is now causing the strong torque. A similar sequence of events could have occurred in comet 103P/Hartley 2, which was visited by the Deep Impact Extended Investigation (DIXI) space mission[8,10] in 2010.

Extrapolating comet 41P's rotation rate forward in time, Bodewits *et al.* predict that the period would have exceeded 100 hours in mid-2017. Such an extremely slow rotation would no longer stabilize the comet's spatial orientation, so that even small torques could make it wobble like a spinning top. If the current strong torque persists, it might eventually drive the comet to spin up again, possibly about a different axis.

A change in comet 41P's rotation axis would affect the seasonal distribution of heating across the body's surface, the associated levels of activity and the pattern of mass transport between different regions[11]. The global process of cometary erosion might therefore be redirected. Observations from the end of the 2017 activity period and from the next perihelion passage in 2022 could document this yet-to-be-seen phase of cometary evolution, and reveal valuable information about the nature of comets and other planetary bodies. ■

Jessica Agarwal *is at the Max Planck Institute for Solar System Research, 37077 Göttingen, Germany.*
e-mail: agarwal@mps.mpg.de

1. Whipple, F. L. *Astrophys. J.* **111,** 375–394 (1950).
2. Bodewits, D., Farnham, T. L., Kelley, M. S. P. & Knight, M. M. *Nature* **553,** 186–188 (2018).
3. Rubincam, D. P. *Icarus* **148,** 2–11 (2000).
4. Marsden, B. G. *Astron. J.* **74,** 720–734 (1969).
5. Keller, H. U., Mottola, S., Skorov, Y. & Jorda, L. *Astron. Astrophys.* **579,** L5 (2015).
6. Hirabayashi, M. *et al. Nature* **534,** 352–355 (2016).
7. Jewitt, D. *et al. Astrophys. J.* **829,** L8 (2016).
8. Steckloff, J. K., Graves, K., Hirabayashi, M., Melosh, H. J. & Richardson, J. E. *Icarus* **272,** 60–69 (2016).
9. Combi, M. *SOHO SWAN Derived Cometary Water Production Rates Collection* (NASA, 2017).
10. A'Hearn, M. F. *et al. Science* **332,** 1396–1400 (2011).
11. Keller, H. U. *et al. Mon. Not. R. Astron. Soc.* **469,** S357–S371 (2017).

NEUROSCIENCE

Neuronal plasticity in nematode worms

Neuronal activity induces changes in the connectivity of a neuron called DVB in adult male nematode worms. This discovery provides an opportunity to study a fundamental process in this powerful model organism. **SEE ARTICLE P.165**

SCOTT W. EMMONS

Central to the function of the nervous system is its dynamic ability to undergo changes, for instance in the physiological properties of its constituent neurons, the synaptic connections between them, and the characteristics of individual synapses. The hypothesis that neuronal activity can lead to such plasticity, first proposed by the neurophysiologist Donald Hebb in 1949, is fundamental to brain science, and has been confirmed in many studies[1]. On page 165, Hart and Hobert[2] describe an example of experience-dependent neural plasticity in the nematode worm *Caenorhabditis elegans*, a species in which this phenomenon has been little studied[3].

It is important to demonstrate this already well-described and widely studied neural phenomenon in a nematode because *C. elegans* is not just any worm, but a powerful experimental model. Genetic studies in *C. elegans* have led to the discovery of several molecular components common to all nervous systems. Furthermore, a complete map of neural connectivity in the nematode nervous system has been available for more than 30 years[4,5] — such a connectome is not yet available for any other animal.

Assembly of the *C. elegans* connectome was made possible not only by the worm's tiny size (1 millimetre long), but also because its cells are constant in number and identity, and its synaptic connections are largely conserved between individuals. These properties, together with the fact that connectivity data were obtained from only a few individuals, have created the impression that the *C. elegans* nervous system is exceptional in having a rigid and constant structure. Intuition suggests that this cannot be the case — the worm's nervous system is so complex that it must be based on dynamic mechanisms. But few examples of variability in *C. elegans* neurons have been described until now.

The *C. elegans* inhibitory neuron DVB makes different connections in the worm's two sexes: males and hermaphrodites[4,6]. A single process extends towards the head of the worm in both sexes, and a male-specific outgrowth towards the tail leads to the formation of synaptic connections to a neuron and muscles that control the movement of the male's spicules — a pair of hardened structures that insert into the vulva of the hermaphrodite during mating[6] (Fig. 1). The formation of these new synapses, and the loss of some old ones, mean that spicule movement comes under the

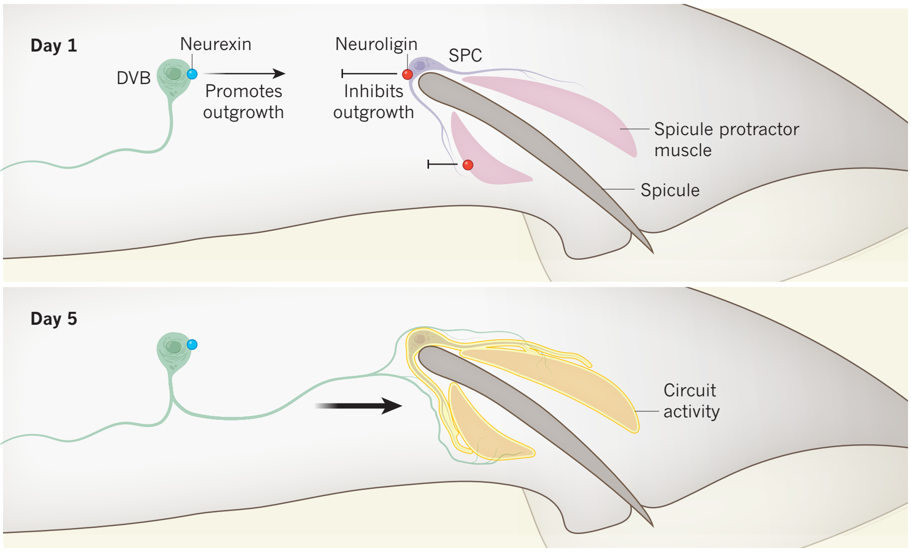

Figure 1 | Activity-dependent neuronal outgrowth in nematodes. Hart and Hobert[2] examined the neuron DVB in nematode worms (*Caenorhabditis elegans*). They report that, between days one and five of adulthood in male worms, DVB grows towards, and makes synaptic connections onto, spicule protractor muscles and the spicule neuron SPC, which control a male-specific mating behaviour involving movement of a structure called the spicule. This outgrowth is regulated, at least in part, by two cell-adhesion proteins: neurexin is expressed by DVB and promotes outgrowth; and neuroligin is expressed by the spicule protractor muscles and SPC, and inhibits outgrowth. The authors show that the expression of neuroligin is repressed when the male undergoes copulatory behaviours, activating these muscles and SPC — DVB outgrowth is therefore activity dependent.