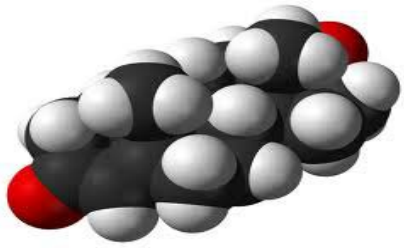
HORMONAL MECHANISMS IN AGGRESSION

Hormones are chemicals that regulate and control bodily functions. Two of these have been implicated in aggressive behaviour, namely **testosterone** and **cortisol**.

Testosterone and aggression

Males produce testosterone in the testes. Women also produce testosterone, but in smaller amounts, by converting *dehydroepiaiandrosterone* (*DHEA*) in the adrenal glands. Testosterone is called an *androgen*, because it produces male characteristics. Testosterone levels reach a peak in young adult males and typically, in Western societies, testosterone levels gradually decline with age.



Testosterone

There are several findings which have linked testosterone with aggression. For example, *castration* leads to a marked decrease in aggression in both non-humans and humans, and replacement testosterone (in castrated mice, at least) restores aggression levels, but only if the replacement occurs within ten days of birth.

In boys, peak testosterone levels (which occur at puberty) are correlated with peak aggression levels, whilst girls affected by *Congenital Adrenal Hyperplasia* (caused by high testosterone levels) indulge in more rough and tumble play than non-affected girls. However, researchers do not believe that it is testosterone as such that causes aggression. Instead, it is argued that testosterone lowers serotonin levels, and it is this that causes aggression.

The problem with many studies of the relationship between testosterone and aggression is that they are *correlational*, and the big weakness of correlational studies is that just because two things are correlated, it does not necessarily mean that a change in one *causes* a change in the

other. However, if we were to administer testosterone to a person and they behaved more aggressively, this would be good evidence that testosterone causes aggression.

Kouri et al. (1995) used a *double-blind procedure* in which two groups of young men were given either testosterone or a *placebo*. They were then each paired with a fictitious participant and told that each member of the pair could, by pressing a button, reduce the amount of money received by the other person. Participants were also told that the other member of their pair *was* reducing the money that the participant himself was receiving. The results showed that participants who received testosterone pushed the button significantly more times than the participants who received the placebo.

The double blind procedure. Sort of.

However, some studies have failed to find an association between testosterone and aggression. For example, **Tomaszewski, et al (2003)** found no difference in testosterone levels in 933 healthy young men, even though some were much more aggressive than others. Similarly, **Bain, et al (1987)** found no significant differences in the testosterone levels of men who had been charged with murder or violent assault and men who had been charged with non-violent crimes such as burglary.

Although there seems to be strong evidence for a clear link between testosterone and aggression in non-humans, the studies described above indicate that the link in humans is less clear. Indeed, according to **Sapolsky (1997)**, researchers have got the causal relationship between testosterone and aggression *the wrong way round*. Sopolsky says that if you put a number of men together after measuring their testosterone levels you cannot accurately predict who will behave aggressively. However, if you observe who is the most aggressive and *then* measure

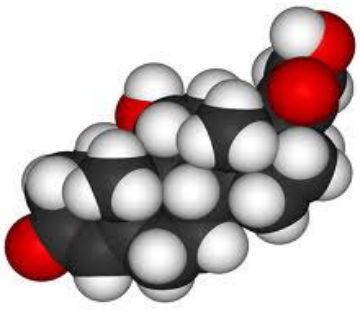
testosterone levels, the most aggressive male will usually have the highest level of testosterone. Therefore, according to Sapolsky increased aggression leads to increased testosterone levels, not the other way round. In Sapolsky's view, scientists assume that hormones regulate behaviour, because hormones are more important. Sapolsky says that behaviour regulates hormones. This is called the '***behaviour regulating hormone hypothesis***'.

It is also worth noting that the majority of this research has concentrated on *male aggression*. Some research has found that 'high testosterone' women *are* more likely to report dominating behaviour, but other studies have found no such relationship. It has been suggested that women may respond to challenging situations with increased testosterone, and so display characteristics such as aggressiveness and dominance. However, not enough research has yet been done on female aggression.

Even if testosterone is involved in aggression, it is only in certain kinds of aggression. There is no evidence, for example, that testosterone is implicated in 'predatory' aggression.

Cortisol and aggression

Cortisol is produced by the *adrenal medulla*, and is an important part of the body's response to a stressor. It has been suggested that *lower* levels of cortisol are correlated with *higher* levels of aggression. There are two reasons why this might be. First, it could be that some people are born with an *under-reactive* autonomic nervous system (ANS). In order to increase their arousal level (because a low level of arousal is aversive or unpleasant), these people would behave aggressively to create stress, which would increase both ANS activity and cortisol release. If true, this would indicate that cortisol is a consequence of aggression rather than a cause of it.



Cortisol

The second possibility is that cortisol is directly or indirectly involved in the causes of aggression, and that it actually *inhibits* aggressive behaviour. Two findings suggest that cortisol may be involved in aggression. First, lower levels of cortisol have been found in habitually violent offenders and aggressive schoolchildren. This would suggest a *direct* causal link.

Second, people with *low* cortisol levels and *high* testosterone levels behave more aggressively than people with *high* cortisol levels and *high* testosterone levels. This finding suggests that testosterone can only exert its effects when cortisol levels are low. Cortisol may therefore be controlling the increase in aggression associated with testosterone. This would mean it is *indirectly* linked with aggression.

The problem is that the findings are not consistent in this area of research. Many studies have found no differences between the cortisol levels of aggressive and non-aggressive people, whilst others have even found *higher* cortisol concentrations in aggressive participants (e.g. **Gerra, et al, 1997)**. This may be because of methodological issues: cortisol levels vary in a circadian way, so how much cortisol production is observed may depend on when the measurement is taken.