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Hormone/behavior relationships

Becker, J.B., Breedlove, S.M. & Crews, D. (eds) (1992) Behavioral Endocrinology. Cambridge: Massachusetts Institute of Technology Press.

Nelson, R.J. (1995) An Introduction to Behavioral Endocrinology. Sunderland, MA: Sinauer Associates.

The effect of hormones on behavior and the effect of the social environment on hormones are at the heart of sociophysiology.

Seeing these books well reviewed in the May issue of Animal Behaviour, I ordered them from the library and was surprised how soon they came. Not much of a queue of readers for behavioral endocrinology!

I have not read them all through, but will recommend some bits. The Becker volume contains an excellent chapter by David Crews. He describes the analysis of mating behavior in parthenogenetic forms of whiptail lizard - in which the receipt of male behaviour is necessary for ovulation to proceed successfully. Some females adopt the male role and mount their sisters, including the transfer of bite from neck to pelvic region to form what the author calls a "doughnut". The neural basis for male behaviour is present in these unisexual females, but what switches it on, since they completely lack androgens? I will not spoil anyone's excitement by revealing the answer.

Crews also describes how the phenomenon of "dissociated reproduction" has helped to disentangle cause and effect in hormone/behaviour relationships. In some animals the sperm and eggs are synthesised many months before embryogenesis begins. In some, such as the garter snake, the male retains the sperm over the winter, in others the female keeps the sperm in storage, in yet others fertilisation occurs in the autumn but the zygote is held in suspension over the winter and embryogenesis does not resume until the spring. In the red-sided garter snake, sex hormones are used for gamete synthesis and play no part in the control of sexual behaviour. In arid Australia, ovulation in the zebra finch may occur ten minutes after the first drops of rain.

The Becker book also contains an excellent chapter on "stress" by Robert Sapolsky. He points out that stress not only prevents more energy and resources flowing into the immune system, but that the immune system is actively inhibited, even to the extent of lymphocytes undergoing lysis. This is likely to have evolved to prevent stress-induced autoimmunity, which seems plausible since stresses are likely to be associated with tissue damage, and the experiencing by the immune system of self products that in normal circumstances it does not encounter.

The single-authored Nelson book contains a most readable chapter on "aggression and social behaviour" among much else. For instance, many rodents are aggressive during the breeding season but form social groups which huddle together during the winter (they could be said to switch to the hedonic mode in winter). But some male prairie voles remain agonic all the year round, and presumably find females to mate with when the winter is less severe.

In Harris sparrows the level of testosterone during the autumn moult determines social status throughout the winter, including priority of access to food. It does this both by making the birds more aggressive in their behavior for the next few months, and by ensuring that they have a high ratio of dark to pale feathers on the crown and throat, a social signal of dominance which is respected by the subordinate pale sparrows. Is this another instance of Mike Waller's comparator gene in operation?

It is becoming clear that there is a vast amount of within-species individual variation in both agonistic and reproductive behaviour. In some species, some of this variation is due to variation in sex hormone levels; but in male house mice, there is evidence that androgens conceal individual variation in aggressiveness, which is revealed by castration and concealed again by the administration of androgens.