Son of Hubble. One preliminary design for the Next Generation Space Telescope, now scheduled for launch in 2009, calls for a honeycombed 8-meter mirror behind a thin shield that blocks the sun.

and mimic NGST's technology on a one-third scale. NASA added Nexus to its lineup this spring after setbacks with prototypes of the telescope's systems convinced mission planners that it was too daring to build NGST without testing its folding mirrors, solar heat shield, and other unproven technology in space. "We're not quite ready to pursue the aggressive schedule we had before," says project scientist John Mather of NASA's Goddard Space Flight Center in Greenbelt, Maryland. The costs for Nexus, Mather says, are part of the technology development budget for NGST and will not increase the telescope's $1.3 billion price tag.

Nexus will employ three small mirrors that unfold to a diameter of 2.8 meters—wider than Hubble's glass eye, but with less collecting area because the segments won't fill an entire circle. Although Nexus will be a powerful telescope in its own right, it will carry just one simple camera to verify that it can view the heavens sharply. "The goal is not science," says mission leader Richard Burg of NASA Goddard. "Nexus is an engineering pathfinder for NGST to reduce and eliminate risk."

The mirrors in particular will stretch the ingenuity of opticians. They must be exceedingly lightweight and adjustable so that the segments align precisely after they unfold, and their mechanical systems must operate at a frigid 50°C above absolute zero. Several groups at universities and optical laboratories are working on 10 possible designs. Mirrors based on beryllium, silicon carbide, and thin layers of glass each have shown promise, says optical physicist H. Philip Stahl of NASA's Marshall Space Flight Center in Huntsville, Alabama. Still, the teams have faced cracking, warping, and other hazards of pushing materials to their limits. "Progress has been slower than we hoped," Mather acknowledges.

Meanwhile, a previously scheduled test of NGST's protective shade will occur as planned in October 2001. Space shuttle astronauts will unfurl a one-third scale model of the thin shield called ISIS, for "inflatable sunshade in space." The test will reveal the stability and thermal properties of the shade, which must cool the telescope but not jiggle it. Indeed, NGST will have to point at its distant targets with an accuracy of less than a millionth of an angular degree, making a motionless shield essential.

Researchers who hope to use NGST think Nexus and the resulting delay are wise. "It's a very good decision," says astronomer Pierre Bely of the Space Telescope Science Institute in Baltimore, Maryland. "Nexus is insurance to make sure we understand the problems in going from Hubble to NGST." Outside observers are also watching with keen interest. "They've got real technical challenges," says Paul Vanden Bout, director of the National Radio Astronomy Observatory in Charlottesville, Virginia. "If they pull all that off, it's a huge step."

–ROBERT IRION

IMMUNOLOGY

A New Way to Keep Immune Cells in Check

To avoid being killed by friendly fire from the body's immune system, normal cells carry a white flag of sorts—proteins on their surfaces that mark them as "self." Until now, researchers have identified only one type of white flag: so-called class I major histocompatibility complex (MHC) proteins—also known as transplantation antigens—that are present in abundance on the surface of most healthy cells. But new findings have broken the MHC proteins' exclusive hold on the self marker business.

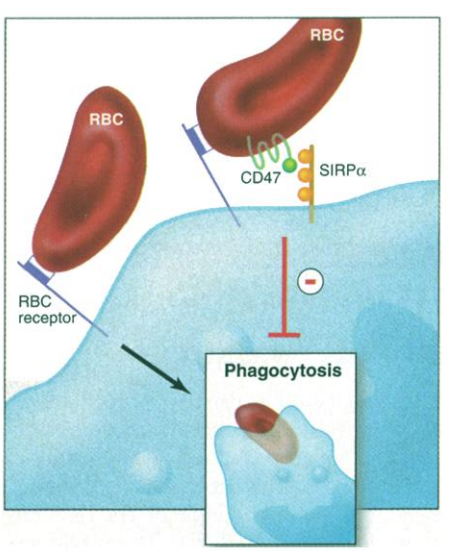
The MHC proteins deliver a peaceful "everything is fine" signal to natural killer (NK) cells, a caste of immune warriors that primarily destroys cells that have turned cancerous or have been infected by a virus and, as a result, carry abnormally low amounts of MHC molecules. Now, on page 2051, a team led by Frederik Lindberg at Washington University School of Medicine in St. Louis, Missouri, reports that macrophages, the immune system's scavenger cells, recognize a different inhibitory signal—a protein called CD47.

Lewis Lanier of the University of California, San Francisco (UCSF), says that the new findings demonstrate that "negative regulation permeates the immune system much more broadly than just NK cells." Indeed, adds Marco Colonna of the Basel Institute of Immunology in Switzerland, CD47 may only be the tip of the iceberg. "Chances are," he predicts, "that a lot more self markers will pop up in the future."

The new findings also shed light on the role of CD47, a surface protein present on basically every cell type—and long a molecule in search of a function. Lindberg and colleague Eric Brown, now at UCSF, cloned the CD47 gene in the early 1990s and then inactivated or "knocked out" the gene in mice in an effort to pin down its function. But to Lindberg's disappointment, the resulting animals were almost normal. They "didn't really give us any hint as to [the gene's] function," he recalls.

But a discovery last year did. Scientists found that CD47 binds to SIRPα, a protein present in high concentrations on many white blood cells. SIRPα's structure suggests that it might be an inhibitory receptor similar to the ones on NK cells that bind MHC proteins, so Lindberg and his colleagues decided to find out if CD47 binding to SIRPα might also lead to immune cell inhibition.

To test this, the researchers used red blood cells (RBCs) on which CD47, but not class I MHC proteins, normally abound. When they transfused fluorescently labeled normal RBCs into either their CD47 knockouts or normal mice of the same strain, the cells persisted. But CD47-lacking RBCs from the knockouts were rapidly destroyed in normal mice. "After 1 day there was nothing left," says Lindberg. That indicated that



Self identifier. By binding to SIRPα, CD47 on red blood cells (RBCs) can prevent phagocytosis by macrophages.

CREDITS: (TOP TO BOTTOM) TRW/BALL AEROSPACE; K.SUTLIFF

CD47 prevents the RBC destruction.

Other experiments pointed to macrophages as the purveyors of the destruction. For example, the CD47-deficient RBCs were quickly destroyed when they were transfused into mice that lacked functional B and T cells, indicating that those cells were not involved. In contrast, removing the spleen, the organ where old and faulty RBCs are usually disposed of by macrophages, prevented RBCs from being eliminated. Evidence confirming that macrophages use SIRPα to recognize CD47 came when the researchers added an antibody against SIRPα to a mixture of macrophages and RBCs. Now, the "blindfolded" immune cells eliminated even normal CD47-bearing RBCs.

Taken together, Lindberg says, these results suggest that "CD47 is a safeguard against macrophages going off too easily. If CD47 is present [on a target cell], the macrophage leaves it alone, but if it's absent the macrophage goes: 'Let's get cracking!'"

To Colonna, CD47's new job makes perfect sense. "RBCs don't express MHC molecules, so they need something else to mark them as self," he says. Lindberg adds that his findings might also explain the anemia seen in individuals who fail to express Rh blood markers on their RBCs. These patients also have a drastically reduced CD47 density on their RBC surfaces, and this may make them more prone to elimination by macrophages, speculates Lindberg.

Still to be determined, however, is whether changes in CD47 concentrations on cells play a role in other pathological conditions. There are hints that they might. For example, ovarian cancer cells express CD47 at a much higher than normal level. "This may signal 'I'm self, don't kill me,'" Lindberg says.

Another open question centers on the role of SIRPα in other tissues. Unlike other inhibitory immune receptors, SIRPα is found on brain cells, for instance. "I'm very intrigued by that," says UCSF's Lanier. "There may be an even broader context in which we need to think about these inhibitory receptors. I guess now the neuroscience people need to get busy." **–MICHAEL HAGMANN**

ALTERNATIVE MEDICINE

Herbal Product Linked to Cancer

A Chinese herb that damaged the kidneys of dozens of Belgian dieters in the 1990s appears to pack a vicious second punch—cancer and precancerous lesions, according to a report in the 8 June issue of *The New England Journal of Medicine*. These findings draw one of the strongest links yet between use of a herbal product and cancer and, critics argue, serve as a grim warning that dietary supplements need more regulation.

The unfortunate subjects of this study are a subset of some 10,000 Belgian dieters, who between 1990 and 1992 took a mixture of Chinese herbs and Western drugs prescribed by weight-loss clinics. After dozens of dieters developed symptoms of kidney failure, investigators discovered that Belgian pharmacists had been using mislabeled Chinese herbs to concoct the diet pills. Instead of *Stephania tetrandra*, pharmacists had packed the pills with derivatives of the herb *Aristolochia fangchi*, known to damage kidneys and to cause cancer in animals. At least 70 people experienced complete kidney failure, and some 50 more suffered kidney damage severe enough to require treatment.

The first urinary tract cancers were found among these patients in 1994. To deter onset of the disease in others, doctors at Erasme Hospital in Brussels counseled patients whose kidneys and ureters had stopped functioning to consider surgical removal of the organs. Thirty-nine people opted for the operation over the past several years. When a team of researchers—coordinated by kidney specialist Joélle Nortier—inspected the excised tissues, they were startled to discover that cancer had already developed in 18 patients, and precancerous lesions (dysplasia) were present in 19 others. Prescription records confirmed that patients who had taken the highest cumulative doses of *Aristolochia* were most likely to have cancer. As further evidence that *Aristolochia* was to blame, the team found in all 39 patients evidence that *Aristolochia* had bound to DNA, a process that could trigger mutations.

Beautiful but deadly. Plants in the *Aristolochia* genus, used in Chinese herbal preparations, can cause kidney damage and perhaps cancer.

Belgium banned the import of *Aristolochia* in 1992. But there's little to prevent a similar herbal disaster in the United States, asserts David Kessler, dean of Yale University School of Medicine and former commissioner of the Food and Drug Administration (FDA)—especially because he was just able to purchase *Aristolochia* in capsule form, he writes in an accompanying editorial. Unlike food additives and drugs, which are subjected to strict premarket tests for safety and effectiveness, products labeled "dietary supplement" may enter the market untested, thanks to the 1994 Dietary Supplement Act. In effect, FDA cannot restrict the use of supplements unless substantial harm has been proven, Kessler says. "You shouldn't have to wait for harm to occur before you do a systematic safety review," Kessler told *Science*. "It's time to have a premarket safety system."

Others argue that FDA's hands are not tied as tightly as Kessler implies. Varro Tyler, a retired dean of the School of Pharmacy at Purdue University in West Lafayette, Indiana, considers company-sponsored premarket testing impractical—the manufacturers simply can't afford it. Instead, he backs a recommendation by a 1997 presidential commission that called for FDA to convene an expert committee to review the wealth of information that already exists on botanicals and then inform consumers and manufacturers about unsafe preparations. "No company in its right mind" would market preparations deemed unsafe, he says. "That would be signing their own death warrant in terms of legal actions."

Last month, the FDA distributed warnings to health professionals and the supplements industry about the dangers of *Aristolochia*. In a few weeks, the agency plans to block the herb's entry into the United States. The action is long overdue, says Norman Farnsworth, director of the Center for Dietary Supplements Research on Botanicals at the University of Illinois, Chicago. The dangers of *Aristolochia* are so well known, he says, that Germany banned it in 1981 and the World Health Organization issued a warning on the herb in 1982. If the FDA "had been doing its job," he says, "they would have banned this stuff 10 to 15 years ago."

–LIESE GREENSFELDER

Liese Greensfelder is a writer in Nevada County, California.

ASTROPHYSICS

Galaxies, Black Holes Shared Their Youths

ROCHESTER, NEW YORK—The origin of massive black holes and the galaxies that surround them is a chicken-and-egg conundrum. In one model of galaxy formation, whopping black holes arose early in the history of the universe. Then, gas spiraling into

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