

MICROBIOLOGY

Gut microbes' survival tactics

Gut bacteria protect themselves from host inflammation by modifying their outer membranes.

Immune responses designed to wipe out infection could, in theory, also perturb helpful flora that reside in the gut. To find out how these microbes resist the effects of inflammation, Andrew Goodman of Yale University in New Haven, Connecticut, and his colleagues studied 17 bacterial species that normally live in the human gut. They found that the microbes were all resistant to antimicrobial peptides released by hosts to kill pathogens.

In the bacterium *Bacteroides thetaiotaomicron*, this resilience was linked to expression of a protein called LpxF, which neutralized the negative charge of the cell membrane, preventing the positively charged peptides from binding to the gut microbe's surface. Mutants that did not express LpxF were outcompeted in mouse guts by other microbes during inflammation. *Science* 347, 170–175 (2015)

MATERIALS

Arsenic forms a semiconductor

Single-atom-thick layers of arsenic and antimony could be efficient semiconductors that have more applications than other two-dimensional materials.

Atom-thick materials can have unique electronic and optical properties, but some operate only at certain wavelengths of light, owing to small 'band gaps'. On the basis of quantum mechanical calculations, Zhongfang



ANIMAL BEHAVIOUR

Monkey in the mirror

Macaques can be trained to recognize themselves in a mirror, the first such observation in any monkey species.

Most animals encountering their reflections act as if they are seeing another creature. To find out whether monkeys can be trained to recognize their own reflections, Neng Gong and his team at the Shanghai Institutes for Biological Sciences placed rhesus macaques in front of a mirror and shone a low-powered laser beam on their faces to produce a mild heat irritation. They rewarded animals when they touched the irritating spot on their face (pictured).

After 12 to 38 days of this regimen, 5 out of 7 macaques using the mirror touched an odourless mark applied to their faces. With a mirror in their cages, some of these monkeys seemed to use it to explore parts of their bodies that they could not otherwise see. It is not clear, however, whether these behaviours mean that the monkeys have higher cognitive abilities such as self-awareness, the authors say.

Curr. Biol. <http://doi.org/x54> (2015)

Chen at the University of Puerto Rico in San Juan, Haibo Zeng at the Nanjing University of Science and Technology in China and their colleagues predict that arsenic and antimony can switch

from being semi-metallic in bulk to semiconducting as a single-atom layer. These materials, called arsenene and antimonene, have wider band gaps than other two-dimensional semiconductors,

meaning that they could be used in short-wavelength optoelectronic devices such as blue or ultraviolet light-emitting diodes.

The authors say that such materials could soon be synthesized in the lab.

Angew. Chem. Int. Edn <http://doi.org/f2x29z> (2015)

EVOLUTION

Lungs began with many chambers

The lungs of ancestral, land-based vertebrates may have had multiple chambers rather than just one, as was believed.

Markus Lambertz at the University of Bonn in Germany and his colleagues studied lung samples from 73 species of amniotes, which include mammals, birds and reptiles. They also looked at lung development in embryos of a gecko, *Paroedura picta*, which has single-chambered lungs. They found that all multi-chambered lungs shared key anatomical features, such as branching of the arteries. These features were present even in the single-chambered lungs of lizards and snakes, and in the embryonic gecko lung.

Ancestral amniotes evolved multi-chambered lungs as they shifted to life on land, the authors say. Some, however, may have later developed single-chambered lungs as they evolved into smaller creatures to maximize air space in the lungs, the team adds.

Biol. Lett. 11, 20140848 (2015)

SUSTAINABILITY

Resource use peaks worldwide

The rates at which humans consume multiple resources such as food and wood peaked at roughly the same time, around 2006. This means