Biomedicine

Hanging upside down may be harmful

Gravity inversion boots are made for hanging—upside down, that is — but our bodies may not be. According to Ronald M. Klatz, Robert M. Goldman and colleagues at the Chicago College of Osteopathic Medicine, hanging upside down in gravity inversion boots raises blood pressure, pulse rate, pressure in the eye globe and pressure in retinal arteries. As a result, the group reports, inverting may be especially dangerous for the elderly and for people with hypertension or glaucoma.

An estimated one million Americans now use gravity boots, developed to relieve stress on joints caused by standing and sitting. The boots consist of metal and foam rubber clamps that encircle the ankle. Front hooks attach to an elevated horizontal bar, allowing wearers to hang upside down. A form of traction, hanging upside down uses gravity and body weight to decompress spinal disks and stretch back muscles.

But, according to Klatz and Goldman, that's not all it does. In an effort to document the previously unstudied physiology of hanging upside down in gravity boots, they inverted 20 healthy people for three minutes each. As reported in the July JOURNAL OF THE AMERICAN OSTEOPATHIC ASSOCIATION, the invertees' blood pressures rose from an average of 119/74 to 157/93. Pulse and arterial pressures also rose, and most intraocular pressures went into the range associated with glaucoma. All measurements but pulse returned to normal shortly after subjects turned upright.

The only other published account of effects of using gravity inversion boots appeared in the Nov. 25, 1982, NEW ENGLAND JOURNAL OF MEDICINE, when a doctor reported that two patients woke with black eyes following inversion. Because the boots are becoming so popular and because many people who use them hang daily for extended periods of time, Klatz stresses the need for more research. "Some people do get significant relief from gravity traction," he says, "but there may be safer and easier ways to get it, especially for people who aren't young and healthy, as those in our study were." He's now testing the effects of inversion on people with hypertension and glaucoma, and warns that individuals predisposed to stroke, using aspirin therapy, with hernias or spinal instability are also at risk.

Diseases passed from pets to people?

• Dogs and hamsters have joined ferrets on the list of animals that carry *Campylobacter jejuni,* an organism linked with diarrhea in humans. While the organism induces diarrhea in some pets, others shed it in their feces without being affected. The bug can spread to humans by contact with a pet's feces.

James G. Fox and colleagues, at Massachusetts Institute of Technology in Cambridge, recently isolated the organism from dogs and hamsters. Fox warns animal handlers to be especially careful in cleaning up pet feces and to be on the lookout for Camplyobacteriosis in themselves and in their children. Children probably face a greater risk as they tend to dehydrate faster than adults when afflicted with diarrhea.

• New findings also link Lou Gehrig's Disease — amyotrophic lateral sclerosis (ALS)—to household pets. Prompted by studies associating pet exposure to multiple sclerosis (MS), Noah Schenkman and colleagues at Mount Sinai Medical Center in New York interviewed 40 ALS patients and 40 controls regarding their exposure to pets, animal carcasses and hides, and farm animals. They found that more ALS victims had been exposed to household pets, particularly small dogs, than had controls.

"The association with [MS] has led others to suggest that pets may be a vector for transmission of that disease, and one could make the same speculation about [ALS]," the group writes in the July 28 NEW ENGLAND JOURNAL OF MEDICINE. The causes of these diseases, both neurologic disorders that result in paralysis, are unknown.

Technology

Future facts from crystal cubes

Flipping through the pages of an encyclopedia may someday involve glancing at laser-illuminated images recovered from a sparkling, finger-sized crystal. At the Oak Ridge National Laboratory in Tennessee, physicist Lynn A. Boatner is studying the use of man-made potassium tantalate niobate crystals for data storage. These cubic crystals "have the theoretical potential for storing tremendous amounts of data in a system not much larger than a typical home computer," says Boatner.

Potassium tantalate niobate is an example of a "photoreactive" crystal. Laser light of a proper wavelength alters the material's index of refraction at illuminated points within the crystal. Because the spots of altered refractive index shift a light beam's path slightly, a laser beam of another color can read information, encoded by the original laser light, without changing it.

Boatner sees the crystal as a holographic storage device in which images are preserved as interference patterns. Thousands of such images could be packed into a single crystal by rotating the crystal slightly between each illumination. Boatner expects that even for very small angles of rotation, essentially no cross talk among the separate interference patterns would occur.

"The problem is making large, high-optical-quality, homogeneous crystals and controlling, in a predetermined fashion, their properties, microsensitivity and storage density," says Boatner. The crystals are grown from a liquid mixture of tantalum oxide, niobium oxide and potassium carbonate, heated to more than 1400°C and then slowly cooled at a rate of 1°C per hour. The ratio of tantalum to niobium can be changed or other substances added to alter the crystal's properties. "This lets you tailor the material to a given application," says Boatner. Current studies are devoted to finding the optimum combination of ingredients for holographic storage crystals and to overcoming the gradual disappearance of the stored holographic images.

The dark side of satellite solar cells

One way of protecting a satellite's solar-cell power supply from the effects of radiation, whether natural or from a nuclear blast in space, is to hide the cells. A research team at the Naval Research Laboratory (NRL) in Washington, D.C., is exploring the possibility of using a thermophotovoltaic power source to do just that.

In the proposed power source, a large solar concentrator focuses sunlight on a cavity lined with highly reflecting walls. At the cavity's bottom sits a heat-absorbing storage vessel, which contains a material that melts at more than 1400°C and has a high heat of fusion. Inserted into this vessel, without touching it, would be a cylinder covered with solar cells that convert radiant heat energy into electricity. Even when the concentrator is blocked from the sun, the material in the storage vessel would still release heat for several hours as it cools and solidifies. Because solar cells run best near room temperature, the solar concentrator performs a second function as a waste heat radiator.

James G. Severns, head of the NRL effort, says, "This is all part of a rather broad effort to enhance the survivability of spacecraft and space systems in general." He adds, "We have solar cells that work, and they fly in satellites all the time, but the solar cells ... hang out in the 'wind,' in the radiation environment of space." This causes deterioration problems even in "benign" orbits away from the earth's radiation belts.

Severns says the project is at a very early development stage. This year, the research team is readying sample "thermal bottles" for furnace testing. Because germanium appears to be the best material for the required photovoltaic cells, the researchers are also trying to bring neglected germanium fabrication technology up to date. Toward the end of the 1980s, Severns says, the NRL team may be ready to "start looking for a ride" for their power supply.