Biomedicine

Kathy A. Fackelmann reports from Dallas at the 63rd Scientific Sessions of the American Heart Association

Vitamin E may safeguard bypass hearts

A purified form of vitamin E appears to protect the heart from toxic "free radicals" that can damage cardiac tissue during coronary artery bypass surgery.

Vitamin E, abundant in such foods as wheat germ, leafy green vegetables, sunflower seeds, almonds and peanuts, functions in the body as an antioxidant, preventing formation of dangerous substances called free radicals. During the final phase of bypass surgery – an operation to improve blood flow to the heart – free radicals form as surgeons briefly flood the heart with richly oxygenated blood. Until now, cardiac surgeons have had no way of shielding the heart from these substances.

Terrence Yau of the University of Toronto reports that presurgical supplementation with vitamin E improves the heart's ability to pump during the especially risky five-hour postoperative period. He and his colleagues base their conclusion on a study of 14 people who took 300 milligrams of highly purified vitamin E every day for two weeks prior to their bypass operations, and another 14 bypass patients who received placebo pills. While the results seem promising, Yau stresses the preliminary nature of the small-scale study and calls for further research to solidify vitamin E's role as the heart's bodyguard during bypass surgery.

Television's cholesterol connection

New research suggests a link between television viewing and high blood cholesterol levels among children and young adults.

Kurt V. Gold and Thomas K. Hei of the University of California, Irvine, studied 1,066 males and females aged 2 to 20 and discovered that more than half of those who had cholesterol readings of at least 200 milligrams per deciliter of blood – a level considered high by the American Academy of Pediatrics – said they watched more than two hours of television daily. Previous studies have shown that elevated cholesterol during youth may lead to clogged arteries and heart disease later in life.

Hei stresses that watching television doesn't cause high cholesterol, but it may indicate a sedentary lifestyle. Kids who habitually watch television, he says, tend to eat more food, especially the fatty "junk" foods that elevate blood cholesterol.

He advises pediatricians to ask about children's television viewing habits during routine checkups and to consider ordering cholesterol tests for those with additional cardiac risk factors.

Sleep apnea: A lethal cardiac twist

Adults with a disorder called obstructive sleep apnea may face an increased threat of death from heart disease, report Bernard Burack, Danuta L. Rozycki and their colleagues at the Albert Einstein College of Medicine in New York City.

This sleep disorder typically interrupts breathing at night and can awaken its sufferers as often as five times an hour, leading to extreme daytime sleepiness, Rozycki says. Despite the loud snoring accompanying the apnea, many people don't recognize the condition, which affects about 2 million individuals in the United States.

The New York researchers studied 223 men and women with obstructive sleep apnea, tracking all participants for at least five years and 43 individuals for a decade or longer. During the study, the investigators recorded 35 deaths, 23 of which resulted from heart attack, stroke and other cardiovascular conditions. Statistical analysis revealed that people with obstructive sleep apnea faced double the average risk of dying from cardiovascular disease.

The scientists can't completely explain the heightened risk, but Rozycki speculates that frequent nighttime awakenings may place extra strain on the heart.

Materials Science

Ivan Amato reports from Columbus, Ohio, at an American Chemical Society meeting on materials design

Designing polymers for structural jobs

Materials such as wood and steel, which can withstand sustained loads and stresses, provide sturdy skeletons for bridges, buildings, cars and other structures. But scientists keep their eyes open for new materials, such as polymers, that might be tough enough for structural roles, yet lighter, cheaper or easier to process.

Although reinforced polymers have already made inroads for certain specialty applications, polymers suited for larger-scale structural uses remain uninvented. The delay stems from a design tradeoff: With polymers, improvements in load-bearing strength nearly always bring an increase in brittleness.

New insights into what makes polymers tough – i.e., strong and nonbrittle – could help researchers get around this tradeoff, says materials scientist Albert Yee of the University of Michigan in Ann Arbor. His team recently gained one such insight while examining the molecular structure of polycarbonate, a material serendipitously discovered in the 1950s and long ranked as the toughest polymer, Yee says.

He and his co-workers found that rigid groupings of six to nine of the monomeric units in this polymer link together to form flexible segments in a chain. Mechanical stresses appear to dissipate through spatial shifting of these groupings, Yee says, rather than through cleavage of chemical bonds – the precursor to material failure.

Previous attempts to strengthen polycarbonates by chemically modifying the monomeric units have increased the polymer's brittleness, he says. But by taking advantage of the cooperative behavior of larger monomeric groupings, the Michigan team has designed and synthesized a polycarbonate that remains strong at higher temperatures (over 150°C) without gaining brittleness, Yee reports.

The smaller path to material hardness

Miners, oil drillers and others who cut, drill or saw through rock and other hard substances use tools even harder than the materials they penetrate. Most of those tools are based on Co-WC, a composite of cobalt metal and tungsten carbide ceramic. The Co-WC industry has grown over about 40 years to gross $3 billion to $4 billion per year, notes materials scientist Bernard H. Kear of Rutgers University in Piscataway, N.J.

Kear now reports that he and his colleagues at the recently formed Nanodyne Inc. have developed a radically new method for making Co-WC and other composites. Their technique, he says, should lead to longer-lasting, easier-to-make components that could save many millions of dollars by reducing energy consumption during manufacturing and by boosting efficiency in industries using such tools.

The traditional method for making Co-WC powder involves crushing, mixing, grinding, milling and consolidating tungsten carbide and cobalt powders before sintering the compacted hybrid powder into the final component. "Yet merely by reducing the scale of your microstructure, you can get a systematic improvement in properties [such as hardness and wear resistance]," Kear says.

The standard, mechanical method reaches its particle-shrinking limit at diameters of about 1 micron, whereas Kear's chemical processing method makes particles in the 200-nanometer range or a crucial several times smaller. By mixing carefully chosen pairs of cobalt- and tungsten-bearing chemicals in water, the researchers make a solution containing a prechosen bimetallic ingredient. Pumping the solution through a small nozzle produces a quick-drying aerosol that leaves behind aggregates of "nanophase" tungsten-cobalt particles. The final step occurs within a "fluid bed reactor," in which a stream of carbon-containing gas reacts with the particles as it whips them into a carbide-forming sandstorm.