

京大過去問 2005年 第2問

次の文章を読んで、下の問いに答えなさい。

For 300 years, Western travelers to Southeast Asia had been returning with tales of enormous groups of fireflies blinking on and off in harmony, in displays that supposedly stretched for miles along the riverbanks. These reports, often written in the romantic style favored by authors of travel books, gave rise to (1)widespread disbelief. How could thousands of fireflies orchestrate their flashings so precisely and on such a vast scale?

In the years between 1915 and 1935, Science published 21 articles on this mysterious form of light show. Some dismissed the phenomenon as a fleeting coincidence. Others ascribed it to peculiar atmospheric conditions of exceptional humidity, calm, or darkness. A few believed there must be a conductor, a firefly that leads all the rest. The naturalist Hugh Smith wrote in exasperation that “some of the published explanations are more remarkable than the phenomenon itself.” But he confessed that he too was unable to offer any explanation.

(2)For decades, no one could come up with a good theory. By the late 1960s, however, the pieces of the puzzle began to fall into place. One clue was so obvious that nearly everyone missed it. Fireflies not only flash in harmony — they flash in rhythm, at a constant tempo. Even when isolated from one another, they still keep to a steady beat. That implies that each insect must have its own means of keeping time, some sort of internal clock. This hypothetical clock is still unknown but is presumed to be a group of neurons somewhere in the firefly’s tiny brain.

The second clue came from the work of the biologist John Buck, who did more than anyone else to make the study of fireflies scientifically respectable. He suggested that the fireflies must somehow be adjusting their rhythms in response to the flashes of others. To test that hypothesis directly, Buck and his co-workers conducted laboratory studies where they flashed an artificial light at a firefly (to imitate the flash of another) and measured its response. They found that an individual firefly will shift the timing of its flashes in a consistent, predictable manner, and that the size and direction of the shift depend on when in the cycle the stimulus was received. (3)For some species, the stimulus always advanced the firefly’s rhythm, as if setting its clock ahead; for other species, the clock could be either delayed or advanced, depending on whether the firefly was just about to flash, whether it was halfway between flashes, and so on.

Taken together, the two clues suggested that the flash rhythm was regulated by an internal, resettable clock. And that immediately suggested (4)a possible synchronization mechanism: In a mass of flashing fireflies, every one is continually sending and receiving signals, shifting the

rhythms of others and being shifted by them in turn. Out of the mass of flashing lights, synchronization somehow emerges naturally.

Thus we are led to entertain an explanation that seemed unthinkable just a few decades ago — the fireflies organize themselves. No conductor is required, and it doesn't matter what the weather is like. Synchronization occurs through mutual cuing, in the same way that an orchestra can keep perfect time without a conductor. What's odd here is that the insects don't need to be intelligent. They have all the ingredients they need: Each firefly contains something like a little metronome whose timing adjusts automatically in response to the flashes of others. That's it.

(1) 下線部(1)widespread disbelief の内容を具体的に表すセンテンスが1つある。それを和訳しなさい。

(2) 下線部(2)を和訳しなさい。

(3) 下線部(3)を和訳しなさい。

(4) 下線部(4)a possible synchronization mechanism の内容を音楽器具に言及して説明しているセンテンスが1つある。それを和訳しなさい。