KAY ROXBY/ALAMY

Bacteria aid fight against blight

Botrytis blight is a common disease of greenhouse crops (pictured), caused by the fungus *Botrytis cinerea*. Writing in the *Journal of the American Chemical Society*, Götze *et al*. report bacterial compounds that are strongly active against *B. cinerea* (S. Götze *et al*. *J. Am. Chem. Soc*. https://doi.org/jt2n; 2023).

Götze and colleagues' discovery stemmed from their observation that the social amoeba *Dictyostelium discoideum* was unable to feed on a strain of *Pseudomonas* bacteria. They found gene clusters in the *Pseudomonas* genome that encode biosynthetic machinery for producing amoebicidal compounds, which the authors named keanumycins. Compounds that kill social amoeba often also act as antifungal agents, and *in vitro* screening revealed that keanumycins were indeed active against a variety of fungi.

Intriguingly, the compounds were particularly active against *B. cinerea*. The authors prepared a fermentation broth of the keanumycin-producing bacteria, and found that it strongly inhibited botrytis blight infection in a model plant (*Hydrangea macrophylla*). The findings suggest that keanumycins could be used to develop antifungal agents for protecting crops from *B. cinerea*.

Andrew Mitchinson

Condensed-matter physics

Light tailors the properties of a model semiconductor

Alberto Crepaldi

When a semiconductor material called black phosphorus is hit with intense laser light, the behaviour of its electrons is found to change. The discovery opens a route to time-dependent engineering of exotic electronic phases in solids. **See p.75**

The atoms in a crystalline solid are arranged in space with a periodicity and symmetry that determine the physical properties of the material. These properties can therefore be modified by altering the crystal structure – for example, with pressure, strain or chemical substitution. But for many technological applications, controlling the properties of a crystal in time is just as important as changing them in space. Such temporal engineering has been successful in systems comprising groups of ultracold atoms arranged in lattices by means of intersecting laser beams[1], and in electrically conductive materials[2–4], but it is had not yet been achieved in semiconductors – until now. On page 75, Zhou *et al.*[5] report that the physical properties of black phosphorus (Fig. 1a), a model semiconductor, can be tailored through irradiation with intense laser light.

The behaviour of electrons in a periodic crystal was first described in 1929 by Swiss–American physicist Felix Bloch[6]. His theory reveals that the electrons have a range of allowed energy levels in the solid, owing to their wave-like nature, and the pattern of these levels is called the crystal's electronic-band structure. The forbidden range of energies between the 'valence' band (low energies) and the 'conduction' band (high energies) is known as the bandgap.

The way in which electrons occupy these bands determines how they can move through a material: metals have partially empty bands, whereas insulators have fully occupied bands with large bandgaps, and semiconductors have fully occupied bands with bandgaps that are small. Electrical conductivity can therefore be controlled by engineering the occupation of the band structure, and by manipulating bandgaps – and this can now be done in a time-dependent way (Fig. 1b).

The necessary mathematical tools for extending Bloch's theory to incorporate time had already been devised in the nineteenth century by French mathematician Gaston Floquet[7]. In the framework of Floquet's theory, when a solid is subjected to an intense