

ECOLOGY

From Acorns to Lyme Disease

Lyme disease, caused by the spirochaete bacterium *Borrelia burgdorferi*, has acquired notoriety in the United States and wilder parts of Europe. It is transmitted by blood-sucking ticks, usually among deer and small mammals. But Ixodes ticks are not fussy and will feed on any vertebrate, including humans. As human activities encroach into wooded and heathland environments, we run the risk of tick infestation and possible Lyme disease transmission. For 13 years, Ostfeld *et al.* looked at the environmental parameters that might predict how severe the upcoming Lyme season might be. Classically, deer abundance and weather were thought to influence numbers of ticks and hence predict the risk of human infection, but it turns out that small mammal abundance over the previous year is a much better indicator. Mice and chipmunks, whose numbers are determined by food supply in the prior year, are important hosts for the tiny juvenile stages of the ticks, which, because they are unnoticeable, tend not to be removed from the skin and can be extremely abundant in summer. Consequently, the acorn supply for mice and chipmunks 2 years previously makes an excellent measure of Lyme disease risk. — CA

PLoS Biol. 4, e145 (2006).



Acorns (right) and mouse (left).

EVOLUTION

Counting Sheep

The environment can be a powerful force in evolution, as the great mass extinctions across geological time testify. Yet classical models of the genetics of populations often assume the simplifying condition of a constant environment, begging the question of what happens to the heritability and selection of specific traits in times of change. Details of the phenotype of Soay sheep—first introduced to the Scottish archipelago of St. Kilda in the Bronze Age and to the main island of Hirta in 1932—have been collected since 1985 and provide a case study of microevolution through changeable times.

Wilson *et al.* analyzed the birth weight of Soay sheep across a 20-year period during which the sheep experienced both low and high mortality rates associated with changing environmental circumstances. Birth weight is a heritable trait that is under potentially strong selective pressure, with

larger lambs having a better chance of survival. Under harsh conditions, the researchers find that their models are consistent with a strong selection for increased birth weight among lambs, which is also associated with a low genetic variation. Favorable conditions result in a reduced selection on birth weight. Thus, for this trait in Soay sheep, the environment acts as a constraint on the microevolutionary potential of the population. — GR

PLoS Biol. 4, e216 (2006).

ANTHROPOLOGY

From Fertile Soil to Fertile Society?

The rise of agriculture at the beginning of the Holocene era is thought to have contributed to large increases in ancient populations. One measure of population growth that can be evaluated with reasonable certainty based on archaeological evidence is the number of juveniles in grave sites. Growing populations have proportionally more children, whereas the converse is true of populations in decline.

Bocquet-Appel and Naji studied the skeleton records in 62 ancient North American cemeteries, and observed that local societal transitions from foraging to agriculture were followed by a significant increase in the juvenile (aged 5 to 19) human remains. This trend parallels a similar but earlier transition in Europe. Thus, regardless of

when agriculture developed globally, it appears to have occasioned a local increase in birth rate (and consequently population) during the ensuing several hundred years. The global data hint that many foraging populations may have stagnated in the years approaching the various transitions, or even declined slightly on account of taxed resources or emerging diseases — BH

Curr. Anthro. 47, 341 (2006).

ECOLOGY

Bleach Prospects for Reef Recovery

Coral bleaching, whereby corals lose their photosynthetic algal symbionts, is now widespread throughout tropical reefs. Loss of algae from corals severely reduces nutrient flow through these ecosystems, with worrying impacts on the diversity and biomass of other reef-dwelling organisms, especially fish. Evidence is fast accumulating that warming events trigger these events. Less is known, however, about the ability of reef communities to recover from bleaching. Graham *et al.* assessed the changes that took place after the bleaching of 75 to 90% of coral in the Seychelles in 1998, the result of a strong El Niño event that year. A total of 50,000 m² were surveyed. The structure of the reef habitats changed markedly after the death of branching and soft corals. By 2005, the structural complexity of the reefs was reduced, and the habitats were dominated by rubble, encrusting corals, and algal fields. There were concomitant reductions in fish diversity, including some local extinctions. The



Soay sheep.

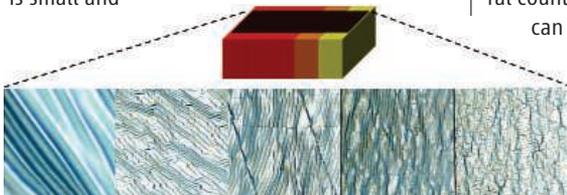
recovery of the reefs has been slower than typically observed in more-continental reefs, probably because of the isolation of the Seychelles, which would reduce the rate of dispersal of larvae from elsewhere. If bleaching events are regular, the prospects for recovery are not good. — AMS

Proc Natl. Acad. Sci. U.S.A. **103**, 8425 (2006).

MATERIALS SCIENCE

Buckle Up for Softy

Tensile or compressive tests to measure the elastic modulus of a material are often limited by the size and shape of test specimens. Local indentation probing is useful for hard metals or ceramics, but less so for soft materials. The elastic modulus is a stiffness indicator but also reflects such properties as adhesion and swelling. Researchers are seeking alternative methods to measure complex samples such as a contact lens, which is small and



Hydrogel buckling patterns (cross-linker concentration increases from left to right).

soft and may need to be studied under hydrated conditions.

Wilder *et al.* address this problem by inverting a technique used to characterize thin films. They measure the modulus of a compressed polymer by coating the surface with a stiffer material of known modulus. The periodicity of the buckling response depends primarily on the modulus ratio between the stiff film and softer substrate, and thus the unknown modulus can be determined from optical measurements of

the buckled film. Modulus values from measurements of a model poly(dimethylsiloxane) system coated with a polystyrene film agreed well with those obtained from compression tests. The technique can also quantify spatial variations in modulus through a single experiment, as demonstrated on a hydrogel sample that was prepared with a spatial concentration gradient of cross-linking agent. — MSL

Macromolecules **39**, 10.1021/ma060266b (2006).

CHEMISTRY

Anion Induction

In traditional asymmetric catalysis, a chiral catalyst binds directly to the reagent and thereby facilitates the reaction path to one product isomer while hindering the path to its enantiomer, or mirror image. Mayer and List show that asymmetric induction can also arise from pairing of an achiral cationic catalyst with a chiral counterion. Chiral amine derivatives

can promote transfer hydrogenation of α,β -unsaturated aldehydes. The authors have now probed the same reaction class using protonated morpholine, an achiral amine, in combination with binaphthol-based chiral phosphate anions. This catalyst system is particularly effective for aromatic substrates, yielding product distributions that favor one enantiomer by 98:1 or higher ratios. Sterically unhindered aliphatic substrates, such as citral and farnesal, are also reduced in high enantiomeric excess. Because the reaction proceeds in aprotic solvent and requires a secondary, rather than tertiary, amine salt catalyst, the authors propose that induction occurs via an ion pair between the phosphate and an iminium intermediate, formed by amine displacement of the aldehyde oxygen. — JSY

Angew. Chem. Int. Ed. **45**, 10.1002/anie.200600512 (2006).

10.1002/anie.200600512 (2006).

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<< Keeping LAT Out

T cell anergy prevents self-reactive T cells that escape elimination in the thymus from responding. T cell anergy is associated with decreased interleukin 2 (IL-2) production and decreased proliferation in response to antigen-specific stimulation. Hundt *et al.* show that although phosphorylation of the tyrosine kinase ZAP-70 is not impaired, phosphorylation of the ZAP-70 substrate, linker of activated T cells (LAT), is decreased. LAT serves as a scaffold recruiting various downstream effectors to the immunological synapse. Thus, lack of LAT phosphorylation prevents activation of phospholipase Cg1 (PLCg-1) and phosphatidylinositol 3-kinase (PI3K). There was no decrease in LAT abundance in the anergic cells, but LAT was selectively excluded from the immunological synapse because of reduced palmitoylation of LAT, which may explain the altered signaling properties in anergic T cells. — NG

Immunity **24**, 513 (2006).

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Bleach Prospects for Reef Recovery

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