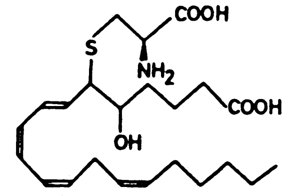
BIOMEDICINE

From the meeting in Washington of the Fourth International Prostaglandin Conference

Another family of prostaglandins



LEUKOTRIENE C

"I feel like a detective furnishing a clue for a crime that someone else just solved," admitted a scientist who was presenting data on SRS-A, a substance involved in a severe allergic reaction of the body, called anaphylactic shock. Earlier in the meeting, Bengt Samuelsson, Pierre Borgeat and their colleagues of the Karolinska Institute in Sweden startled a good many of the world's prostaglandin experts by their finding that the chemically elusive SRS-A belongs to a newly identified family of prostaglandins that the Swedish group has named leukotrienes.

Prostaglandins are part of a steadily growing group of fatty acid compounds known to exert potent physiological effects on living tissues. Originally found in, and named for, the prostate gland, prostaglandins exist in many tissues of the body. These small molecules, which typically are only 20 carbon atoms long, cause smooth muscles to contract.

The leukotrienes represent a previously unknown branch of the prostaglandin family, according to Samuelsson. Leukotriene C, the compound formerly called SRS-A, helps to constrict air passages in the bronchi during an asthma attack or at the onset of more serious, sometimes fatal, shock reaction known as anaphylaxis. Such attacks are triggered when antibodies on cells in the lungs react with a foreign molecule, such as a drug or pollen, probably releasing a burst of arachidonic acid. Samuelsson says that enzymes in the cells quickly convert arachidonic acid into leukotrienes. Designing drugs to inhibit those enzymes specifically might provide new "rational" therapies, he adds.

Leukotrienes are named for leukocytes, the blood cells in which they were discovered, and for the set of three double bonds, or "triene," they contain. The triene gives the molecules a characteristic signature in ultraviolet light that other prostaglandins lack. Like the handwriting on a forged check, that signature was an important clue leading to the leukotrienes' identification.

Prostaglandins vital for even blood flow

Another, not quite brand-new, group of prostaglandins called prostacyclins now are considered hormones, says John R. Vane of Wellcome Research Laboratories in the United Kingdom. With his colleagues there, Vane discovered the prostacyclins several years ago. He now believes that the principal task of prostacyclins is to prevent platelet cells in the blood from congregating unnecessarily and forming blood clots.

When damage occurs to a blood vessel, a substance called thromboxane is released that overrides the normal prostacyclin signal. Vane says that this chemical seesaw may tip too much in one direction in certain illnesses, such as strokes, some heart attacks and peripheral vascular disease (PVD). But he reports that the seesaw can be used to gain some leverage in clinical procedures where blood is removed temporarily from the body to circulate through a heart-lung or kidney-dialysis machine. Platelets are often damaged or, worse, form clots during such excursions, but a bit of prostacyclin prevents the problem. Vane says the substance destroys itself before the blood returns to the body, thus avoiding side effects. Prostacyclin is being tested in Europe for treating PVD, where the substance is infused directly into the bloodstream. For a few patients, prostacyclin has successfully cleared up PVD that was "refractory to other treatment," Vane reports. Prostacycline, unlike other prostaglandins, does not cause diarrhea, he adds.

PHYSICAL SCIENCES

Mary-Sherman Willis reports from Washington at the 1979 ISEEE/OSA Conference on Laser Engineering and Applications.

ZETA's zap is denser

Developers of laser fusion have been facing a ferocious task: to blast a deuterium-tritium "microbubble" fuel pellet smaller than a grain of sand with pulsing laser beams capable of delivering a punch of a trillion watts or more. The pellet must reach a fuel density of 1,000 to 10,000 times its normal liquid density for billionths of a second before it blows apart and cools. The goal is breakeven — reached when the energy produced by the reaction equals the energy put into it.

One step toward breakeven (projected by the Department of Energy to occur by 1984) happened May 22 at ZETA, the University of Rochester's 6-beam laser fusion instrument. Using 1.65 trillion watts of laser power, ZETA produced a temperature of 67 million degrees, according to Moshe Lubin, director of Rochester's Laser Energetics Laboratory. These results were "five to ten times the projected results. ... We were surprised, almost astonished," Lubin said. Most astonishing, to Richard L. Schriever of DOE's Office of Inertial Fusion, was the 30-fold increase in fuel density — from 0.004 g/cm^3 to 0.12 g/cm^3. The increased density represents increased efficiency, and (to DOE) a more feasible system for commercial energy production, he said.

Lost in the ozone

Floating 40 kilometers high above Palestine, Tex., last fall, a balloon-borne laser radiometer stared at the setting sun's infrared light and made the first measurement of chlorine monoxide (ClO) in the earth's atmospheric ozone layer.

Back on earth, Robert Menzies of NASA's Jet Propulsion Laboratory received some unexpected results: The concentration of ClO (a byproduct of the fluorocarbon sprays formerly used in aerosol cans) was two or three times greater than expected.

ClO is believed to eat away at the top of the ozone layer. It filters up through the layer as part of a fluorocarbon. The fluorocarbon photodissociates under the sun's ultraviolet rays; ClO quickly forms and descends into the ozone layer, where it attacks the ozone molecules and leaves oxygen molecules behind.

Menzies imagines the ClO concentration he found — two or three parts per billion (ppb) rather than the predicted one ppb — is "pretty uniform all over the globe." Yet the ozone layer is not disappearing, despite ClO's seemingly voracious appetite for ozone: One molecule of ClO could destroy 1,000 ozone molecules, Menzies says.

Menzies's answer: The ozone layer must be more resilient than we thought.

Follow the bouncing atom

For the first time, the motion of a single atom has been measured. The atom in question is sodium, drifting slowly in helium gas and detected by Chiao-Yao She and colleagues at Colorado State University two months ago.

Chiao-Yao She used a dye laser beam 200 μm wide and tuned to resonance with a sodium atomic transition. When the atom crossed in and out of the beam it fluoresced, emitting photons that were detected by a photomultiplier. By averaging the number of times the atom fluoresced, the researcher derived a diffusion coefficient that indicates how fast the atom moves outside the beam because of random motion. The coefficient varies with the pressure of the helium gas.

Chiao-Yao She's next mission is to measure the atom's drift velocity using two laser beams. He plans to measure an atom 5.2 angstroms wide as it travels between two beams about 800 microns apart at a rate faster than 50 cm per second to offset diffusion coefficient measurements. "It's just a matter of sensitivity," he says.