

## CHAPTER 19

### *Sexual Physiology*

Hormones are intimately involved in our sex lives, as well as all other aspects of our lives, from well before we are born until we die. Of these, the most important for sex are the so-called sex hormones. Mammalian sexual behaviour is controlled by these gonadal steroids acting at the level of the central nervous system. They are divided into the male hormones (or androgens) and the female hormones. While both sexes produce both types, those corresponding to the appropriate sex predominates (in most cases).

The main male hormone is testosterone, which causes the male sex organs to develop within the foetus and, at puberty, deepens the male's voice, gives him pubic hair and a beard, broadens his shoulders and packs on muscle mass, enlarges his penis and starts his testicles producing sperm. Uniquely to humans, testosterone, by its action on the hypothalamus, a thumb-sized neural entity beneath the forebrain, is responsible for active sexual desire (stimulating sexual intercourse and masturbation) in both sexes, though it is produced in much smaller quantities by women than by men. In men, levels are fairly constant but, in women, it rises to its highest level right around ovulation. This is the time when women are most likely to exhibit 'male' behaviour - including being unfaithful. By its action on the amygdala, it also helps fuel aggression, the thirst for competition and the 'typically male' drive for dominance. There is a gradual decline in production in males with age and testosterone replacement can treat flagging libido in males with low levels of testosterone; however, it does not increase their ability to get an erection and increases their chances of getting prostate cancer (in fact, castration is sometimes used to treat prostate cancer). Testosterone replacement is also sometimes used to boost libido in females on oestrogen replacement therapy but, in a small number of cases, it can produce facial hair, weight gain, a deepening of the voice, acne and increased blood cholesterol levels. If a male is castrated, his sex drive gradually tapers off to nearly nothing over a period of 1-2 years. Some male sex offenders appear to be abnormally sensitive to testosterone and are sometimes given a synthetic female hormone which shuts down testosterone production and calms their out-of-hand sex drive. Contrary to widespread belief, heterosexuals and homosexuals do not have significantly different testosterone levels.

Semen contains not only sperm but also water, simple sugars to provide fuel for the sperm, alkalis to buffer the acidity of the urethra and the vagina, prostaglandins that cause contractions of the uterus and fallopian tubes and are thought to aid in the sperm's passage to the womb, vitamin C, zinc, cholesterol and a few other things. The average amount of ejaculate is about three to five millilitres.

The main female hormone is oestrogen, which stimulates the development of the female sex organs both within the foetus and at puberty, creating her femaleness, her rounded breasts and curvy hips. It also enhances pheromonal secretion and 'invitational' behaviour ('come here and touch me', 'take me I'm yours', 'kiss me', 'cuddle me') and her yearning for sexual contact. Oestrogen levels peak just prior to ovulation. They drop off precipitously during menopause, with consequent vaginal dryness and atrophy and increased risk of osteoporosis and heart disease.

These are not the only hormones regulating sexual behaviour. Oxytocin, another hormone produced by the hypothalamus, also incites sexual activity in males and females. More than this, it stimulates maternal/paternal behaviour and reduces aggression. Its concentration in the cerebrospinal fluid rises after ejaculation. In females, it induces labour, and later lactation, and mediates milk ejection.

Differences in the levels of testosterone, oxytocin and oestrogen between males and females are responsible for their differing responses to stress and threats. Males produce less oxytocin than females and are likely to exhibit a 'fight or flight' response to stress, which may drive them to become angry or aggressive or else to withdraw. On the other hand, not only do females produce more oxytocin but the oestrogen they produce enhances oxytocin's effects.

Therefore, women exhibit a 'tend and befriend' response to stress; they are more likely to seek support from friends and family. These hormonal differences are also largely responsible for the classic responses shown by most mammals to threat of attack: males will leave a baby to fend for itself while they physically take on an aggressor, while females will stay with their babies to protect them and will bond with others who can help provide protection.

Progesterone, another female hormone, rises towards the end of the menstrual cycle and during pregnancy and causes nurturing and defensive, rather than active and aggressive, behaviour.

Overproduction of prolactin, another hormone, depresses all aspects of sexual behaviour in both men and women, probably by causing reduced dopamine activity. Sexual drive can be restored by treatment with bromocriptine.

Gonadotrophin-releasing hormone is thought to have an important physiological role in the stimulation of female sexual behaviour. In males, it is also stimulatory but its physiological significance is not known.

Ovulation is a complex process involving the interaction of the adrenal glands, the ovary, the pituitary gland and a higher brain centre. Two days before ovulation, the pituitary secretes leutinising hormone and follicle stimulating hormone, initiating oestradiol secretion from a wave of follicles in the ovary. The increased oestradiol levels act at the higher brain centre to set the neural trigger for a gonadotrophin surge and at the pituitary to heighten sensitivity to gonadotrophin releasing hormone. The elevated oestradiol levels also act to increase secretion of adrenocorticotrophic hormone from the pituitary. The released adrenocorticotrophic hormone acts upon the adrenal to stimulate secretion of progesterone. Adrenal progesterone acts to initiate leutinising hormone and follicle stimulating hormone release through actions at the higher brain centre and pituitary. These hormones stimulate ovarian progesterone secretion. This in turn acutely stimulates an even greater leutinising hormone release and a prolonged release of follicle stimulating hormone. These hormones are responsible for induction of ovulation. The prolonged follicle stimulating hormone release starts the growth of the next wave of follicles. Chronically, ovarian progesterone acts at the higher brain centre to limit the surge of gonadotrophins to a single day. Progesterone also has a significant role in the facilitation of implantation and in the maintenance of pregnancy, due to its ability to suppress uterine contractility and the immune response to the foetus.

Both oestrogen and progesterone can reduce sex drive in males. On the other hand, leutinising hormone releasing hormone stimulates male sex behaviour. So does alpha-melanocyte stimulating hormone.

Hormones do not act alone in determining sexual behaviour; a number of neurotransmitters are also involved. One of the most important of these is dopamine, which is involved in all aspects of male sexual behaviour - arousal, copulatory activity and penile reflexes. It has been suggested that it enhances 'invitational' behaviour and arousal in females but at the same time inhibits receptive behaviour.

Noradrenaline stimulates arousal while inhibiting penile reflexes. It is possible that it mediates the effects of both oestrogen and progesterone in inducing receptivity.

5-hydroxytryptamine has an inhibitory effect on most aspects of male sexual activity but has a more complex effect in females, being sometimes stimulatory and sometimes inhibiting.

Acetylcholine reduces the threshold to ejaculation in males and may have a stimulatory effect on receptivity in females.

Gamma-aminobutyric acid has an inhibitory effect on both male and female sexual behaviour.

Angiotensin II inhibits male sexual activity.

Substance P stimulates male and female behaviour.

Neuropeptide P inhibits male and female sexual behaviour.

Serotonin has been proposed to be an inhibitory transmitter in the control of sexual drive.

However, it also seems to have a role in producing erection in the male.

The stress-related peptides, corticotrophin releasing factor and beta-endorphin, are inhibitory.

Hormones and neurotransmitters are not all there is to sex. The frontal cortex of the brain plays a large part. Particularly in females (whose biological response is nowhere near as obvious as it is in males), it can persuade us we are not stimulated when we are or that we are stimulated when we are not. But, it not only acts as a censor for the other parts of the brain but also as an initiator. Evolutionary psychologist Geoffrey Miller suggests that the frontal cortex is largely a device to attract and retain mates and that the uniquely large human cortex may have developed that way largely because of the battle of sexual wits between same-sex humans.