high-density clusters in Fig. 1, similar to the observations reported in ref. 7. Irrespective of which additional effects are also operative in the poly(dioctyl)phenyl-vinylene thin-film system, it is clear that interest in this field has gone full circle to include systems that are far from a light-localization regime, and that there exists intruding behaviour under weak scattering conditions.

Many of the difficulties in pinning down the mechanisms responsible for random lasing are arguably the result of insufficient quantitative characterization of important aspects of the media in which it arises. These include the degree of inhomogeneous broadening, the dispersion of the gain profile, the presence of scattering and boundaries not within the gain medium, and the polarization dephasing rates of the active media. The dephasing rates are particularly important when the length scales result in cavity-mode build-up times that are in the subpicosecond regime. Comprehensive experiments such as those conducted by Tulek *et al.* could be combined with additional measurement techniques, such as near-field scanning microscopy, to study lithographically designed structures with engineered disorder to allow us to develop a complete random-laser phase diagram that can ultimately lead to controllable and predictable outputs from these systems.

There is a rich frontier ahead in the field of random lasers. Studies of the time-dependent behaviour may indeed provide new insight into how these systems produce rich mode structure in various regimes of scattering and gain. Femtosecond laser technology, along with low sample temperatures to slow dephasing rates in systems such as conjugated polymers, can allow researchers to access the full dynamical richness of the Maxwell–Bloch equations in the regime where adiabatic elimination of the polarization is not justified. Other areas to pursue include highly precise electron beam excitation as demonstrated in the 1960s in CdS, CdSe and ZnO, and systems where the scattering lengths depend on the instantaneous gain through plasmon polariton resonances of the scattering centres[9]. ❐

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FLIGHT CONTROL

Correction on the fly

Flies are not easily perturbed in their pursuit of prey, be it fruit or humans. The flies' insistence may be annoying, but their ability to maintain stable flight, despite all interference, is impressive. Leif Ristroph and colleagues have now studied in detail how fruit flies recover from flight disturbances, and propose a mechanism of autostabilization that keeps these — and possibly other — animals on course (*Proc. Natl Acad. Sci. USA* **107,** 4820–4824; 2010).

In their experiments, Ristroph *et al.* mapped the free flight of common fruit flies (*Drosophila melanogaster*), using three orthogonally arranged high-speed cameras, each recording 8,000 frames per second. To perturb the flies' flight in a controlled manner, they glued 1.5-mm-long pieces of carbon steel wire onto the backs of the insects. Once inside the filming volume, magnet-field pulses applied through a pair of Helmholtz coils tilted the pins, and the flies with them.

For perturbations that caused deflections of up to 45°, the flies recovered remarkably quickly. Typically they were back on their original trajectory within fewer than 60 ms, with an accuracy of 2°. When thrown by more than 45°, the flies could still get back on track, but less precisely.

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The time resolution of the recordings that Ristroph and co-workers made of these manoeuvres — roughly 35 frames per wing beat — is sufficiently high to see the mechanism at work. The flies counteract the imposed rotation by generating aerodynamical torque by adjusting the wing angles. The angles of attack are different for the two wings, causing the fly to turn.

But how does the animal sense that it has been derailed? The speed with which the correction happens rules out visual input. It takes the flies roughly 10 wing beats to react to visual stimuli — and yet in this time, they have already executed the entire correction manoeuvre. Instead, the flies sense body rotation through structures known as halteres. This pair of drumstick-shaped extensions (seen behind the wings in the picture) evolved from a pair of hind wings and acts as a vibrating-structure gyroscope.

Ristroph *et al.* propose a model in which the wing and body motions are coupled, leading to strong damping of rotations. Such damping would constitute efficient autostabilization, making it unnecessary to actively stop rotations. That this mechanism fails for large deflections might be caused by saturation of the brain structures that process information from the halteres.

Taking on board aspects such as sensor saturation, this study should serve as a basis for further exploring the neural circuitry that controls fruit-fly motion. And it may provide insight into the general physical principles that allow stable flapping-wing flight.

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