

## **A epitome from “supernature” – Lyall watson**

“... Cockroaches generally suffer from a bad press, but they are excellent experimental animals. The common species *Periplaneta Americana* becomes active soon after dark each day and scavenges continuously for five or six hours, but if one has its head cut off, it no longer shows this circadian rhythm of activity. Not surprising, perhaps; but in fact if the head is removed surgically and precautions are taken to keep the insect from bleeding to death, it survives for several weeks. A headless cockroach eventually starves to death, but while it lives, it continues to move in a random and desultory fashion.

Janet Haarker found that she could give a cockroach back its sense of direction by a process of transfusion. All insects have very rudimentary circulatory systems, in which blood just washes around in the body cavity bathing the internal organs. One individual can be made to share its blood with another by simply cutting a hole in the body wall of each and connecting them together with a short glass tube. Haarker solved the problem of differences of opinion by an ingenious if somewhat gruesome compromise. She strapped the blood donor upside down on the back of the headless cockroach and cut off the upper one's legs to prevent it kicking and upsetting the weird combination. Paired like this in parabiosis (which means living side by side) the double-bodied cockroach with one head and one set of legs functioned almost normally. It once again showed the typical circadian rhythm with activity confined to the period immediately after dark. Something in the blood of the donor passed through the glass tube and communicated rhythm to the legs of the disorganized, headless cockroach. The substance responsible seems to be a hormone produced in the insect's head. Haarker made a series of surgical transplants, each involving one of the organs in the head, and found that the subesophageal ganglion (a tangle of nerves just below the mouth) was the source of the message. She discovered that if this ganglion was transferred to a headless cockroach, the insect developed a rhythm identical to that of the donor.

So in the cockroach, the center that responds to natural cycles of light and dark has been located and can even be translocated. This is vital information, but Haarker went on to turn up something even more interesting. She kept one group of cockroaches on a normal schedule and put a second group on a reverse timetable with lights burning all night and darkness during the day. The second lot soon adapted to this situation and became active during the artificial night, so their rhythms were always out of phase with the control group. A subesophageal ganglion could easily be transplanted from a member of one group to a headless individual in the other, and it would impose its own rhythm on the recipient; but if the second cockroach kept its own pacemaker as well, there was immediate trouble. The extraganglion turned out to be a lethal weapon. Having two time-keepers sending out two completely different signals, the poor insect was thrown into turmoil. Its behavior became completely disorganized, and it soon developed acute stress symptoms, such as malignant tumors in the gut, and died.

This is a perfect demonstration of the importance of natural cycles in life; confusion of the cockroach rhythm kills the insect. Life keeps time, and it seems that the beat is an old one, determined mainly by the rotation of our own planet, which turns the sun on and off like some giant cosmic strobe light....”