Tomatoes silence crown gall disease

The soil bacterium *Agrobacterium tumefaciens* infects perennials such as fruit and nut trees, generating crown galls that can compromise the yield of the crops. Now, Matthew Escobar, Abhaya Dandekar, and colleagues at the Department of Pomology, University of California Davis, have used RNA interference (RNAi) to generate thale cress and tomato plants resistant to the infection (*Proc. Natl. Acad. Sci. USA* **98**, 13437–13442, 2001). *A. tumefaciens* infects plants through wounds, hijacking the host's cellular machinery and forcing it to overproduce hormones that stimulate uncontrolled cell proliferation. The research team designed an *A. tumefaciens* vector that generates self-complementary RNA transcripts to two gall-forming bacterial oncogenes—*iaaM* and *ipt*. The transformed plants produce transcripts that block the expression of the oncogenes, thereby preventing hormone overproduction and gall formation. RNAi-mediated resistance could be more durable than resistance mediated by traditional methods of plant resistance, which are more vulnerable to the impact of pathogen protein mutations. Currently the UC Davis group says that it is applying the RNAi technology to protect English walnut rootstocks, which are regularly afflicted with *A. tumefaciens*. *JJ*

Tailor-made immunity

Nir Hacohen and colleagues at the Whitehead Institute for Biomedical Research (Cambridge, MA) have found a novel application of microarrays—to better understand how the immune system creates tailor-made responses to invading pathogens (*Science* **294**, 870–875, 2001). The researchers exposed human dendritic cells to the bacterium *Escherichia coli*, the fungus *Candida albicans*, and the influenza virus, measuring the pattern of the gene expression using microarrays. Each of the three pathogens regulated a common set of 166 genes, the temporal expression of which correlated with the activation of the immune system—from antigen recognition to the induction of T cells. However, each pathogen also triggered an additional set of genes that were unique to each pathogen, suggesting that dendritic cells differentiated between invading agents early in infection. Hacohen says that the information could ultimately be used to turn on pathogen-specific immune responses in patients, or as a diagnostic: "We're still a long way from knowing if this is a robust approach to diagnosing infections, but in principle, it is worth pursuing, and it has some parallels with using microarrays to diagnose different tumor types." *LF*

Research News Briefs written by Liz Fletcher, Judy Jamison, and Christopher Martino.

Bug-sensing plasters?

Since 1884, a cumbersome staining technique—the so-called Gram stain—has been used to distinguish between the two main classes of bacteria, Gram-positive and Gram-negative. Now, researchers at the Center for Future Health in Rochester have developed a simple means of discriminating between the two classes using silicon-based sensors (*J. Am. Chem. Soc.* November 1, 2001, ASAP preprint version). Porous silicon has ideal characteristics for a versatile biosensor: it has pores or cavities that can accommodate a range of bacterial species, and has luminescent properties that alter with the local environment. Previously, silicon-based sensors have been constructed to detect DNA and proteins. Here, Benjamin Miller and colleagues fabricated a silicon wafer coated with a molecule that could bind to lipid A, a lipopolysaccharide abundant in the outer membrane of $Gram^-$, but not $Gram^+$, bacteria. When lysed and applied to the silicon wafer, $Gram^-$ bacteria, such as *Escherichia coli* and *Salmonella*, shifted the photoluminescence spectrum of the silicon, whereas $Gram^+$ bacteria did not. "Arrayed sensors incorporating small organic molecules, antibodies, and oligonucleotides on the same chip" could be used to monitor not only the type of bacterium but also its antibiotic resistance, says Miller. *LF*

Biofilms exposed

When bacteria exist as a biofilm—an organized group of individual bacteria that act as a single entity—they become highly resistant to antibiotics, proving difficult to eradicate. Now, Marvin Whitely and colleagues from the University of Iowa have used microarrays to shed light on the molecular differences between free-floating bacteria and those in biofilms (*Nature* **413**, 860–864, 2001). The researchers studied *Pseudomonas aeruginosa*, a common cause of lung infection in patients with the lung disease cystic fibrosis. To their surprise, changes in the expression of just 73 genes, around 1% of *P. aeruginosa*'s 5,500 genes, occur when the bacteria forms a biofilm. The researchers also studied a mutated strain of *P. aeruginosa*, in which the gene *rpoS,* previously implicated in biofilm development, was repressed. The mutant strain formed biofilms significantly faster and thicker than normal strains of the bacteria, and developed greater antibiotic resistance. Co-author Everett Greenberg says that the group plans to "study a selected subgroup of the 73 genes," hoping to "narrow down the search for genes involved in biofilm maintenance and genes conferring antibiotic resistance." *CM*

Transgenic sperm triumph

To date, most transgenic work has used female cells such as oocytes, fertilized eggs, and blastocysts. At least in theory, stably expressing a transgene within sperm stem cells could generate an abundant and self-sustaining supply of living vectors for the creation of transgenic progeny. However, sperm stem cells are recalcitrant to culture *in vitro*, and will frequently "silence" the transgene. Now, Ralph Brinster and colleagues from the University of Pennsylvania (Philadelphia, PA) have created the first transgenic animals from transplanted, genetically modified sperm stem cells (*Proc. Natl. Acad. Sci. USA* **98**, 13090–13095, 2001). Brinster and his team used a retrovirus to deliver the *lacZ* gene into sperm stem cells, achieving expression rates of 2–20%. He then transplanted these stem cells into infertile mice, where they divided and populated the testes. The mice were then mated, and around 4.5% of their progeny expressed *lacZ*. Though preliminary, transgenic male germ cells might be useful for introducing foreign genes into different species, although to date only mouse and human spermatogonial cells have been cultured *in vitro*. Moreover, retroviruses are often used in gene therapy, and evidence that they can incorporate into male germ lines will be of some concern to drug developers. *LF*