

data. Although seemingly unlikely, we cannot definitively rule out the existence of a population of low-mass stars or dead stellar remnants at the galaxy's centre that do not produce much visible light. An X-ray source that might be produced by a supermassive black hole has been detected at the heart of M60-UCD1, but this radiation could also be generated by the dead remnant of a star<sup>3</sup>. Follow-up observations at radio wavelengths could distinguish between these possibilities<sup>9,10</sup> and provide further support for the presence of a supermassive black hole.

Seth and colleagues' discovery is an important step towards understanding the nature of ultra-compact dwarf galaxies. Many other ultra-compact dwarfs show tantalizing hints that they, too, harbour supermassive black holes and are therefore stripped galaxy nuclei, but direct evidence is lacking. The authors are participating in ongoing observing programmes that may provide conclusive evidence for supermassive black holes in four other ultra-compact dwarfs. But at present, detecting the gravitational pull of a black hole on surrounding stars is feasible for only the brightest and closest systems. Attempting to detect the direct gravitational signatures of black holes in a large population of ultra-compact dwarfs must therefore wait for the next generation of telescopes.

If supermassive black holes are indeed commonplace in ultra-compact dwarfs, this would have major implications for the demographics of such black holes — Seth *et al.* estimate that there could be more than double the number of supermassive black holes in the local Universe than is presently thought. Although this is possible, it is far from certain. Future studies will tell us whether M60-UCD1 is a fluke, or whether other ultra-compact dwarfs are also stripped galactic nuclei that host black holes. ■

**Amy E. Reines** is in the Department of Astronomy, University of Michigan, Ann Arbor, Michigan 48109-1107, USA.  
e-mail: reines@umich.edu

1. Kormendy, J. & Ho, L. C. *Annu. Rev. Astron. Astrophys.* **51**, 511–653 (2013).
2. Seth, A. C. *et al.* *Nature* **513**, 398–400 (2014).
3. Strader, J. *et al.* *Astrophys. J.* **775**, L6 (2013).
4. Brodie, J. P., Romanowsky, A. J., Strader, J. & Forbes, D. A. *Astron. J.* **142**, 199 (2011).
5. Schwarzschild, M. *Astrophys. J.* **232**, 236–247 (1979).
6. van den Bosch, R. C. E. & de Zeeuw, P. T. *Mon. Not. R. Astron. Soc.* **401**, 1770–1780 (2010).
7. Reines, A. E., Greene, J. E. & Geha, M. *Astrophys. J.* **775**, 116 (2013).
8. Volonteri, M. *Astron. Astrophys. Rev.* **18**, 279–315 (2010).
9. Gültekin, K., Cackett, E. M., King, A. L., Miller, J. M. & Pinkney, J. *Astrophys. J.* **788**, L22 (2014).
10. Merloni, A., Heinz, S. & Di Matteo, T. *Mon. Not. R. Astron. Soc.* **345**, 1057–1076 (2003).

## NEUROSCIENCE

## Shedding light on a change of mind

**Sophisticated genetic tools that make brain cells responsive to light have now been used in mice to trigger a memory connected with a particular place, and to switch its association from negative to positive, or vice versa. SEE LETTER P.426**

**TOMONORI TAKEUCHI  
& RICHARD G. M. MORRIS**

We often believe that our memories are accurate, but in fact they can be malleable, changing over time as recollections become less precise or as events that never happened are falsely remembered<sup>1</sup>. There is also another way in which memory can change. The memory of a romantic first meal out with a partner may take on a different mood when the relationship falters. That of a favourite family beach in summer may be destroyed by witnessing a swimming tragedy there. In these cases, memory of the place remains accurate, but the positive associations with that place are lost. On page 426 of this issue, Redondo *et al.*<sup>2</sup> investigate the neural basis of this selective change.

Our memories are representations of past experiences that are believed to be encoded in networks of neurons that fire together or in sequence. The representation of a particular place — a 'where' memory — is encoded in a brain structure called the hippocampal formation, which is embedded within the medial temporal lobe. A separate representation in the amygdala of the brain encodes a 'what' memory, which recalls whether one feels good about a place (a positive valence) or has marked it off as dangerous (a negative valence). These two representations are thought to become connected during learning. The amygdala also has direct downstream connections to the action and endocrine systems that are involved in approach and avoidance<sup>3</sup>.

Redondo and colleagues investigated the separate representations of 'where' and



## 50 Years Ago

*Journey to the Jade Sea.* By John Hillaby — Books by writers who go to Africa in search of their souls are always interesting to us who went there in search of wages; this book is fascinating. “Essentially, I walked into the N.F.D. for the hell of it” (p. 2); Mr. Hillaby took his own hell by using a small string of unhealthy camels for transport instead of a lorry or Land-Rover, as do other people in that part of Kenya. “Perhaps all safaris start this way. Somewhat despondently...” (p. 7); they do not, but I should have been despondent if I had started with that collection of provisions... in old cardboard boxes... Messrs. Constable have published a most interesting book. They might also publish an interesting one by the Warden, for he no doubt would tell us more about the animals and plants.  
**From Nature 19 September 1964**

## 100 Years Ago

Let us consider lastly a disease which collects the last toll from one-seventh of humanity, and debilitates and enfeebles the lives of many whom it does not entirely destroy... How are we organizing our campaign against tuberculosis? Bacteriology has taught us that it is an infectious disease and has isolated the organism... all over the civilized world the total death-roll of human kind annually from tuberculosis probably does not fall short of a million souls... This disease must be stopped at its source as well as dealt with on its course. No disease has ever been eradicated from a community by discovering cures for it, and none ever will; many diseases have disappeared because their sources have been cut off. Let us be scientific, let us search out the truth; having found it, let us act upon it, and let us conceal nothing that is true.  
**From Nature 17 September 1914**