Spider clues for stronger silk

Commercial silkworm silk is about three times weaker and stiffer than dragline spider silk. Scientists believed that these differences were attributable solely to the superiority of the spider's raw material, and have attempted to improve the silkworm's product by inserting spider genes. However, Zhengzhong Shao (Fudan University, Shanghai, China) and Fritz Vollrath (Oxford University, UK) now show that simple alterations in spinning conditions can markedly improve the characteristic of silkworm silk (*Nature* **418**, 741, 2002). The researchers fixed *Bombyx mori* silkworms onto motorized holders and set them to spin threads in straight lines, not their usual figure-of-eight configuration, to mimic a spider's web-spinning behavior. The team varied the temperature and speed at which the silk was spun and found that there was a trade-off between elasticity and strength: faster spinning produced strong but brittle threads, whereas slower spinning produced weak but elastic fibers. By varying spinning conditions, the worm silk's tensile strength could be modified to rival that of spider silk. The researchers are now investigating the physiology of the silk-spinning organ and the spinning behavior of the silkworm. Ultimately, they could engineer a silkworm superbreed that spins cocoons faster and more evenly, producing silk fabrics with more desirable qualities. *IH*

Golden probes

US researchers have developed a method for detecting DNA that is more than twice as sensitive as the best available techniques and could be used to study multiple DNA targets in parallel (*Science*, **297**, 1536–1540, 2002). The technique is a refinement of the use of gold nanoprobes, labeled with an oligonucleotide, to detect target DNA (e.g., viral DNA) in sample solutions. Chad Mirkin and colleagues at Northwestern University (Evanston, IL) gave the gold particles additional labels consisting of so-called Raman dyes, which can be detected using surface-enhanced Raman spectroscopy. Mirkin's group used these probes to detect DNA targets at concentrations down to 20 femtomoles, lower than the 50 femtomoles previously achieved. Moreover, the team could perform "multiplexed" assays in which gold nanoprobes carrying Raman dyes of different colors could identify several distinct DNA targets in a single assay; standard methods can identify only one target at a time. Mirkin suggests that the technique could enable researchers to quickly and accurately screen a sample for several pathogens simultaneously, without having to do PCR amplification first. *PM*

Research briefs written by Liz Fletcher, Ingrid Holmes, Christopher Martino, and Peter Mitchell.

Druggable gene control

The overexpression of common oncogenes such as c-*MYC* is associated with cancer growth, so switching off their expression could be an effective anticancer strategy. To this end, researchers from the University of Arizona, working with biotech company Cyternex (San Diego, CA), have identified a drug that can reduce c-*MYC* expression by stabilizing a specific conformation of one of its promoter regions (*Proc. Natl. Acad. Sci. USA* **99**, 11593–11598, 2002). Laurence Hurley and colleagues first examined the three-dimensional conformation of one of the most influential regions of the c-*MYC* promoter—NHE III_1—using mutation analysis. This region of DNA can contort into two quadruplex conformations, only one of which (the so-called "chair" form) influences c-*MYC* expression. Mutating one base in the NHE III_1 region destabilizes this key chair conformation, resulting in a threefold increase in c-*MYC* expression—a prelude to cell proliferation and the generation of cancers. However, adding a porphyrin-based drug, TMPyP4, to the chair conformation stabilizes it and reduces c-*MYC* expression. Hurley says that the team has "already identified another 16 cancer-related genes that we believe are also controlled by a quadruplex," which could be regulated by other porphyrin derivatives. *LF*

Punching holes in anthrax

Natural born killers of anthrax—bacteriophage—have provided a valuable way to detect and treat the deadly bacillus. Raymond Schuch and colleagues at The Rockefeller University (New York) have identified a bacteriophage enzyme, PlyG lysin, that kills *Bacillus anthracis* both *in vitro* and *in vivo* (*Nature* **418**, 884–889, 2002). Here they show that PlyG lysin, derived from the γ-phage for *B. anthracis*, can eliminate anthrax by punching holes in the bacterium's outer wall. The researchers infected 15 mice with a non-virulent strain of anthrax and injected PlyG 15 minutes later. Nearly 80% of the infected animals survived. The group also used PlyG to detect and eliminate anthrax spores: anthrax spores can remain dormant, so the team induced germination using the amino acid L-alanine, and then treated the bacteria with PlyG. As the bacteria burst, they release ATP, which causes light emission in the presence of luciferase and luciferin that can be detected using a hand-held luminometer. The scientists tested for resistance to PlyG lysin, but found none. The authors believe that resistance to lysin might develop only slowly, as it strikes at a fundamental component of the bacillus—the cell wall. *CM*

Jello bacteria

Biosensors and bioreactors rely on the encapsulation of enzymes within inorganic matrices such as silica gels. Sources of such enzymes include living bacteria and yeast spores, but to date there has been little exploration of how well such cells survive in these matrices. Now, French researchers have examined the viability of *Escherichia coli* within silica gels (*Nat. Materials* **1**, 42–43, 2002). To optimize the viability of the bacteria, which can be destroyed by the by-products of the silica gel's manufacture, they were first suspended in a 10% glycerol solution. Approximately 40% of bacteria suspended within glycerol–silica gels for four weeks could be cultured, compared with just 10% of those stored in either glycerol solution or standard silica gels for the same period. Although the metabolic activity of the silica-suspended bacteria dropped over time, around half could still metabolize glucose after four weeks. Curiously, the bacteria suspended in the gel did not form colonies but remained isolated, which the authors suggest could be of value for the study of chemical signaling between bacteria, so-called "quorum sensing." Further studies are needed to assess the viability of other animal cells when encapsulated in silica—for example, for the production of bioengineered organs. *LF*