postpartum period predict mother–infant bonding. *Psychological Science*, 18(11), 965–970.
- Freud, S. (1891). *On aphasia*. New York: International Universities Press.
- Freud, S. (1905). *Three essays on the theory of sexuality*. Standard Edition, 7.
- Freud, S. (1914). *On narcissism: An introduction*. Standard Edition, 14.
- Freud, S. (1917). *Mourning and melancholia*. Standard Edition, 14.
- Gimpl, G. & Fahrenholz, F. (2001). The oxytocin receptor system: Structure, function, and regulation. *Physiological Reviews*, 81(2), 629–683.
- Gordon, I., Zagoory-Sharon, O., Leckman, J.F. & Feldman, R. (2010). Prolactin

Freud himself never published the manuscript outlining this project, statements in his later work suggest that he not only thought it a worthwhile venture, he considered it inevitable that, given sufficient time, the neurosciences would eventually achieve the necessary level of knowledge and sophistication required to fully ground psychoanalytic apparatus within a neurophysiological framework.

One example of Freud's hope for the scientific future of psychoanalysis and psychology is evident in this following quote:

We must recollect that our provisional ideas in psychology will presumably some day be based on an organic substructure... We are taking this probability into account in replacing the special chemical substances by special psychical forces. (Freud, 1914, pp.78–79; for more quotes of this kind see Solms & Turnbull, 2011)

This suggests that Freud moved to focus entirely on 'special psychical forces', rather than the structure and functions of the brain, somewhat reluctantly and out of necessity, and that he thought a return to a focus on the organic alongside the psychoanalytic was both likely and desirable at some point in the future. However, it has perhaps taken much longer for this to occur than Freud would ever have anticipated.

The challenges that Freud believed remained for neuroscientists can therefore be broadly summed up in the following way: the need to account for the brain as an active and dynamic system rather than one that is passive and static, and the need to account for the different levels of consciousness that Freud thought occurred within the human mind. In addition, a third challenge could be said to have arisen as a result of Freud's rejection of neuroscientific methods following 1895. By instead adopting introspective clinical/therapeutic methods Freud is often criticised for relying on 'subjective data', obtained via his

technique of free association. By contrast neurology and neuropsychology rely predominantly on objective data and have, for the most part, excluded the subjective mind, a position that has in turn has also received criticism (for example, see Sacks, 1984).

Freud believed then that whilst he focused on developing an increased understanding of the mental apparatus, neuroscience would eventually develop sufficiently to meet the aforementioned challenges, ultimately enabling a re-integration of the two fields. Although this did not take place in Freud's lifetime, considerable developments in the technology and methodology of neuroscience over the past few decades has led some, most notably Mark Solms and Oliver Turnbull (e.g. 2011), to suggest that this re-integration is possible now, described by the term neuropsychanalysis. Although far from all neuroscientists would see value in an attempt to link the clinical work of Freud's psychoanalysis with developments in the neurological sciences, it is at least now possible to compare and potentially even attempt to map psychoanalytic ideas about the structure and function of the mind onto current understandings of brain anatomy and processes.

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The libido

A key part of Freud's psychoanalytic theory is the concept of the libido, which he regarded as one of the most important motivating forces of human personality and behaviour. The popular use of the word libido links it with the idea of the human sex drive, and Freud did originally associate the libido primarily with sexual desire. For example, Freud (1905) states: 'We have defined the concept of libido as a quantitatively variable force which could serve as a measure of processes and

transformations occurring in the field of sexual excitation.' But in later work Freud expanded the meaning of the term so that it came to represent more of a general life instinct, referring to instincts connected with self-preservation and survival, which still included sex but also added other motivators (Schultz & Schultz, 2004).

That Freud used two different meanings for the same concept at different points in his working life does make linking his notion of libido to specific biological processes somewhat problematic for neuroscientists. Another key issue relates to how Freud's idea of the libido, as a form of psychic energy that stems from the unconscious and creates states of internal tension leading a person to behave in ways likely to reduce that tension, can be married to the terminology and research of neurobiology. Freud's take on the libido is perhaps best viewed as an example of a drive theory of motivation. Although critics of such theories refer to numerous examples of human behaviour that cannot be explained via an appeal to the reduction of drives, there has nevertheless been considerable work within modern neurobiology that supports the idea that such drives do exist (see Solms & Turnbull, 2011, for a brief review). The exact relationship between drives as Freud and other psychoanalysts have discussed them and those researched by neurobiologists and psychologists is still far from clear, but this is one area where neuropsychanalysis may be able to offer some insight.

The question being asked in this case is whether it is possible to link Freud's idea of psychic motivation – the appetitive desire for pleasure-seeking, perhaps specifically relating to sexual arousal and desire and/or romantic attachment and bonding – to biological processes in the brain that may underlie the same thing? Is there a particular brain structure, hormone or neurotransmitter

oxytocin, and the development of paternal behaviour across the first six months of fatherhood. *Hormones and Behaviour*, 58(3), 513–518.

Heim, C., Young, L.J., Newport, D.J., et al. (2009). Lower CSF oxytocin concentration in women with a history of childhood abuse. *Molecular Psychiatry*, 14(10), 954–958.

Heinrichs, M. & Domes, G. (2008). Neuropeptides and social behaviour:

Effects of oxytocin and vasopressin in humans. *Progress in Brain Research*, 170, 337–350.

Lee, H.J., Macbeth, A.H., Pagani, J.H. & Young, W.S. (2009). Oxytocin: The great facilitator of life. *Progress in Neurobiology*, 88(2), 127–151.

Lukas, M., Bredewold, R., Neumann, I.D. & Veenema, A.H. (2010). Maternal separation interferes with developmental changes in brain

vasopressin and oxytocin receptor binding in male rats. *Neuropharmacology*, 58(1), 78–87.

Marx, O.M. (1967). Freud and aphasia: An historical analysis. *American Journal of Psychiatry*, 124(6), 815–825.

Northoff, G. (2012). Psychoanalysis and the brain – why did Freud abandon neuroscience? *Frontiers in Psychology*, 2, 3–71.

Oreland, S., Gustafsson-Ericson, L. &

Nylander, I. (2010). Short- and long-term consequences of different early environmental conditions on central immunoreactive oxytocin and arginine vasopressin levels in male rats. *Neuropeptides*, 44(5), 391–398.

Sacks, O. (1984). *A leg to stand on*. London: Duckworth.

Saito, A. & Nakamura, K. (2011). Oxytocin changes primate paternal tolerance to offspring in food transfer. *Journal of*

Looking back

that contributes to the motivating forces that Freud ascribed to the libido? And if so, might this provide a framework that can be used to encourage further collaborative discussion and investigation between psychoanalysts, psychologists and neuroscientists in this area?

Oxytocin and the Freudian libido

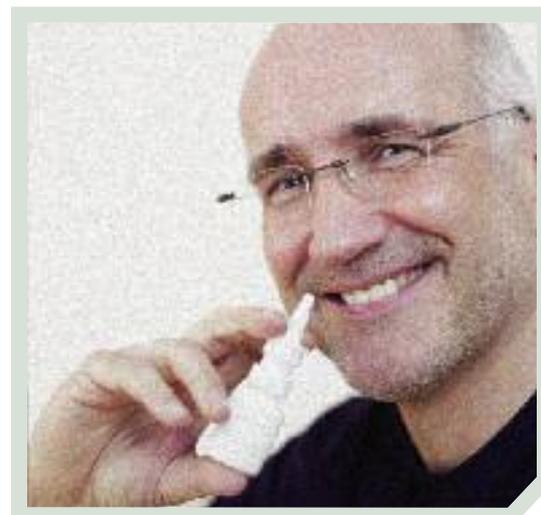
Oxytocin is a small peptide with a single receptor that exerts multifaceted effects on cellular activity. In the central nervous system oxytocin is primarily expressed in neurons of the hypothalamus and pituitary gland, which release the hormone throughout the brain and into general circulation to act throughout the body. Expression also occurs in many other areas of the body including genital areas, where release of oxytocin may act to promote further release of oxytocin in the brain to exert behavioural effects. The classic action of oxytocin is in smooth muscle contraction during childbirth and lactation, although the finding that oxytocin is present at similar concentrations in both sexes has led to suggestions of other functions. However, many diverse actions of oxytocin, both physical and behavioural, may be considered to act to facilitate successful reproduction. This idea alone may warrant comparison between this hormone and Freud's notion of a general life instinct, and there are, in particular, three relevant actions of oxytocin that might relate to the Freudian libido.

Blood levels of oxytocin are raised during arousal and orgasm in humans, and in several animal species sexual behaviours can be blocked by administration of an oxytocin receptor antagonist (Gimpl & Fahrenholz, 2001). Conversely, central administration of oxytocin has been shown to potently induce sexual behaviours including penile erection in male animals, supporting the findings of a beneficial effect of oxytocin on psychogenic impotence, anorgasmia and general sexual function in men (see Argiolas & Melis, 2013). Intranasal

oxytocin (oxytocin administered using a nasal spray) has also been reported to increase perceived arousal in men during masturbation and to potently increase arousal in a woman being treated for deficient lactation, whilst changes in plasma oxytocin during the menstrual cycle have been shown to correlate with vaginal lubrication (see Lee et al., 2009). How oxytocin affects sexual behaviour is currently unclear; in rats several brain regions appear to be involved, though most important is the paraventricular nucleus of the hypothalamus, where oxytocin acts to cause further oxytocin release (Argiolas & Melis, 2013; Lee et al., 2009).

Oxytocin is strongly implicated in romantic attachment and this has been well studied using the monogamous rodent, the prairie vole. Oxytocin release during mating (probably from genital areas) is a powerful determinant of pair bond formation for the prairie vole, but in humans oxytocin can also be elevated by more subtle interactions, such as eye contact and non-sexual touch. Recently, Scheele et al. (2012) have shown that intranasal oxytocin causes men in a monogamous relationship to keep a greater distance from an unknown, attractive female compared to controls, but interestingly this effect was absent in single men. A further study showed that such men also specifically judged their partners to be more attractive when given intranasal oxytocin (Scheele et al, 2013) again indicating a pair-bond maintaining-effect for oxytocin in humans.

In this recent study by Scheele et al. (2013) such effects of oxytocin were demonstrably linked to the nucleus accumbens where changes in oxytocin and dopamine receptor levels are thought to underlie the long-term behavioural change induced by oxytocin in prairie voles. The nucleus accumbens is a well-established reward centre and this is



Men judged their partners to be more attractive when given intranasal oxytocin

consistent with the idea of romantic bonding being partially akin to partners becoming operantly conditioned to each other's presence. These findings make an interesting comparison with Freud's notion of bonding as being an attachment of the libido to a person, as discussed in 'Mourning and Melancholia' (1917). Considering this, a quote such as 'it is a matter of general observation that people never willingly abandon a libidinal position, not even, indeed, when a substitute is already beckoning to them' (p.244) can be used to draw an almost irresistible parallel with the Scheele et al. (2012) study.

In addition to a role in romantic attachment, Oxytocin also appears to be highly important in parent-child bonding. In female animals oxytocin is released during pregnancy, labour and lactation, and the shift to maternal behaviours at parturition can be replicated by central oxytocin treatment whilst similar effects are observed in parenting male animals (Gimpl & Fahrenholz, 2001; Saito & Nakamura, 2011). In humans oxytocin is released following parent-infant interactions

Comparative Physiology A:

Neuroethology, Sensory, Neural and Behavioral Physiology, 197(4), 329–337.

Scheele, D., Striepens, N., Güntürkün, O. et al. (2012). Oxytocin modulates social distance between males and females. *Journal of Neuroscience*, 32(46), 16074–16079.

Scheele, D., Wille, A., Kendrick, K.M. et al. (2013). Oxytocin enhances brain reward system responses in men

viewing the face of their female partner. *Proceedings of the National Academy of Sciences of the USA* 110(50), 20308–20313.

Schultz, D.P. & Schultz, S.E. (2004). *A history of modern psychology*. Belmont, CA: Thomson/Wadsworth.

Solms, M. & Turnbull, O.H. (2011). What is neuropsychanalysis? *Neuropsychanalysis*, 13(2), 133–145.

Veenema, A.H., Bredewold, R. &

Neumann, I.D. (2007). Opposite effects of maternal separation on intermale and maternal aggression in C57BL/6 mice: Link to hypothalamic vasopressin and oxytocin immunoreactivity. *Psychoneuroendocrinology*, 32(5), 437–450.

Wismer Fries, A.B., Ziegler, T.E., Kurian, J.R. et al. (2005). Early experience in humans is associated with changes in

neuropeptides critical for regulating social behaviour. *Proceedings of the National Academy of Sciences of the USA*, 102(47), 17237–17240.

(Feldman et al., 2010a) and blood levels of oxytocin are positively correlated with parental behaviours (Feldman et al., 2007; Gordon et al., 2010). The recognised anxiety-lowering effect of oxytocin, mediated through modulation of the amygdala, the hypothalamic–pituitary–adrenal axis and also the cardiovascular system, may also be important in motivating affiliative processes in humans and animals.

Conversely, infants are also seen to have raised oxytocin levels following parental interaction (Feldman et al., 2010b), whilst rodent litters that undergo daily maternal separation are seen to have lower levels of oxytocin (Oreland et al., 2010; Veenema et al., 2007) and an abnormal oxytocin receptor profile (Lukas et al., 2010). In line with this, a study examining urine oxytocin levels in young children who had experienced earlier neglect found these children to be oxytocin deficient compared to those with a typical upbringing (Wisner Fries et al., 2005); whilst a study of adult women who had experienced childhood traumas were similarly seen to have decreased concentrations of oxytocin in their cerebrospinal fluid (Heim et al., 2009). Thus oxytocin may also be important in parent–child bonding on the side of the child and is suggested to developmentally impact on subsequent social behaviour. Indeed, the role of oxytocin in social interactions and relationships is also well established (Heinrichs & Domes, 2008). The involvement of oxytocin in parent–child bonding is particularly interesting when linking oxytocin to the Freudian notion of libido given the importance Freud placed on the relationships between children and their parents for later adult relationships and mental health.

An intriguing comparison

In summary, oxytocin is strongly implicated in arousal and sex, romantic attachment and parent–child bonding. How one molecule can mediate multiple diverse behaviours is currently unknown. The different brain regions and systems affected may be important as well as regulation of the oxytocin receptor, in particular by gonadal steroids, which are needed for many of the effects of oxytocin in animals. However, despite its enigmatic nature, evidence for the importance of oxytocin is mounting and these reported phenomena present an intriguing comparison with Freudian ideas of libido. We may go further and ask if the problem of explaining how one molecule can produce these different effects lies in the

consideration of these phenomenon as being mechanistically distinct; might the behavioural actions of oxytocin be more easily explained if a psychological construct akin to that of Freud's libido were conceded?

Psychologists reading this may be sceptical about the benefits and applications of this material, either because of a mistrust of Freud's work and ideas, a concern about reducing complex human concepts such as sex, romantic attachment and parent–child bonding to the hormonal level, or more likely a combination of the two. In addition, psychologists, psychoanalysts and neuroscientists may query whether these speculative links between oxytocin and Freud's concept of libido have any practical function. Solms and Turnbull (2011) suggest that neuroscientific findings linked to psychoanalytic ideas could be used to generate and test hypotheses, which opens up some interesting possibilities, such as the use of intranasal oxytocin for patients undergoing psychoanalysis or trained psychoanalysts reflecting on their own use of intranasal oxytocin. Clearly these ideas need more consideration, but they could provide a basis for empirical investigation into psychoanalytic concepts that have previously been unavailable.

It is important to note that whilst this commentary has discussed oxytocin, some Freudian comparisons may be equally valid with other hormones. In particular the structurally related peptide vasopressin has a similar psychopharmacological profile and indeed it may arguably be more appropriate to consider vasopressin and oxytocin jointly in the context of the Freudian libido. In addition, it is worth noting that when Freud expanded the meaning of the libido concept it came to encompass a range of motivators, some of which are not related to oxytocin whilst conversely oxytocin may have actions that are more difficult to relate to the idea of libido, such as effects on trust (see Baumgartner et al., 2008). Further developments within neuropsychology may facilitate the study of different hormones and to what extent they map onto Freudian ideas about the libido, which may in turn allow for a more operational definition of this Freudian concept.

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