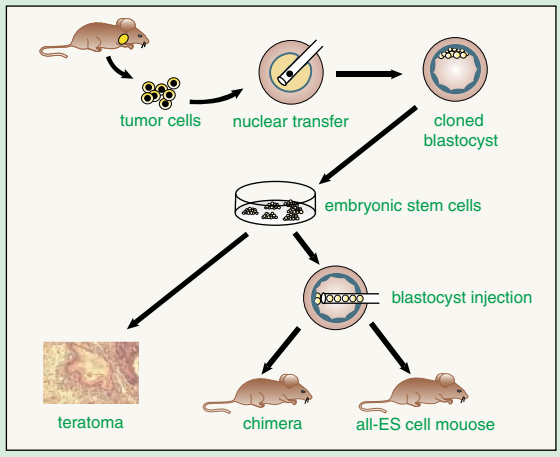
edited by Gilbert Chin

CANCER

Reprogramming Cancer Cells

An anguished Lady Macbeth says, "What's done cannot be undone." Does this apply to cancer cells?

Cancer arises as a result of both genetic and epigenetic modifications. Whereas genetic changes permanently alter the DNA sequence of the tumor cell, epigenetic changes act more subtly—for example, by altering the way that critical proteins are packed around DNA. The extent to which these reversible epigenetic changes contribute to tumorigenesis is poorly understood.



Procedure for assessing the tumorigenic potential of ES cells.

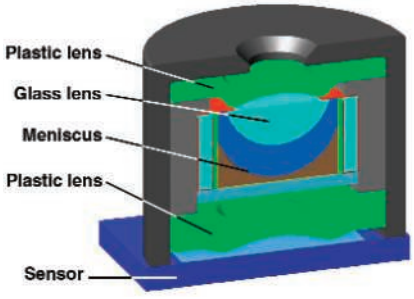
In two studies, investigators have examined whether cancer cells can be reprogrammed into a normal state by transferring nuclei from mouse tumor cells into enucleated mouse oocytes and then assaying their ability to direct early embryo development. Blelloch *et al.* found that transfer of nuclei from embryonal carcinoma cells resulted in normal blastocysts from which embryonic stem (ES) cells could be produced, but the ES cells had the same tumorigenic potential as the donor cells. Hochedlinger *et al.* likewise found that nuclei from many tumor cell lines could not be reprogrammed. One remarkable exception, however, was a melanoma cell line whose nucleus not only produced ES cells, but was able to direct the full development of an adult mouse. These results underscore the important role of genetic changes in tumor development, but raise the possibility that in certain tumor types, epigenetic changes may play a predominant role. — PAK

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.0405015101 (2004); *Genes Dev.* **18**, 1875 (2004).

APPLIED OPTICS

A Liquid Lens

Mechanical imaging systems focus images by using tiny motors and drivers to position the lens physically. The miniaturization of mechanical systems requires precision engineering and is limited by the tolerances of the machining tools. Kuiper and Hendriks demonstrate that the meniscus, or curvature, of the interface between two immiscible liquids can be controlled by application of an electrostatic potential. They go on to show that this effect can be used to instantiate a variable focus lens by building a miniature camera suitable for incorporation into a mobile phone. Without any moving parts, the liquid lens should find immediate application in a wide range of optical devices where size, speed, and robustness are critical requirements. — ISO



Schematic of the liquid lens

Appl. Phys. Lett. **85**, 1128 (2004)

MATERIALS SCIENCE

Silicon Windows

Although the sample chambers in most electron microscopes are under vacuum, environmental scanning electron microscopes are making it feasible to analyze biological samples at ambient pressures. For these microscopes to work, the electron column, where the beam is formed, has to stay under high vacuum, and so a cascade of pressure stages (like a series of locks in a canal) is used to maintain a pressure gradient. Similarly, if x-ray detectors are used, they need to be protected from contamination with a window made either of beryllium, which cuts off x-rays below 1 keV, or of a polymer, which can be fragile.

Schilling *et al.* have fabricated a macroporous silicon membrane using photoelectrochemical etching to generate the pores, followed by oxidation and chemical etching to smooth them out. The resulting structure features 50-μm-long pores that are capped with dome-shaped silicon dioxide shells, only 60 nm thick. The nonporous regions of the membrane allow it to withstand a pressure differential of ambient on one side and vacuum on the other. Transmission levels for an electron beam with an accelerating voltage of 25 keV were as high as 22%, albeit with significant variation from pore to pore. Further tests showed that these membranes would also transmit x-rays and infrared radiation. — MSL

Appl. Phys. Lett. **85**, 1152 (2004).

IMMUNOLOGY

Sharing with the Needy

When not responding to pathogens, naïve T cells survive with the aid of a variety of homeostatic influences. Dominant among these is the signal provided by the cytokine interleukin-7 (IL-7), which maintains the activity of anti-apoptotic (anti-death) pathways. However, the limiting amounts of IL-7 that are available relative to the large number of T cells suggests that a mechanism must exist that enables cells to compete successfully for this resource without risking the loss of antigenic diversity as represented by the whole T cell population.

Park *et al.* observed that expression of the IL-7 receptor (IL-7R) was reduced on T cells that had already received an IL-7 signal. This was traced to a decrease in transcription of the gene encoding the α chain of the IL-7R and was ascribed to activation of the transcriptional repressor GFI1. In transgenic mice with forced constitutive expression of the IL-7R α chain the T cell pool was reduced, rather than expanded,

CREDITS: (TOP) HOCHEDLINGER ET AL., *GENES DEV.* **18**, 1875 (2004); (BOTTOM) KUIPER AND HENDRIKS, *APPL. PHYS. LETT.* **85**, 1128 (2004)

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indicating that prolonged IL-7R expression in these animals had conferred an overall survival disadvantage. Thus, the survival benefit of IL-7 is spread across the pool of naïve T cells by reducing demand from those T cells that have already received their allotment: an efficient means by which cells share a scarce resource. — SJS

Immunity **21**, 289 (2004).

ASTROPHYSICS

Denuded Dwarfs

Globular clusters of stars are ubiquitous and provide important clues about galaxy formation. They also are large and luminous, and hence one of the easier kinds of sub-galactic objects to study. They all "look" the same; that is, they have scale radii, surface brightness, and velocity dispersion properties that are similar from one globular cluster to the next, suggesting that they all formed in the same fashion. But how do millions of stars come together into a relatively featureless glob?

Martini and Ho observed 14 new globular clusters in a large elliptical galaxy, Centaurus A, and estimate that these clusters are almost as massive as dwarf galaxies. In fact, the clusters have properties so similar to those of the centers of dwarf galaxies that the authors conclude the clusters might actually be the naked cores of dwarf galaxies. In other words, these shapeless clusters might once have been beautifully structured galaxies that were tidally stripped of their finery. Such a reclassification would alter hierarchical models of galaxy formation and enhance the importance of near-collisions between galaxies that lead to tidal stripping. — LR

Astrophys. J. **610**, 233 (2004).

ECOLOGY/EVOLUTION

Maintaining One's Niche

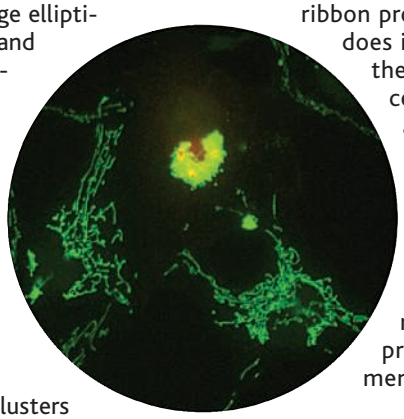
The concept of limiting similarity—literally, the limits to how similar two species can be if they are to coexist in a habitat—is an important element in the theory of assembly rules governing composition and diversity within ecological communities. Nevertheless, rigorous empirical evidence for limiting similarity has been hard to obtain. Stubbs and Wilson, in a study of a sand dune plant community in New Zealand, examined whether plants with similar functional characteristics (such as height, leaf shape, root morphology, nitrogen and phosphorus content of leaves) coexisted less often than would be expected if their distribution were random. Plants were sampled at different spatial scales up to 50 m^2. Many of the functional characters showed less-than-expected mean dissimilarity at the 0.5 m^2 scale, providing support for the rule of limiting similarity in this community. The effects were seen particularly clearly in functional characters relating to nutrient uptake and the control of leaf water. — AMS

J. Ecol. **92**, 557 (2004).

CELL BIOLOGY

Ribbons and Bows

The Golgi complex in mammalian cells resides in a juxtanuclear position that depends on the centrosome and on microtubules. How is this single Golgi ribbon produced, and how does it "know" to form at the periphery of the centrosome? Rios *et al*. find that the protein GMAP-210, peripherally associated with cis- (the side facing the nucleus) Golgi membranes, binds to microtubules and promotes the recruitment of γ-tubulin–containing complexes to the Golgi. Reduction of GMAP-210 levels causes the fragmentation of the Golgi complex and interferes with membrane traffic. The ability of GMAP-210 to recruit organelles to the centrosomal region can be transferred—when GMAP-210, or only its C-terminal domain, was engineered to insert into the mitochondrial membrane, the mitochondria recruited γ-tubulin and moved toward the centrosome. Thus, GMAP-210 appears to play an organizing role in the generation and maintenance of a single, central Golgi complex. — SMH



Colocalization of mitochondria (red) and the engineered GMAP-210 C-terminal domain (green).

CREDIT: (RIOS *ET AL.*, *CELL* **118**, 323 (2004))

Cell **118**, 323 (2004).

Ribbons and Bows

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Science **305** (5688), 1215.
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