Hemosponge: A breath of fresh air

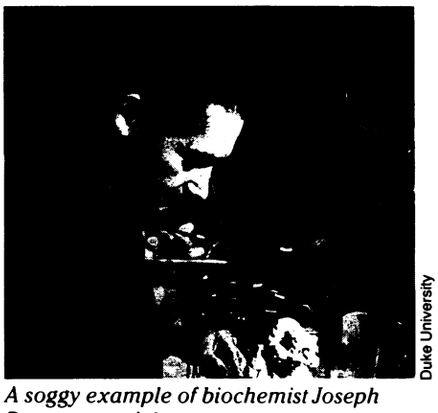
What started as a pet project in 1976 for two biochemists at Duke University's Marine Lab in Beaufort, N.C., has grown into a $1 million patent sale plus an additional $300,000 research grant. Joe and Celia Bonaventura's "hemosponge" — a polymer capable of extracting oxygen from seawater — has caught the imagination of many people who are interested in underwater exploration free from stifling ties to an oxygen supply at the surface.

The Bonaventuras have developed a method to immobilize proteins, like hemoglobin, in a polyurethane sponge, retaining the molecule's biological activities. "Instead of moving the red-blood-cell oxygen-carrier hemoglobin past seawater, like a gill," says Joe Bonaventura, "we have immobilized the oxygen carrier and can flow seawater past it. Then the hemoglobin will extract the oxygen from the water."

In early November, Aquanautics Corporation, a San Francisco-based underwater development company, purchased the patent rights to underwater applications of the hemosponge. With a two year development grant from Aquanautics, the Bonaventuras will be developing a prototype for using the hemosponge to supply oxygen for submarines, submersibles and individuals underwater. "We have proven the principle in the lab," says Joe Bonaventura, who has carried a sample of the golden spongy substance in his pocket since 1976. "Can you believe that piece still works?"

Most likely, the working prototype will involve a two stage, loading and unloading process. All surfaces of the sponge will be active and the Bonaventuras believe if water were passed through a three-foot wide by 10-foot long canister of hemosponge, enough oxygen for 150 people could be extracted. Either an electrochemical or a more mechanical vacuum would then "unload" the oxygen from its hemecapture. The result will enable a vehicle or an individual (with a smaller canister) to breathe underwater like a fish.

In early December, Aquanautics contracted Makai Ocean Engineers of Hawaii to develop another promising aspect of the hemosponge: extracting oxygen from seawater for fuel-burning combustion in underwater powerplants, a process which could be 300 times more efficient than a battery power source. "This could completely revolutionize underwater vehicles as we know them today," says Joseph Van Rizen, president of Makai. —*M. Wolfe*



Duke University

A soggy example of biochemist Joseph Bonaventura's hemosponge, a protein polymer capable of extracting oxygen from fluids.

New Oak Ridge operator

Four Department of Energy (DOE) laboratories known for their nuclear-related activities — three of them in Oak Ridge, Tenn. — will have new management beginning Jan. 2. Union Carbide Corp., which began operating the labs in the 1940s and early 1950s, announced last year it would not be renewing its contract. Since then, more than 70 firms have expressed interest in managing the laboratories' research, production activities and 17,700 employees — operations now estimated to run about $2 billion a year. On Dec. 13, DOE selected Martin-Marietta Corp., an aerospace conglomerate based in Bethesda, Md., to manage the facilities.

Affected are Y-12, a plant that produces components and subassemblies for the nuclear-weapons program; the Oak Ridge Gaseous Diffusion Plant, which produces enriched uranium fuel for commercial power reactors; the Paducah (Ky.) Gaseous Diffusion Plant, which produces low-enriched uranium; and Oak Ridge National Laboratory, world-renowned for its basic and applied energy research.

DOE said it chose Martin-Marietta over Westinghouse Electric Corp. and Rockwell International Corp. — the other final contenders — because of its impressive management, understanding of technology transfer, low-cost estimates, and lack of any known or apparent conflicts of interest. □

Zoo giant panda news: Hers and his

Holiday spirits at the zoo are hopeful this year as the nation's female panda seems to be recovering from a serious kidney illness diagnosed earlier this month. Ling-Ling was thought to be near death on Dec. 6, when a medical examination indicated she was extremely anemic and had evidence of kidney failure. Although her appearance was good, she had become lethargic, stopped eating and had passed blood in her urine the week before.

To boost Ling-Ling's critically low red blood cell count, veterinarians at the National Zoological Park in Washington, D.C., gave Ling-Ling a transfusion of blood taken from the resident male panda, Hsing-Hsing. They also administered antibiotics in the hope that the problem was an infection, rather than degenerative kidney disease.

Jessie Cohen, National Zoo

Ling-Ling's kidneys are examined with a laparoscope while she is anesthetized.

Although Ling-Ling is still considered to be very ill, she is doing better daily, a zoo spokesperson says. Tests performed Dec. 13 on blood drawn from Ling-Ling showed that Ling-Ling is still anemic. But she now has near-normal blood levels of the waste products that the kidneys filter from the blood. "These are very encouraging signs," says Mitchell Bush, the zoo's chief veterinarian. "She's far from being a well animal. We just feel more comfortable with the progress she's making."

There was only good news about Hsing-Hsing, the National Zoo's male panda. He remained healthy and was recognized as one of the few proven giant panda sires. Tests at the National Institutes of Health in Frederick, Md., indicate that last summer's short-lived pup (SN: 7/30/83, p. 68), was fathered by Hsing-Hsing as a result of natural mating rather than by the London (England) Zoo's Chia-Chia through artificial insemination. Stephen J. O'Brien and David Goldman examined more than 200 proteins taken from cells grown in their laboratory from blood and skin samples of Ling-Ling, Hsing-Hsing, Chia-Chia and the deceased pup. Only eight proteins were present in genetically different forms among the animals, and two of these gave information on the pup's parentage. "Both these proteins show that the only way that the baby could be Ling-Ling's son is if Hsing-Hsing were the father," O'Brien says. "We're very proud of Hsing-Hsing." —*J.A. Miller*