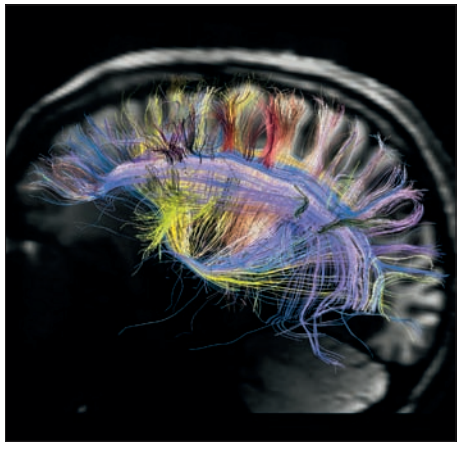
Sciencewatch

Compiled by John Swain, Northeastern University

Brain fibres reveal a grid-like structure

Many people visualize the connections between neurons in the brain as being extremely complex and close to random-looking in their distribution. However, it turns out that they are laid out much like a grid. Using diffusion magnetic-resonance (MR) imaging on brains of humans and other primates, Van Wedeen of Massachusetts General Hospital in Boston and colleagues found sheets of nerve fibres that run at right angles to each other and to other sheets, making the brain's wiring look like a 3D grid and remarkably free of "spaghetti" wiring.

Higher primates had more curvature to the lines but the sheet structure remained.



The work has important implications for understanding the human brain and could help elucidate how evolution could make small incremental changes in brain wiring without radically altering overall function.

Further reading

V J Wedeen *et al.* 2012 *Science* **335** 1628.

Diffusion spectrum MR image of human brain showing the curvature of two-dimensional sheets of parallel neuronal fibres that cross at right angles. (Image credit: Martinos Center for Biomedical Imaging, Massachusetts General Hospital, MGH-UCLA Human Connectome Project.)

Synthetic DNA

Life on Earth uses "backbones" of DNA or RNA to store and carry genetic information represented by bases. Now, the same functionality has been achieved with different "backbones". Philipp Holliger of the MRC Laboratory of Molecular Biology in Cambridge and colleagues have made six different xenonucleic acids (XNAs) in which they replaced the sugars in DNA and RNA with other molecules.

The standard enzymes that copy information would not work for these XNAs, so the researchers modified them until they did the job. Now the team can copy information from an XNA to DNA and back to another XNA – somewhat like a retrovirus, with XNA playing the role of RNA. The work opens up the possibility that life on other worlds could well have developed using a biochemistry similar to that on Earth – but with XNAs in place of the DNA and RNA. This would truly be life, but not at all as we know it.

Further reading

V B Pinheiro 2012 *Science* **336** 341.

Lasing without light

Atomic clocks using optical transitions provide the most accurate measurements of time but require reference resonators that bounce laser light back and forth between two mirrors. However, tiny changes in the length of the resonator always occur as a result of thermal fluctuations and they shift the resonant frequency.

Justin Bohnet at the University of Boulder in Colorado and colleagues have found a clever way round the problem. Rather than storing coherence in the electromagnetic field between the mirrors, they store it in the coherent excitations of more than a million rubidium-87 atomic dipoles placed between them. This makes a "laser" with an average of less than 0.2 of a photon inside the cavity, which is 10,000 times less sensitive to displacements of the mirrors.

Achieving the "superradiant" mode requires using an external laser to drive the rubidium atoms between two long-lived states to mimic a narrow atomic transition. Nevertheless, it seems to work and coherence can be preserved in the atoms for milliseconds. Apart from its great novelty, the technique could dramatically increase the precision in measuring that most elusive of quantities – time.

Further reading

J G Bohner *et al.* 2012 *Nature* **484** 78.

Graphene's silicon sister

Given the similarity between carbon and silicon, is there a silicon analogue of graphene – "silicene"? Patrick Vogt of Aix-Marseille University and the Technical University of Berlin and colleagues have found that the answer is, "yes". They deposited layers of silicon onto silver by evaporation from a heated silicon wafer. Because there is no silicon analogue of graphite from which to peel off layers of silicene, the fabrication is a little more complex. Both the structural and the electronic properties support the formation of silicene. (Previous attempts used only observations by scanning-transmission microscope.)

The road may now be open to silicene electronics. The material may be much easier to integrate with current silicon technology than graphene, opening up a range of new devices.

Further reading

P Vogt *et al.* 2012 *Phys. Rev. Lett.* **108** 155501.

Disappearing dark matter

Christian Moni Bidin of the University of Concepción in Chile and colleagues used historical survey data, as well as newer data from the La Silla and Las Campanas Observatories in Chile, to track more than 400 stars within 13,000 light-years of Earth. The result is surprising. They can account for all of the stars' motions using just the visible mass present and no dark matter – a far cry from the 83% or so of the total matter in the universe that is usually attributed to dark matter. What this will turn out to mean is still not clear but it could explain why terrestrial dark-matter detectors have not yet found any. It could be that there is not much of it, at least around the vicinity of Earth.

Further reading

C Moni Bidin *et al.* 2012, arXiv:1204.3924v1 [astro-ph.GA], accepted by *Ap. J.*