



Research Letter from: ... England

Females Thrive After Sex!

By our corresponding author, **Manley Puff**

Feminism was all the rage in 1980's Britain, even if a certain female Prime Minister created much consternation for both feminists and men preferring women in more 'traditional' roles. Now, some researchers from Yorkshire, Northern England's machismo heartland, may have come up with a biological mechanism for helping males to get their females back to the domestic grindstone. Ironically, for an English discovery, it simply requires lots of frequent sexual activity! For the moment, however, it should be noted that the method only works on flies.

Sleepless after mating

In his report, Leeds University's Prof. R. Elwyn Isaac tells us that "*Drosophila* male sex peptide inhibits siesta sleep and promotes locomotor activity in the post-mated female" (*Proc Royal Soc. B*, vol. 277: 65-70). Although Isaac normally investigates neuropeptide control of behaviour and sex-life in insects and nematode worms, the starting point for this study was sleep, with possible human analogies. "It would appear that preventing sleep and inducing extra domestic-type duties to prepare for the birth of offspring in females is a further tactic used by the male to ensure successful paternity after mating."

He looked at sex-based differences in sleeping patterns. It seems that when flies aren't sleeping, they're moving, so to measure fly sleep, he set up activity monitors ("Trikinetics DAM2") that use an infrared beam to detect movement as the fly walks along a glass tube. With standardised fly days – 12 hours light, 12 hours dark – he noted the number of breaks in the infrared beam during either five or 30 minute "time-bins". A "sleep unit" was defined as a "five-minute time-bin with no locomotor activity (no registered beam breaks)".

Isaac observed female "rhythmic walking activity" and found that not all females behaved the same. Virgin females behave more like males. That's to say, they have peaks of walking activity at the transition between lights-on and lights-off (pseudo-dawn and dusk), and don't do much at night or during the rest of the day – they like day-time "siestas". However, once females have had sex they become quite excitable, displaying "sustained and robust activity" during day-time, followed by deep sleep at night.

All because of a little peptide

The act of "sexual copulation results in the female losing 70% of day-time sleep", a sexual boost in active female behaviour that lasts for "at least 8 days after copulation".

What aspect of *Drosophila* sex gets the female flies so worked up? Obviously, this being *Drosophila*, there are mutants for just about everything. To start with, Isaac fished out some "tud¹/tud¹" males, who can't make sperm, and mated them with wild-type virgins – despite their lack of sperm, tud¹ males

still drove their females into a frenzy of post-copulative activity. It's not the sperm!

What next? Well, it's no accident that Isaac specialises in neuropeptide activity. "It is well established that molecules in the seminal fluid of male *Drosophila* elicit profound changes in the physiology and behaviour of mated females." The best known of these is the aptly named "sex peptide" (SP), a 36 amino acid peptide with a tryptophan-rich N-terminal region, by which it attaches to the external surface of sperm tails, "a mechanism that carries SP with sperm to the sperm storage organs of the female."

Of course, sex peptide null mutants also exist, in which males carry a targeted deletion of the SP gene. These males were duly encouraged to inseminate wild-type virgin females. However, in the absence of sex peptide, no sleep was lost. Without SP, the females continued to sleep like virgins, enjoying lazy daytime siestas.

Isaac's conclusion is that sex peptide is a "wake-promoting" molecule that alters the day-time behaviour of females from "male-like laziness" to a more active state. By having sex, the male flies are switching females from a "low-risk behaviour to a more adventurous lifestyle that involves increased day-time

wakefulness and locomotor activity, necessary to find food to satisfy greater nutritional demands imposed by the very high rate of egg production, and for seeking suitable egg-laying sites".

Is there an analogy in humans? Well, Elwyn Isaac is very keen to stress that *Drosophila* are, in fact, a very "good model for looking at sleep behaviour in humans as they exhibit many of the hallmarks

of mammalian sleep". Yes, we are talking about the same annoying little flies that turn up whenever something in the fruit bowl turns a little overripe. Like us, it seems they "sleep deeply at night, from which they're difficult to rouse". They also have "preferred sleeping posture". And, if kept awake through the night, (e.g. loud music in the fly facility), they "exhibit tiredness the next day". In very human fashion, they can also be fed caffeine to keep them awake.

Of his sex peptide discovery, Isaac says, "If we can work out exactly how this natural molecular switch can disrupt sleep behaviour, we may be able to apply this knowledge to neurological disorders relating to human sleep such as narcolepsy, which we think is caused by a fault in the neuropeptide signalling pathway in the brain."

One can't help wondering if, instead of "narcolepsy", less scrupulous male researchers mightn't be more interested in knowing whether humans possess an equivalent sex peptide capable of producing similar post-copulative boosts in female activity. Macho heaven?

