Biomedicine

Bilirubin: Bad, yet good?

As an end product of the breakdown of red blood cells in mammals, bilirubin can cause problems if it accumulates in tissues in abnormal amounts, and it is particularly destructive when concentrated in the nervous system. Although normally excreted with body wastes, the fat-soluble bilirubin can cause dangerous jaundice, such as that seen in hemolytic disease of newborns. But there may be a good-news side to bilirubin's story, according to a report in the Feb. 27 SCIENCE.

Researchers at the University of California at Berkeley and San Francisco found that very small concentrations of bilirubin "scavenge" harmful oxygen radicals in laboratory tests. Hydrogen peroxide and other oxygen radicals, by-products of the oxygen used during normal cellular metabolism, can damage cell membranes and enzymes through chemical reactions. They have been suggested as causes of a wide range of conditions, from cancer and heart disease to aging.

The study suggests that bilirubin in the body routinely acts as an antioxidant, disarming the oxygen radicals and thereby speeding repair of cell damage. Laboratory experiments show that when the oxygen concentration is equivalent to that found in living cells, the antioxidant activity of bilirubin exceeds that of well-known antioxidants found in mammalian cells.

New mean team: Flu and toxic shock

Clinical cases of a deadly disease duo — which may in fact have felled residents of ancient Athens — have been noted for the first time by the medical community, according to two articles in the Feb. 27 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. The authors report the deaths last year of 10 influenza patients in Minnesota and Virginia that were apparently due to toxic shock syndrome (TSS). More commonly associated with the use of tampons or contraceptive sponges, the potentially fatal condition is characterized by fever, sloughing of skin, shock and other symptoms. It has been attributed to toxins produced by the common bacterium *Staphylococcus aureus* (SN: 6/15/85, p.377). The researchers do not know why the infection occurs in certain flu cases.

The average age of the nine Minnesota patients was 26 years, and several died at home before they could be hospitalized. Because of the rapid course of TSS, physicians are cautioned to be alert for TSS symptoms in influenza patients. Although this phenomenon had not been described previously in the medical literature, an accompanying editorial points out that a 1985 report suggested, based on historical accounts, that the influenza-TSS link may have caused an Athens "plague" in 5th century B.C.

Gift of life not taken by givers

Although it is safer for patients awaiting elective surgery to donate their own blood for use after surgery, very few are taking advantage of this blood-banking procedure, called autologous donation. A national survey of nearly 5,000 surgery patients at 18 university hospitals during January and February 1986 found that only 5 percent of the 590 patients considered eligible for autotransfusion donated their own blood. In addition, a report on the survey, published in the Feb. 26 NEW ENGLAND JOURNAL OF MEDICINE, suggests that perhaps 10 percent of the hospitals' blood supply used during the test period could have been saved by using autotransfusion.

Recognizing that not all hospitals are yet equipped for processing a patient's own blood donated for his or her surgery, authors of the report still stress that the procedure should be encouraged by more physicians. In addition to saving blood for emergency cases, autologous donation can minimize the danger of acquiring diseases like AIDS and hepatitis through transfusion.

Environment

Janet Raloff reports from the 26th annual Society of Toxicology meeting, in Washington, D.C.

Circadian variation in ozone tolerance

Most ozone studies involving rodents are done during the day, when the human experimenters are most alert, notes toxicologist Leendert van Bree. But this is not the most active period for nocturnal animals such as rats. Even if rats are awake during a daytime study period, their bodies may not have adjusted — it may still feel like their rest period.

Because the body's production of various chemicals — including those involved in an animal's antioxidant defense system — can undergo large circadian variation, van Bree and his colleagues at the Dutch National Institute of Public Health's Laboratory of Toxicology in Bilthoven decided to compare health effects of ozone exposures delivered at different times. They now report that, in rats, a 12-hour nocturnal exposure to 0.4 parts per million ozone yields twice the respiratory damage as a 12-hour daytime exposure.

"The toxic process that was taking place is an inflammatory one," van Bree notes. "It damages the blood-air barrier in the lungs," causing, among other problems, an increase of blood-serum infiltration into the small lung airways. "So if you lavage [wash out] the lung and analyze for serum ingredients and inflammatory cells, you can detect evidence of inflammation." Related studies by the Bilthoven researchers indicate that this time-of-day effect is a more important factor in the amount of damage that will occur than the number of consecutive days of exposure. Another unexpected finding: 24-hour exposures were not measurably worse than 12-hour nocturnal ones.

There's a potentially important message here for air-quality regulators, van Bree believes: Extrapolations from rat data based on daytime (sleep period) exposures "may seriously underestimate human effects" from daytime exposures.

Exercise may worsen NO_2 toxicity

Last year the Environmental Protection Agency reported on studies indicating that even healthy people who exercise vigorously at smog-ozone levels previously thought to be safe may suffer adverse respiratory effects (SN: 6/28/86, p.405). Now researchers at Los Alamos (N.M.) National Laboratory report animal data showing that exercise following exposure to nitrogen dioxide (NO_2), another component of photochemical smog, can worsen that pollutant's respiratory toxicity.

After being trained over a 15-day period to run on a treadmill for 8 minutes per day, rats were exposed to a single "sublethal" dose of NO_2 — at a concentration of 25 to 150 parts per million (ppm) for up to 30 minutes. An hour later, one group of animals in each exposure group then made a last treadmill run. The rest were exposed to a 5 percent concentration of carbon dioxide (CO_2), to stimulate the same deep breathing the exercising animals were getting.

Though all six exercising rats that had been exposed to 150 ppm NO_2 were dead within 6 hours of running, none of the nonexercising (CO_2-exposed) controls was. Even those exercising animals that had been exposed to as little as 25 ppm NO_2 for 15 minutes had four times more damage to lung tissues than did controls. "These results indicate that exercise following NO_2 inhalation can potentiate the severity of the toxic response," say Bruce E. Lehnert, Doug M. Stavert and coworkers. And that raises some provocative occupational-health concerns, they add, since many people are exposed to comparable acute NO_2 exposures in the workplace — as welders, miners, firefighters or grain-silo fillers.

Stavert notes that his NO_2 studies were conducted in the morning — the rat's normal sleep period. However, he told SCIENCE NEWS, "I wouldn't expect any major [toxicological] differences to be found if we changed [the rats' biological clocks] so that their sleep/wake cycles corresponded with those of the human."