Developments to Watch

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ANOTHER STEP CLOSER TO AN AIDS VACCINE

Scientists once hoped that HIV could be tamed by stimulating the immune system to make antibodies that neutralize the invaders. But while antibodies can protect against measles or polio, none has proved potent enough to fight AIDS. So researchers have been trying to harness another part of the immune system: killer T-cells.

This approach is showing promise. In the Jan. 17 issue of Nature, scientists at Merck and at Duke and Harvard universities report that an experimental vaccine enables monkeys to keep the virus at bay for more than a year—although the vaccine doesn’t prevent infection. It uses a modified cold virus to carry an HIV-like gene into the body’s cells. The cells use the gene’s instructions to make a viral protein, which they display on their surfaces. Then the immune system makes killer cells to attack any cells displaying the protein. But even this may not be sufficient. Another report in Nature suggests that the virus, in some cases, can mutate drastically enough to escape the attacks.

John Carey

A WAY TO GUIDE TINY SATELLITES INTO PORT

Engineers have dreamed of deploying swarms of picosatellites—spacecraft the size of hummingbirds—to maintain, repair, and gather data for larger satellites and space stations. But for that to happen, the tiny birds would need to be able to dock frequently to refuel and offload the data their sensors collect.

Tiny pulsating artificial hairs developed at Stanford University and adapted by Karl Böhringer, an electrical engineer at the University of Washington, may facilitate docking. Designed to behave like the small hairs that line the human windpipe, these so-called microcilia wave back and forth to nudge the picosats in different directions.

The microcilia are made of layers of a temperature-sensitive polymer that has been deposited onto a silicon wafer. Each hair comes equipped with a heating element made of titanium and tungsten that controls its movements. When cool, a cilium curves up and away from the silicon plate. But when heated, it flattens out. By precisely regulating the temperature of each hair, it is possible to generate the waves necessary to move small objects. In low-gravity laboratory tests, Böhringer says, a patch of 1,000 cilia was able to move a 45-gram block across the surface of an air-hockey table. The results were recently published in Smart Materials & Structures.

A NOVEL CONTRACEPTIVE GEL THAT MAY ALSO PROTECT against sexually transmitted diseases and urinary tract infections is under development at Johns Hopkins University and privately held Baltimore-based ReProtect. In the coming months, almost 1,000 women will participate in a clinical trial using this new contraceptive, called BufferGel. Next year, the scientists plan to launch an even larger trial to test BufferGel’s ability to block transmission of HIV and genital herpes.

Conventional spermicides such as nonoxynol-9 are made from detergents that kill sperm by stripping away their outer membranes. Although effective, these soap-based spermicides can irritate the vaginal lining and also wipe out “good” bacteria that thwart bugs responsible for urinary infections. BufferGel works by a different mechanism: The colorless polymer that forms the basis of the spermicide reinforces the mildly acidic conditions of the vagina that are toxic to sperm and other microbes. And because the polymer has been used in other pharmaceutical products for many years without problems, the compound is believed to be very safe.

Innovations

Medical researchers at the University of California at Irvine believe that attention-deficit hyperactivity disorder (ADHD) may result from a genetic mutation that helped humans adapt to their environment thousands of years ago. The scientists studied the genes of 600 people and found a new variation in the dopamine receptor gene that is linked to both ADHD and a behavior trait correlated with greater alertness called “novelty seeking.” The variation appears to have arisen between 10,000 and 40,000 years ago—what is thought to have been the dawn of human societies.

A technique that dramatically reduces the amount of liquid emitted by inkjet printer nozzles has been developed by chemists at Purdue University. It could lead to printers that produce higher-resolution images while using less ink. Scientists have spent years trying to reduce droplet size by building smaller and smaller nozzles. The Purdue researchers decided instead to alter the electrical signals that control how the nozzles produce the droplets. The result: droplets 7/8 to 9/8 the size of those from commercially available nozzles.

Brookhaven National Laboratory scientists may have found a way to curb the pollution from burning coal. Mow Lin and Eugene Premuzic harvested naturally occurring bacteria called Leptospirillum ferrooxidans from piles of coal refuse and grew them under harsh conditions. The bacteria that survived were able to gobble up the sulfur, heavy metals, and other toxic impurities that give coal its dirty reputation. Power plants typically wash coal to remove contaminants before burning it. Lin believes that Leptospirillum could be added to the washing mix to improve the cleaning process.