A World Without Pain

You glide across an icy canyon where you meet smiling snowmen, waddling penguins, and a glistening river that winds forever. You toss snowballs, hear them smash against igloos, then watch them explode in vibrant colors.

Back in the real world a dentist digs around your mouth to remove an impacted tooth, a procedure that really, really hurts. Could experiencing a pretend world distract you from the pain? NIGMS grantee **David Patterson** shows it can.

Patterson, a psychologist at the University of Washington in Seattle, helped create the virtual reality program "Snow World" in an effort to reduce excessive pain in burn patients. To find out if life in Snow World really is painless, Patterson and his coworkers strapped healthy undergraduate student volunteers into immersive virtual reality headgear that completely shut out physical reality by offering wintry sights and sounds. The researchers fitted a second group of students with gear that only partially blocked out the real world.


HUNTER HOFFMAN, UNIVERSITY OF WASHINGTON

Patterson and his team exposed all the students to brief periods of heat both before and during their virtual reality experiences, and then measured their perception of pain. Students fully immersed in a virtual reality experience reported 60 percent less pain, whereas the partial virtual reality gear offered only limited relief.

The researchers say that an interactive digital experience may distract us from the real world because our minds can focus on just a few things at once.

While virtual environments can have drawbacks—like motion sickness, for one—they offer a promising new way to manage pain during medical or dental procedures. And, as recent research shows, reducing pain can speed recovery. Now that's a relief!—*Emily Carlson*

Making Sense of It ALL

About 2,400 U.S. children, most of them toddlers, are diagnosed each year with acute lymphoblastic leukemia (abbreviated ALL). This disease, the most common childhood cancer, starts in bone marrow cells and can spread to other parts of the body.

Fortunately, doctors can cure about 80 percent of patients with ALL using chemotherapy medicines. Some of the remaining 20 percent don't completely respond to treatment because cancer cells become resistant to the chemotherapy's effects. In such patients, the cancer can come back a few years later.

To get a handle on why some patients are cured and others aren't, NIGMS grantee **Mary Relling** of St. Jude Children's Research Hospital in Memphis, Tennessee, looked at the cancer cells' DNA. Relling, a research clinical pharmacist, found 124 genes associated with resistance to chemotherapy drugs. To her surprise, the genes that turned up are known to carry out processes that seem unrelated to cancer, such as building or breaking down proteins and sugars.

Relling and her coworkers also identified genes that reveal which patients might not be able to tolerate the chemotherapy drugs used to treat patients with ALL. For these young patients, the side effects of the medicine can be as deadly as the cancer itself.

The findings of this study could help doctors customize and improve treatments for leukemia, taking into account the genes of each patient. The information may also help drug developers, who could use certain genes as guides for designing completely new anticancer therapies. —*Alisa Zapp Machalek*

Ginseng's Many Moods

Traditional Chinese medicine holds that different varieties of the herbal product ginseng have opposite effects on mood. New research shows that ginseng can also have variable effects on other body processes.

NIGMS grantee **Ram Sasisekharan** of the Massachusetts Institute of Technology in Cambridge identified several active ingredients from different kinds of ginseng and figured out how they impact the growth of blood vessels.

Past studies of ginseng's effects on blood vessels have provided puzzling results. Some scientists have reported that ginseng may help combat cancer by stunting the growth of blood vessels that feed tumors. Others have shown that ginseng can help heal wounds by stimulating blood vessel growth.


THOMAS G. BARNES, USDA-NRCS PLANTS DATABASE

So who's right?

Sasisekharan's findings show that both are correct. Using a combination of lab techniques, the biological engineer and his coworkers studied the chemical properties of four different varieties of ginseng. They discovered that the molecule Rb1, found predominantly in American ginseng, starves blood vessel growth. Conversely, they found that a different molecule, Rg1—which is abundant in Asian ginseng—does just the opposite, nourishing blood vessels and helping them grow.

Molecular studies such as these may eventually lead to a better understanding of the many different biological effects of ginseng and other herbs, which are now widely used across the globe.

Sasisekharan offers a note of caution to those taking ginseng, or any herbal product for that matter. Herbal supplements are not subject to review and approval by the U.S. Food and Drug Administration, so specific contents of grocery-shelf bottles can vary dramatically. —*Kirstie Saltsman*

Genes Help Treat Trauma

Each year, millions of trauma victims end up in emergency rooms, where doctors must decide immediately how to treat them. Yet the choices aren't easy, since the extent of internal damage and a patient's general health before his or her injury are often not known.

Due in part to this lack of information, predicting an individual patient's outcome can be agonizingly difficult. Among people with nearly identical injuries, some respond to treatment and steadily improve, while others struggle for days and die.

Now, thanks to a national team science effort involving clinicians and basic researchers, doctors are one step closer to knowing exactly what to do for each patient.

Trauma surgeon **J. Perren Cobb** of the Washington University School of Medicine in St. Louis, Missouri, led a team that scanned genetic material from trauma patients and healthy volunteers, looking for differences in gene activity that might be associated with the most deadly effects of severe trauma. Knowing these genetic signatures in advance may enable doctors to act early to prevent life-threatening complications such as multiple organ failure or body-wide inflammation.

Compared to healthy people, the trauma patients' white blood cells showed dramatic differences in the activity of certain genes. The team is now working to harness this information into quick genetic tests that would help identify the most vulnerable trauma patients.

The researchers plan to further develop their approach into a nationwide program that uses genetic information to treat trauma. If things go as planned, emergency-room physicians will someday be making split-second, life-and-death decisions with a powerful new set of predictive tools. —*K.S.*

Stressed Out DNA

"In the last month, how often have you felt nervous and stressed?"

That was one of the questions posed to 58 women in a study to determine how psychological stress affects cells. Chronic stress has long been known to influence immune function and raise heart disease risk, but scientists aren't exactly sure how.

Now, NIGMS grantee **Elizabeth Blackburn** of the University of California, San Francisco, has found that psychological stress causes damage by boosting levels of harmful chemicals inside cells. She also found that stress quickens the loss of telomeres, the protective caps on chromosome tips that are fastened on by the enzyme telomerase. Telomere length approximates a cell's biological age; each time a cell divides, its telomeres shrink.

Blackburn, a molecular biologist, teamed up with clinical researchers to test two groups of women: 39 mothers of chronically ill children (caregivers) and 19 mothers of healthy children (controls). The scientists expected that the caregivers would be more stressed out than the controls. They discovered that telomere length wasn't much different between the two groups. However, the researchers found that the length of time spent caring for a sick child did make a difference. Within the caregivers group, cells of the women spending more time had less telomerase, and thus shorter telomeres.

The team then used a set of standard questions to rate the women's perceived stress levels. Those reporting the most stress (including some of the women with healthy children) had markedly less telomerase, and shorter telomeres, than their more relaxed counterparts. Compared to the low-stress group, the high-stress group's cells appeared to have aged an extra 9 to 17 years! The findings provide the first cellular evidence that chronic stress really can take years off your life. —*K.S.*

These stories describe NIGMS-funded medical research projects. Although only the lead researchers are named, science is a team sport and it is important to realize that many researchers work together to carry out these studies.