

## Cell biology

## Enlightened messages

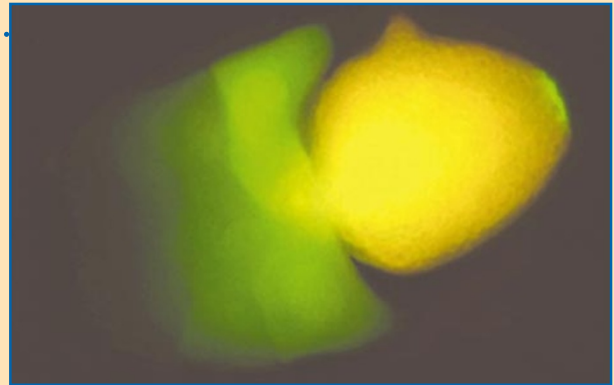
Writing in *Proceedings of the National Academy of Sciences*, Diana Bratu and colleagues describe a way to trace the movement of messenger RNA (mRNA) in living cells (doi:10.1073/pnas.2233244100).

Every moment inside cells, thousands of proteins and RNA molecules shuttle from one location to another. By fusing cellular proteins to other, fluorescent proteins, their movements can be followed visually. But it is not possible to tag RNA in the same way. Bratu *et al.* have devised a different sort of tracking system to monitor the transport of specific RNA messages. They created fluorescent 'molecular beacons' — short stretches of nucleic acids

that seek out and bind to complementary mRNA sequences.

Attached to one end of the beacon is a fluorophore; a fluorescence quencher is fixed to the other end. The single-stranded beacon normally folds back on itself, forming a double-stranded hairpin structure in which the quencher and fluorophore are held in close proximity. But when the beacon binds to its complementary sequence in the RNA message, it unfolds — the fluorophore is separated from the quencher and the mRNA lights up.

To test their tracking system, the authors designed beacons for the *oskar* mRNA of fruitflies. The *oskar* message encodes the Oskar protein,



which is involved in patterning the developing fruitfly egg. It is produced in 'nurse cells', which nurture the developing eggs. After entering and traversing the egg, *oskar* mRNA accumulates at the posterior end.

Bratu *et al.* injected *oskar*-specific molecular beacons into a living egg to see whether the pattern

of fluorescence would unfold as expected. As the picture shows, it did — the authors detected the *oskar*-specific signal (green) in the neighbouring nurse cells and at the posterior end of the egg, whereas the signal from a control beacon was located throughout the egg (yellow). **Clare Thomas**

forest is that of Janzen<sup>4</sup>. In this, recruitment of individuals to a community is regarded as a consequence of dispersal from the parent plant, combined with predation by seed-eating organisms such as bruchid beetles, which are particularly adept at dealing with the many secondary plant compounds that deter most seed predators.

Because seed predators tend to concentrate around the parent tree, recruitment there is low, despite a high input of new seeds. There is a critical distance from the parent — within the range of frequent seed arrival, but with few predators — in which recruitment is most abundant. Beyond this, seed arrival is limited by dispersal ability. This model accounts for why many species of tree tend to be widely separated in tropical forests. But it does not explain why others may occur in clumps.

Working on Maracá Island in the Amazon basin of Brazil, Fragoso *et al.*<sup>1</sup> studied the effects of tapir feeding on the fruits of the palm *Attalea maripa* (formerly known as *Maximiliana maripa*), which is unusual in that it tends to grow in clusters. The fruits are 5–8 cm in length and are produced in large numbers. They consist of a fibrous husk, a layer of yellow pulp and a further woody layer — the endocarp — that encloses the seeds. Many small mammals feed upon the fruits, first removing the husk and then eating the pulp. The inner part is then abandoned and is usually attacked by bruchid beetles, which lay their eggs on the damaged fruits: their larvae penetrate to the seeds and consume them. Infestation close to the parent tree can approach 100%.

Tapir fruit-eating behaviour is different from that of the smaller mammals. These are

large animals (about 250 kg; Fig. 1), with home ranges of several thousand hectares. They ingest the palm fruits intact, digest the pulp, and finally pass the endocarps and husk fragments in their faeces. They habitually defecate in specific latrine sites, both in the upland, drier areas and in the wetland swamps of Maracá Island. The endocarps at these sites are 98% viable, and the establishment of young palms is far more successful there than around the parent trees. Aerial surveys confirmed the existence of aggregations of palms, possibly reflecting former patterns of tapir latrines. But to find out more about the factors enhancing seed survival, experiments were required.

Fragoso *et al.* tackled matters as follows. They collected palm endocarps, placing them at different distances from the parent trees, and enclosing them in wire frames to exclude all large predators but allow access by beetles. Some plots contained clean endocarps. In others, the endocarps were covered with tapir faeces (from which any ingested endocarps had been removed) to simulate the burial conditions at latrine sites.

The results showed that, up to a point, survival was significantly enhanced by distance from the parent site (a consequence of the scarcity of bruchid beetles away from those sites). Survival was also greater when endocarps were buried in faecal material (making it more difficult for the beetles to locate the endocarps and lay their eggs on them). The effect of burial, however, became insignificant in very distant sites, presumably also because of the scarcity of the seed predator. Modelling of palm population dynamics under these conditions will evidently prove complex<sup>2</sup>.

This work<sup>1</sup> illustrates the complexity of interactions between palm, tapir and beetle. But it also has a bearing on conservation. Restriction of tapir movement, by habitat fragmentation for example, could severely affect palm population dynamics. The patches of palm in the forest and sometimes also in the savanna, created at tapir latrines, constitute a mosaic of habitats in which biodiversity thrives. Such interactions between plants and animals might be a central determinant of the rates of adjustment of vegetation to changing conditions — the future of the forest could in part lie within the intestines of a tapir. ■

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## Editorial note

The News and Views article "Molecular biology: Complicity of gene and pseudogene" (*Nature* **423**, 26–28; 2003) discussed the discovery of pseudogene function in the mouse, as described by S. Hirotsune *et al.* on pages 91–96 of the same issue. There is an earlier report of pseudogene function, in a mollusc and with a different mechanism (S. A. Korneev, J.-H. Park & M. O'Shea *J. Neurosci.* **19**, 7711–7720; 1999).