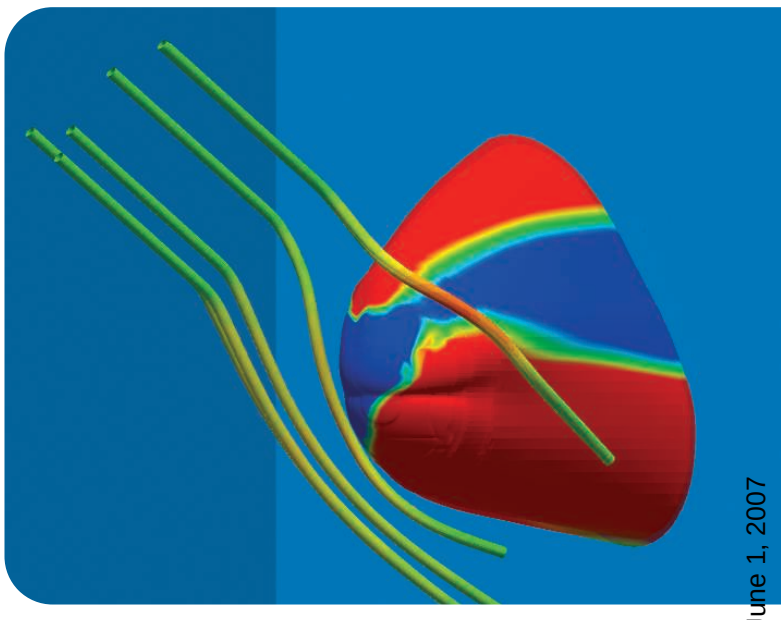
EDITED BY STELLA HURTLEY AND PHIL SZUROMI

## Magnetic Misalignment >>

The two Voyager spacecraft detected a series of radio sources that lie just beyond the heliopause, the outer extent of the solar wind–inflated bubble that encases the solar system. These radio sources may originate from the intersection of an interplanetary shock with the heliopause, but model studies have required assumptions about the direction of the interstellar magnetic field in this region. The orientation of the local field introduces asymmetries that affect the location of radio emission and the streaming direction of ions from the termination shock of the solar wind. Others have assumed that the magnetic field is aligned with the galactic plane, as it is on large scales in the Milky Way. However, by comparing a magneto-hydrodynamic model of the heliosphere with Voyager observations, **Opher *et al.*** (p. 875; see the Perspective by **Jokipii**) show that locally the interstellar magnetic field is misaligned by 60° to 90° relative to the galactic plane.



## Pairing Up But Not Condensing

When equal populations of fermions of opposite spin states come together, they can be expected to pair and condense into a macroscopically coherent state, such as a superfluid. What happens when the initial populations are unequal? **Schunck *et al.*** (p. 867; see the news story by **Cho**) look at conditions of strong population imbalance using clouds of fermionic gases. Pairing of the atoms occurs, but condensation of the pairs into the superfluid state is suppressed by the imbalance, even down to the lowest temperatures.

## Fighting Desertification

Drylands host more than one-third of the world's population, including many of the poorest inhabitants of developing nations. These areas are likely to be impacted disproportionately by global warming, but efforts to stem outcomes such as desertification are hampered by a limited understanding of the interconnectivity of dryland ecosystems and human social systems. **Reynolds *et al.*** (p. 847) offer a framework for a more integrative approach to understanding dryland development and combating desertification, with particular emphasis on constructing solutions that synthesize scientific, management, and policy concerns.

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## Foggy Fallout

Titan's orange haze is caused by a smog of organic molecules created in its atmosphere. Some of the heavier red-brown organic molecules, called tholins, are thought to precipitate onto Titan's surface. It has been thought that tholins form at stratospheric heights in Titan's lower atmosphere, but **Waite *et al.*** (p. 870; see the Perspective by **Atreya**) show that they form at much higher altitudes (about 1000 kilometers). Analysis of data taken by the Cassini spacecraft shows that a series of chemical reactions transform simple organic molecules (such as methane and nitrogen molecules) into much larger molecules (with masses of 80 to 350 daltons). Eventually, these molecules form organic molecules as heavy as 8000 daltons that also bear a negative charge.

## Crumbing Carbonates

As earthquakes propagate, their actions may actively weaken previously stable faults through changes in the rocks at high velocity. **Han *et al.*** (p. 878; see the Perspective by **Madariaga**) demonstrate experimentally that frictional heating causes dramatic fault weakening in Carrara marble. At the sliding fault interface, heat causes the marble to decompose into fine particles tens of nanometers in size that make it more slippery. Such effects could make earthquakes rupture more easily in carbonate rocks.

## Ice, the Mantle, and Canadian Gravity Lows

Terrestrial gravity above a point on Earth can vary with changes in the amount or density of underlying mass. In northern Canada, a large depression of the continental craton has created a region of anomalously low gravity. This topographic low may be the remnants of the depression made by the Laurentide Ice Sheet, in the case of incomplete rebound of the crust (glacial isostatic adjustment, or GIA) after the melting of the ice sheet at the end of the Last Glacial Maximum, or the result of active downwelling of the mantle. **Tamisiea *et al.*** (p. 881) examine 4 years of data from the Gravity Recovery and Climate Experiment (GRACE) satellites and conclude that GIA has contributed 40 to 50% of the gravity anomaly over the area. They also infer that the Laurentide Ice Sheet had two large domes during the Last Glacial Maximum, rather than only one as some studies have suggested.

## Masterful Decisions

In the immune system, B and T lymphocytes develop via distinct pathways from common bone marrow progenitors, and the signaling protein Notch plays a crucial role in deciding T cell fate determination. **Maeda *et al.*** (p. 860; see the Perspective by **Maillard and Pear**) now find that a proto-oncogene called *LRF* represses this

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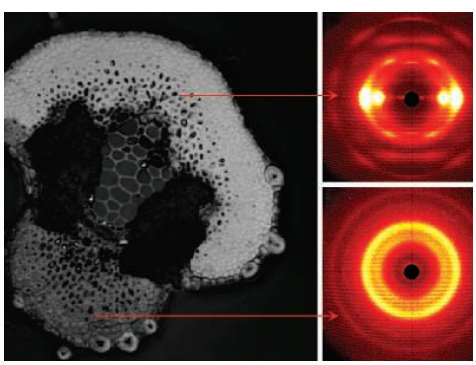
Notch signal and in so doing induces progenitors to undergo a B cell developmental program. Thus, *LRF* may act as a master regulator in the cell fate decision that generates the two main arms of the adaptive immune system.

## $IP_4$ Recruits Signaling Proteins

Inositol phosphates are important intracellular second messengers in eukaryotic cells. In particular, higher-order inositol polyphosphates regulate a range of biological processes, from chromatin remodeling to calcium signaling. **Huang *et al.*** (p. 886, published online 5 April; see the Perspective by **Irvine**) now report that inositol 1,3,4,5-tetrakisphosphate ($IP_4$) plays an unexpected role in T cells by modifying a well-established protein recruitment pathway. Soluble $IP_4$ in the cell was found to lock onto pleckstrin homology domains that regulate the recruitment of signaling proteins to the cell membrane for activation during T cell development.

## Genetic Factor in Obesity

To be considered robust, genetic association studies must be confirmed in more than one independent set of subjects. **Frayling *et al.*** (p. 889, published online 12 April; see the 13 April news story by **Kaiser**) present a genome scan of DNAs from a large case-control study for type 2 diabetes and identify a common genetic variant associated with obesity and a risk of being overweight. These findings of were confirmed in 12 additional cohorts, among a total of 38,759 individuals. On average, individuals homozygous for the high-risk allele weighed nearly 3 kilograms more than individuals homozygous for the low-risk allele. The effect was consistent across samples, across ages (from 7 years upward), across genders, and irrespective of diabetes status.



## Awns and Seed Dispersal

Awns are pointed projections on the seeds of wheat and other grasses that play a role in the dispersal of seeds in the air and on the ground. **Elbaum *et al.*** (p. 884) show how changes in humidity lead to bending of the awns as the result of moisture-induced changes in the arrangement of the awn's cellulose fibrils. In turn, the bending of the awns not only pushes the seed along the ground, but can even lead to the active burial of the seed, which presumably improves the chances of germination.

CREDIT: ELBAUM *ET AL.*

## Bat Flight Control

When animals fly, their wings produce a vortex wake that can provide clues about the aerodynamic forces they generate. **Hedenström *et al.*** (p. 894; see the cover) describe unusual aerodynamic features of the wake topology for the small bat species *Glossophaga soricina*, using digital particle image velocimetry that captures the movement of fog particles in the wake of flying animals. The two wings generate separate vortices, interlinked by vortex structures shed from the body. During the upstroke the outer (hand) part of the wing generates negative lift, while the inner part of the wing (arm) generates positive lift. Different parts of the wing produce extra vortices in the wake, which differ significantly from the wakes produced by birds.

## Subliminal Motivation

Humans are normally aware of their motivation, such as during athletic training or studying for an exam. Can motivation also be unconscious, such that a person is unable to report the goals or rewards that drive a particular behavior? **Pessiglione *et al.*** (p. 904, published online 12 April) developed an incentive force task using either one penny or one pound as a reward. The coins were displayed at different durations so that they were either consciously or subliminally perceived. Using functional magnetic resonance imaging and measuring a range of other physiological parameters, the authors found that even when the subjects were not consciously aware of the size of the reward, they nonetheless exerted more force in association with higher stakes.