

## <<Endotoxin Revealed

Nematic liquid crystals are composed of rigid rod molecules that try to orient in the same direction on a local scale. When confined in certain geometries, the molecular ordering cannot satisfy the boundary conditions of the system. Instead, regions of low order in the form of point defects will form, which are easily observed using optical microscopy. **I.-H. Lin *et al.*** (p. 1297, published online 19 May) show that lipid A will interact with the defects in a liquid crystal droplet, allowing for the extremely sensitive detection of this glycopospholipid, an essential component of a bacterially produced endotoxin.

## Understanding Change

As a result of human activities, ecological communities are losing functionally irreplaceable species and gaining functionally novel ones, but research into the two processes has developed largely independently. **Wardle *et al.*** (p. 1273) review these two topics, explore how the species interchange may transform ecosystems through altering aboveground and belowground processes, and search for generalizations and unifying principles needed to understand how the Earth system may respond to global change.

## Macrophages Expand in Place

Macrophages play an important role in pathogen clearance during infections. Macrophages increase in number in infected tissues through the recruitment of monocytes from the blood, which then differentiate into macrophages. Although this is the case for inflammatory macrophages participating in classical “type 1” responses, **Jenkins *et al.*** (p. 1284, published online 12 May; see the cover; see the Perspective by **Randolph**) report a different mechanism for macrophage accumulation in tissues during “type 2” responses, which often occur in response to parasitic infection. Tissue resident macrophages proliferated in situ in response to infection with a filarial nematode. Proliferating macrophages had an “alternatively activated” phenotype and required the type 2 cytokine interleukin-4 for their expansion. This mechanism of macrophage expansion may promote parasite sequestration and tissue repair in the absence of

the immune pathology typically associated with the recruitment of inflammatory cells.

## Microcredit in the Philippines

One of the aims of microcredit—the granting of small loans to groups or individuals with limited access to traditional formal lending sources—is to spur the start or growth of small-scale businesses, especially those run by women. **Karlan and Zinman** (p. 1278) developed a randomized methodology for assigning microloans to individuals in the Philippines. The availability of microloans increased the amount of borrowing that individuals undertook, but their businesses did not grow and could actually shrink. However, microcredit fostered ties between these individuals and their communities, making risk more manageable and increasing access to informal lending.

## Graphene Transformation and Integrated Circuits

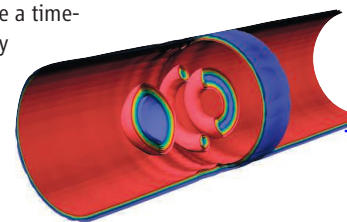
Metamaterials and transformation optics allow for the design of circuits and devices with functionalities beyond those of natural materials. **Vakil and Engheta** (p. 1291) show numerically that the optoelectronic properties of graphene offer the possibility of realizing such designer circuitry in a two-dimensional landscape only a single atom thick. The high mobility of charge carriers in graphene makes it an ideal candidate for the high-frequency devices used in radio-frequency applications. High-frequency, field-

effect transistors have been demonstrated, but devices such as mixers, which create the sum and difference combination frequencies from two input frequencies, require other components. **Y.-M. Lin *et al.*** (p. 1294) used electron-beam lithography to define the components of a mixer for graphene grown in silicon carbide.

## Superfluids in a Stir

Stirring a liquid can result in the formation of vortices or a change in the properties of the liquid, where a phase transition can be induced. If the liquid is a superfluid, quantum mechanical considerations restrict the angular momentum of the vortices so that they take quantized values and the liquid can become “normal.” Using somewhat phenomenological descriptions, how the vortices develop for a given condition is well understood, as are the different states that can arise, but a general theory describing the full evolution has been lacking. **Bulgac *et al.***

(p. 1288) describe a time-dependent density functional theory that provides a generalized description of the dynamics and phase transitions associated with the complex interactions of Fermi superfluids, which should prove a powerful tool in describing such systems.



## Through a Topsy-Turvy Tunnel

One of the counterintuitive consequences of quantum mechanics is that chemical reactions can sometimes proceed in systems that lack the energy needed to power the associated atomic rearrangements. This phenomenon is termed tunneling: The molecules pass through, instead of over, an energy barrier to products. **Schreiner *et al.*** (p. 1300; see the Perspective by **Carpenter**) describe a system in which tunneling completely upends the expected course of a molecular rearrangement. In an unstable carbene compound with OH and CH<sub>3</sub> groups bonded to a low-valency central carbon, an H atom shifted to the central carbon to form a more stable isomer. However, the H atom came from the OH group, despite facing a higher barrier than would a competing H shift from CH<sub>3</sub>.

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