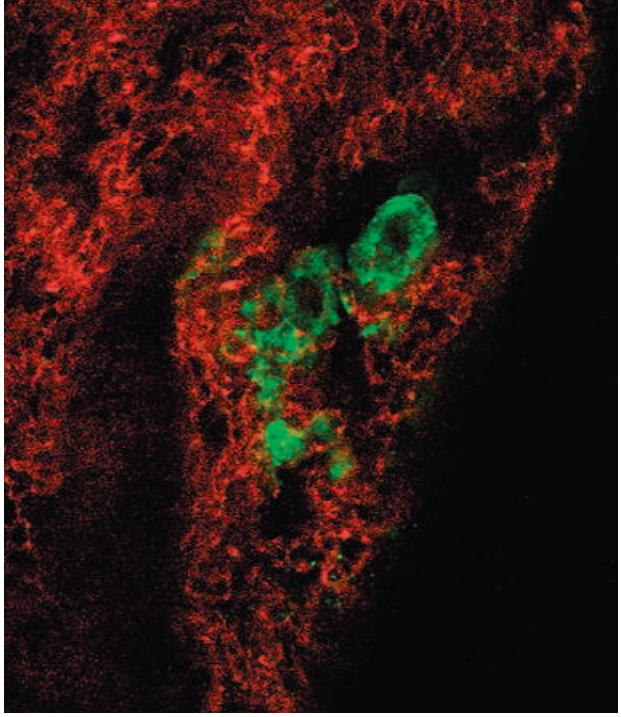


<< Rethinking Cancer Metastasis

Most human cancer deaths are caused by metastasis, in which cancer cells spread from the primary tumor to new sites in the body. Because metastatic cells must successfully negotiate a series of complex steps, including survival in the bloodstream and establishment in a foreign tissue environment, metastasis has been viewed as a late event in cancer progression. **Podsypanina *et al.*** (p. 1841, published online 28 August; see the Perspective by **Klein**) suggest that the metastatic process may begin earlier than previously thought. Normal mouse mammary cells were genetically manipulated to allow the timing of oncogene expression to be experimentally controlled and injected into the bloodstream of mice. Surprisingly, in the absence of oncogene expression, normal mammary cells were capable of traveling to and surviving in the lungs for up to 16 weeks, although they did not initiate aggressive growth until after oncogene activation. Thus, metastases might arise from disseminated normal (premalignant) cells that remain clinically silent until genetic changes render them malignant.

DNA Templates for Nanomachinery

The precise and complementary base pair matching in DNA has increasingly led to its use as a building or templating material in the assembly of nanoscale objects like particles or wires, or for the decoration of particles and wires with metals or other molecules. **Aldaye *et al.*** (p. 1795) review recent developments in the use of DNA as a precise positional tool for complex material assembly. Developments have moved from simple one-dimensional templating to two and three dimensions, with scope for dynamically changing the shape or size of an object, or the fabrication of nanomachines.

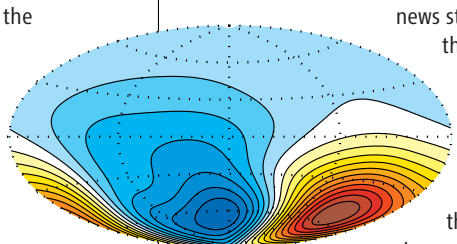
Cancer Genomes: From Chaos Comes Order?

Identification of the genes altered in cancer cells is critical for understanding how the disease arises and for designing more effective diagnostic tests and therapies (see 5 September news story by **Kaiser**). **Parsons *et al.*** (p. 1807, published online 4 September) and **Jones *et al.*** (p. 1801, published online 4 September) catalog the numerous genomic alterations that help turn normal cells into two of the deadliest human cancers: glioblastoma multiforme (the most common type of brain cancer) and pancreatic cancer. Although for each cancer type, the specific genomic alterations varied from tumor to tumor, the altered genes affected a limited number of cellular signaling pathways and regulatory processes, suggesting that these are the pathways that go awry and lead to the disease. Of particular interest in the glioblastoma study was the discovery of recurrent mutations in the active site of isocitrate dehydrogenase 1, encoded by the *IDH1* gene. In this small study, *IDH1* mutations were more prevalent in glioblastomas from younger patients and in "secondary" glioblastomas, and they were associated with a better prognosis.

CREDITS (TOP TO BOTTOM): KATRINA PODSYPANINA; STANLEY *ET AL.*

Martian Dynamo

One surprise from recent spacecraft observations of Mars is that its crust in the southern hemisphere is strongly magnetized, but not so in the northern hemisphere. This pattern seems similar to the major crustal difference on Mars in that the northern hemisphere is relatively smooth, at a much lower elevation, and younger. Mars now lacks an active dynamo.



Stanley *et al.* (p. 1822; see the news story by **Kerr** and the Perspective by **Langlais and Hagay**) show through numerical models that if the heat flow were lower across the core-mantle boundary in the northern hemisphere, as might be expected from any mechanism producing the crustal dichotomy, the resulting geomagnetic field might not be a dipole but be concentrated just in the south. Such a dynamo would also affect Mars' atmospheric evolution because only part of the planet would be strongly shielded from the solar wind.

Working Together to Get the Job Done

Bob tries to make a call to Alice but finds that the line is too noisy. Picking up his second phone (he's a very busy builder), he finds that line is also too noisy and so gives up trying to contact her. With two bad lines, Bob wouldn't be able to make that phone call, at least using the classical communication channels of his provider. Had he had access to quantum communication channels, **Smith and Yard** (p. 1812, published online 21 August; see the Perspective by **Oppenheim**) show theoretically that the situation is quite different. Two quantum channels, each with zero capacity to transmit information independently, will allow information to be carried across them when used together. Not only of theoretical interest, this counterintuitive result may be of practical use in the design of quantum communication networks.

Dissecting a Disordered Material

Graphite oxide was first prepared almost 150 years ago, but the functionalization of the graphite is not uniform, which has hampered efforts to characterize it. This material is now of interest as a precursor for the formation of graphene, which has potentially useful electronic properties. **Cai *et al.*** (p. 1815) have now prepared graphite oxide from graphite with varying degrees of ^{13}C-labeling (up to almost 100%). The labeled product allowed much higher resolution in solid-state nuclear magnetic resonance studies and excluded some of the potential models for the chemical bonding network of this material.

Continued on page 1739

Published by AAAS

Continued from page 1737

Sodium's Nonlinear Response

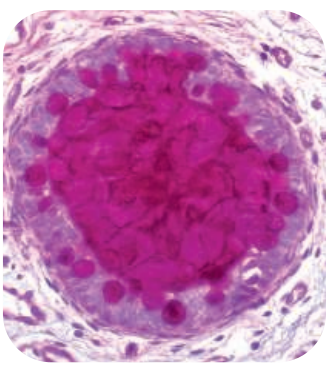
The influence of solvent rearrangements on chemical reactions in solution is often modeled using the linear response approximation, which essentially dictates that all starting configurations that equilibrate to a given final state do so with the same dynamics. **Bragg *et al.*** (p. 1817; see the Perspective by **Stratt**) show that the approximation comes up short for the formation of neutral sodium-electron ion pairs in tetrahydrofuran. Equilibration is twice as fast when the reaction proceeds by reduction of a Na^+ precursor than when Na^- is oxidized. The breakdown can be attributed to the large size differences between the cation, anion, and neutral, which substantially alter the extent of necessary solvent cavity rearrangements in each case.

Modeling Ocean Circulation

Hydrothermal systems along ocean ridges help control the chemistry of the oceans and alter and hydrate the upper oceanic crust; this, in turn, returns water to the Earth's mantle at subduction zones. Hydrothermal systems also foster deep ocean ecosystems. Observations seem to indicate that although ocean ridges are broadly linear, outflows are spaced out along them. **Comou *et al.*** (p. 1825) have developed a three-dimensional numerical model of this flow to help reveal the dynamics. Their model shows that optimizing heat transfer causes the flows to self-organize into narrow pipe-like upflows, spaced about 500 m apart, fed by zones of warm downflow that recirculate up to a quarter of the heat.

Cystic Fibrosis Remodeled

Cystic fibrosis (CF) is caused by mutational disruption of *CFTR*, a gene encoding an ion channel required for chloride- and bicarbonate-mediated fluid secretion in epithelia and for salt absorption in many organs. Two decades of intense research on CFTR has not yet translated into new clinical therapies, in part because mice—the traditional animal model for human disease research—do not develop the full spectrum of pathologies seen in human CF. To address this problem, **Rogers *et al.*** (p. 1837) have inactivated the *CFTR* gene in pigs, an animal that shares many anatomical and physiological features of humans. Newborn pigs lacking CFTR developed many of the gastrointestinal pathologies seen in infants with CF, including intestinal obstruction and abnormalities of the pancreas, liver, and gallbladder, and their nasal epithelia showed defects in chloride transport. These results, while still preliminary, suggest that the pig model may be a valuable tool for testing new therapies for CF.



From the Minds of Babes

Human babies between 8 months and a year of age cannot perform certain cognitive tasks. In one of these, called the A-not-B error, an object is hidden under a container and the infant repeatedly reaches for it. Then the experimenter hides the object under a different container, in full view of the infant, but the baby still looks under the first container to find it. **Topál *et al.*** (p. 1831) propose a new explanation for this error, suggesting that the socially intense "teaching" interaction that usually accompanies the repeated hiding of the object under the first container ensures strong association of the object with that location. When the object is hidden without any communication between the experimenter and the infant, the baby's error rate is reduced. Previous explanations for the phenomenon suggested that it was due to the immaturity of the infant's executive motor control or his or her limited cognitive capacities.

The Agony of Defeat

Auctioneers take advantage of human nature to increase the sale prices of items. But are they banking on the successful bidder's enjoyment of winning, or are they instead relying on the bidder's aversion to losing? Two sides of the same coin, one might say, but **Delgado *et al.*** (p. 1849; see the Perspective by **Maskin**) argue that it is the latter that drives the phenomenon known as overbidding. When participating in an auction, brain areas sensitive to loss became active. When the authors modified the ground rules of the auction so as to emphasize the potential for loss, without altering the basic possibility of winning, the tendency to overbid was magnified.

CREDIT: DAVID K. MEYERHOLZ

Published by AAAS