

on the body by biologically damaging free radicals (SN: 11/21/92, p.346).

Arginine — an amino acid building block of many proteins — is a precursor of nitric oxide (NO), a free radical, explains cell biologist Erkki Ruoslahti of the La Jolla (Calif.) Cancer Research Foundation. So if dietary protein fosters kidney cancer via the production of free radicals, Ruoslahti says, "It's possible that arginine — as a source of NO — might be the constituent of protein causing this effect."

However, there are other pathways by which protein may affect kidney cancer risk, notes nephrologist Wayne A. Border of the University of Utah School of Medicine in Salt Lake City. For instance, transforming growth factor beta (TGF-beta), an immune system messenger produced by the body, can be a tumor promoter. And experiments that Border's lab conducted together with Ruoslahti indicate that in rats, diets low in protein suppress the kidney's production of TGF-beta.

Moreover, Ruoslahti notes, kidney disease is almost invariably associated with increased TGF-beta production. As such, he says, protein's TGF-beta connection may also explain why a history of certain kidney diseases increases an individual's risk of developing kidney cancer.

— J. Raloff

## Extreme fatigue hard on repaired hearts

In the days or weeks before a heart attack or sudden death from heart disease, many people feel drained and devoid of their usual energy. A new study suggests that psychological factors help to produce this kind of exhaustion in some individuals after surgical repair of narrowed heart arteries; the fatigue then markedly boosts their chances of suffering further serious cardiac problems.

Fatigue, heightened irritability, and a sense of demoralization make up what Willem J. Kop, a psychologist at the Uniformed Services University of the Health Sciences in Bethesda, Md., and his colleagues call "vital exhaustion."

"It may be that psychological stress reduction, resulting in a reduction of feelings of vital exhaustion, will reduce the risk of new cardiac events in patients [after the artery procedure]," the scientists conclude in the July/August *PSYCHOSOMATIC MEDICINE*.

Kop's team recruited 127 adults, none more than 70 years old, who had undergone angioplasty to widen at least one significantly constricted cardiac artery. About 2 weeks after successful treatment, each participant completed a questionnaire designed to tap into the three components of vital exhaustion.

A previous study employing this questionnaire, which followed healthy men

## Enigmatic bursts show their true colors

High above the tops of thunderstorms, flashes of light dance like sprites in Earth's atmosphere. For the first time, researchers have captured the true colors of these scintillations — red bursts resembling jellyfish and blue ones shaped like flaring trumpets.

Though the bursts reveal an electrical link between the ionosphere and the atmosphere's lower depths, their origin remains a mystery. Adding to the puzzle, other scientists have noted a possible correlation between thunderstorms and flashes of gamma rays and radio waves.

Scientists confirmed the visible-light flashes last year. Flying over the Midwest, they videotaped in black and white several bursts above storm clouds.

This June 28 through July 12, Davis Sentman and Eugene Wescott of the University of Alaska at Fairbanks took to the skies again, this time with a color video camera. Coordinating with ground-based teams, the pair made observations from two aircraft, allowing them to accurately measure the flashes' speed, position, and altitude.

Sentman and Wescott found that the flashes fall into two categories. "Sprites" appear higher in the atmosphere, some 75 to 85 km above ground, and last for a few thousandths of a second. Though they don't connect to the storm clouds, some of these blood-red flashes have dangling blue tendrils.

In contrast, says Wescott, "jets" last longer, originate at the tops of storm clouds, and shoot up to an altitude less than half that of sprites. Jets are narrower than sprites, fanning out like a trumpet in a blue or purple hue.

Wescott speculates that the electric field generated by lightning travels up



True-color image of a flash of light, dubbed a sprite, high above a Midwestern thunderstorm. White-blue area beneath the red sprite is normal lightning.

through the atmosphere and then discharges, creating the sprites. But the jets, although also associated with thunderstorms, appear to be "a completely new phenomenon," he adds.

Daniel N. Holden of the Los Alamos (N.M.) National Laboratory and his colleagues have now linked some 300 unusual radio bursts detected by the ALEXIS satellite to possible thunderstorm activity (SN: 2/12/94, p.100).

Holden says it's tempting to associate these bursts with those seen in visible light, as well as the atmospheric gamma-ray flashes recorded by the Compton Gamma Ray Observatory. But he cautions that the much shorter duration of the radio bursts suggests that they may come from a far smaller source in the atmosphere. — R. Cowen

for more than 4 years, found that the rate of initial heart attacks doubled for those who had cited vital exhaustion.

The current project, which monitored volunteers for 1½ years after their discharge from the hospital, reveals a similar pattern. About one-third of the 43 patients who noted vital exhaustion after treatment suffered severe chest pains, heart attacks, or sudden death due to cardiac complications; only 17 percent of the remaining 84 experienced these reactions.

This disparity remained after controlling for the initial severity of each volunteer's heart disease, as indicated by the number of narrowed arteries.

Vital exhaustion may overlap with severe depression, the researchers say. Other evidence suggests that depression markedly elevates the death rate of heart attack survivors (SN: 10/23/93, p.263).

However, depression includes intense sadness, low self-esteem, and guilt feelings that usually do not show up in cases of vital exhaustion, they argue.

Vital exhaustion may render patients more prone to plaque formation or blood clotting in heart arteries, thus leading to narrowing or blockage of the vessels, Kop and his coworkers theorize.

In an accompanying editorial, Stewart Wolf, a psychiatrist at Totts Gap Laboratories in Bangor, Pa., compares vital exhaustion to a feeling of "carrying a heavy load and never quite getting to the resting place." He has found that this fatigue raises the likelihood of further complications in heart attack survivors. Brain areas that send impulses to the heart and blood vessels may trigger fatal reactions after particularly stressful experiences, Wolf maintains.

— B. Bower