Protein found to stimulate bone growth

A group of California scientists reports it has isolated a potent chemical, a protein found in human bone, that stimulates bone growth and might be responsible for regulating the body's normal bone destruction and rebuilding process.

The protein, called skeletal growth factor (SGF), was isolated and tested by John R. Farley, David J. Baylink and colleagues at Loma Linda University in California.

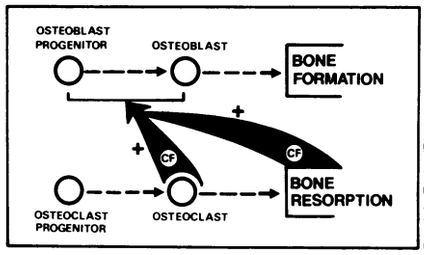
Baylink explains that in normal adults, bone is constantly being destroyed and renewed at equal rates. Many scientists believe a "coupling factor" exists that regulates this process so that the right amount of bone volume is maintained. Baylink and Farley believe that SGF is such a factor. They propose that destroyed bone releases SGF, which stimulates growth of osteoblast cells, which in turn lay down new bone. The researchers report in the July 16 BIOCHEMISTRY that SGF increased the growth rate of bone cells taken from human hip bone by 1,000 percent but had no effect on human skin cell growth. The group previously reported that embryonic chicken bone exposed to SGF showed an increased growth rate of almost 200 percent over that of controls.

If SGF is a coupling factor it might have important implications in the detection and treatment of certain bone diseases. "Most of the bone diseases we see are abnormalities of too much bone or too little bone, so the mechanism that would regulate bone volume could be very important," Baylink says.

According to Guy Howard, who studies the protein at the University of Washington in Seattle, SGF might ultimately help physicians diagnose and treat osteoporosis, a common debilitating bone disease characterized by lower than normal bone formation. Howard says researchers believe osteoporosis patients have lowered amounts of the coupling factor. If that were true, he says, doctors could measure the amount of coupling factor in a suspected osteoporosis patient and take steps to treat the disorder early. Right now, most osteoporosis patients are diagnosed after the disease has progressed enough to show porous or broken bone on X-ray film, according to Howard.

Baylink says that preliminary results measuring SGF in bone disease patients look promising. In early experiments with patients having Paget's disease (a disorder characterized by higher-than-normal bone destruction), the group has found abnormally high levels of SGF. Baylink says this is what one would expect if SGF is a coupling factor; bone destruction would release increased amounts of the coupling factor, which in turn leads to increased bone formation. In fact, Baylink says, these patients have deformed bones that are sometimes twice the normal size.

Baylink admits there is much skepticism in the scientific community about whether SGF is indeed a coupling factor. He says, "We have reservations about what its function might be. At the very least it has some function in fracture repair." Though the evidence that SGF acts as a coupling factor is compelling, he concedes that it is still mostly circumstantial. Marshall Urist, a bone researcher at the University of California at Los Angeles medical school, says he is not convinced that the protein Baylink's group has isolated is a coupling factor. "There is no proof that it [SGF] is actually connected to bone resorption," he says. To date, researchers haven't been able to prove that bone destroyed or resorbed *in the body* releases SGF or that SGF stimulates bone cell growth in the body. Howard says all research has been done on bone cells in the laboratory and that no one knows how SGF functions *in vivo*. He says research proving SGF's function *in vivo* would be technically difficult and that the best evidence that SGF is a coupling factor may be circumstantial. —*K.A. Fackelmann*



Baylink, Farley/Biochemistry

A model of Baylink and Farley's coupling mechanism in bone. They suggest that SGF, a large molecular-weight protein molecule, regulates bone formation/resorption by stimulating bone cells called osteoblast progenitors, which produce osteoblast cells. Baylink's group believes SGF is probably released during bone resorption by the bone itself, but may be released by bone-destroying osteoclast cells.

Attractions of a polyhelical magnet

To study the magnetic properties of matter, any and all kinds of matter, it is necessary to provide the magnetic fields that make those properties do whatever it is they do. There is a continuing need for stronger and stronger fields. At last week's 3rd Joint Intermag-Magnetism and Magnetic Materials Conference in Montreal, H.D. Schneider-Muntau of the Max Planck Institute in Grenoble, France (a laboratory supported jointly by the French National Council for Scientific Research and the German Max Planck Society) reported a new record for an electrically resistive magnet, 25 tesla, with a new kind of magnet design, the so-called polyhelix. (One tesla equals 10,000 gauss or about 20,000 times the average strength of the earth's magnetic field.)

Steady, reusable magnets come in two kinds, resistive and superconducting. Superconducting magnets have the advantage of producing relatively strong fields with very little power expenditure, because of the resistanceless quality of the coils that generate the field. But superconducting magnets carry their own doom inside themselves. Superconductivity and magnetism are generally incompatible. One tends to drive the other out. When the field of a superconducting magnet reaches a certain critical strength (depending on the metal or compound in the coils), it destroys the superconductivity, and the magnet goes kaput. Superconducting magnets are effective up to between 11 and 13 tesla, Schneider-Muntau says.

Resistive magnets can do better, provided there is a design that will stand the heat and the electrical and mechanical stresses, and provided the requisite power can be supplied. It took 10 megawatts of power (or 10,000 kilowatts for those who like to figure the electric bill) to get 25 tesla out of the new Grenoble magnet. Only two magnet laboratories in the world can supply that much power to a magnet, says Schneider-Muntau, Grenoble and the Francis Bitter National Magnet Laboratory in Cambridge, Mass.

The usual design for high-field resistive magnets has been the Bitter magnet, named after its inventor, the late Francis Bitter. This is basically a stack of circular copper plates interleaved with insulation. The plates look something like phonograph disks, having a large hole in their centers, the bore, in which experimental material is placed. The plates are connected to each other in such a way that the current flows around the top plate, descends to the next, flows around it, descends again and so on in a helical path until it comes to the other end.

The strength of field that can come out for a given power input without having the magnet tear itself apart depends on a complicated balance of electrical, mechanical and thermal properties. The Grenoble people found that they could improve on the Bitter design by slicing the disks into concentric rings and connecting the rings vertically; instead of the single, wide-ribbon helix of the Bitter design, they get an arrangement of concentric narrow-ribbon helices electrically insulated from one another. (Cambridge did manage to reach 25 tesla with a Bitter design, says Schneider-Muntau, but it took 16 megawatts of power and the power density led to electrical burnout.) Other places in the world doing better than 20 tesla are Moscow; Wroclaw, Poland; and Nijmegen, the Netherlands.

The next step is hybrid magnets, a superconducting coil on the outside, a re-

sistive one on the inside, to boost the field in the bore even higher. Cambridge is working on one for 29 tesla, Grenoble on one for 30 tesla. Thirty tesla is a figure of great interest to biologists, Schneider-Muntau says. At that point the energy of the magnetic field equals the internal energy of a cell, and with that balance they expect serious magnetobiological effects to occur. With more improvements they hope to achieve 40 tesla in 5 or 10 years.

—D. E. Thomsen

IWC sets commercial whaling moratorium

Ten years after the proposal first gained worldwide popularity, the International Whaling Commission last week voted for a cessation of all commercial whaling beginning in 1986, with a gradual phasedown of catch quotas until that date. The vote, 25 to 7 with five countries abstaining, passed this year because several new members gave the anti-whaling side its long-awaited three-quarters majority.

U.S. Commissioner to the IWC John V. Byrne, Administrator of the National Oceanic and Atmospheric Administration, hailed the vote as "a major accomplishment," but added that "we still have another inning or two to go." Under the terms of the 1946 convention, for example, a member may formally object to an IWC decision within 90 days and then legally refuse to comply. While Japan, the major commercial exploiter of whales, has not yet filed an objection, officials there have expressed dissatisfaction and "they probably will object," says U.S. Deputy Commissioner Tom Garrett.

If objections are filed and the moratorium ignored, the IWC can do nothing to enforce it. But the United States, under two amendments to domestic fisheries legislation, must restrict by at least 50 percent fishing rights within U.S. waters of any nation certified by the Secretary of Commerce to be disregarding an IWC recommendation. In addition, the Secretary of the Treasury may decide to embargo that nation's fisheries products.

Such actions could have an impact on Japan's decision to comply. In 1981, that country's catch of fish in U.S. waters totaled more than $425 million, according to Craig Van Note, executive vice president of Monitor, a coalition of 35 conservation groups. "Japan's entire whale catch is worth only $50 million annually," he says. Restricting access to U.S. waters "could knock out close to a quarter of all jobs in the Japanese offshore fishing industry," says Garrett, "a loss of jobs many times the loss if the whaling industry shuts down."

Byrne says it's "premature" to talk about sanctions yet because a nation must violate, not just object to, an IWC decision first and he believes that "whaling nations will honor the vote." *—L. Tangley*

New JPL director was USAF chief of staff

In a time of growing concerns about the shifting balance between the nation's civilian and military space programs, the Air Force's just-retired chief of staff has been named to head Jet Propulsion Laboratory, the California Institute of Technology facility that is the principal center of planetary exploration for the National Aeronautics and Space Administration. On Oct. 1, Lew Allen Jr., a Ph.D. nuclear physicist who held the rank of general prior to his June 30 retirement, will take over the post occupied for the previous six years by Bruce Murray, a Caltech professor of planetary science (SN: 4/17/82, p. 260).

Aware of possible fears among scientists who have seen the NASA planetary program dwindle while Defense Department space expenditures have grown, Caltech president Marvin L. Goldberger says that Allen "has a genuine interest in space science and space exploration." Although Allen's experience with space development has been almost entirely defense-related, it dates to the beginnings of the space age, Goldberger notes, and brought him into contact with satellites, launch vehicles, communications technology and other areas, as well as the administration of a force of a million people. For such reasons, says Goldberger, Allen was the Caltech selection committee's unanimous first choice, "and not because we intend to turn the laboratory into a DOD installation.... The military thing, I'd like to emphasize, played essentially no role." If anything, he says, Allen's military background could give him additional credibility as an advocate for civilian programs.

Would Allen undertake such a role — to push for planetary missions? "Oh, yes," he told SCIENCE NEWS, "no reservations about that." Furthermore, he said, "the need for additional exploration of the planets should remain the prime focus of attention at JPL."

But not the only focus. JPL deals with energy projects and other earth-oriented applications, and last year Caltech's board of trustees authorized the lab to take up to 30 percent of its budget from conducting DOD-funded research — triple the university's previously imposed limit. And with such work often comes the requirement of secrecy, a constraint that Allen says should be approached by JPL "with great care — and with limitations, [so that] one doesn't significantly impede the openness to the work at JPL which has been felt by the Caltech faculty, and indeed by the students.... If that [classified] portion of the work got to be too large," he says, "I think it would be to the detriment of the total, combined institution.... And so I think one wants to be very careful about that."

— J. Eberhart

OCS oil-leasing plan cleared by Interior

Secretary of the Interior James Watt has approved a controversial program that offers for lease to oil and gas companies one billion acres of the outer continental shelf (OCS)—or nearly the entire U.S. coastline. The 41 separate sales are scheduled to begin next month and can continue until 1987. The plan's purpose, said Watt in a July 21 statement, is to accelerate OCS oil and gas development that "drastically declined" during the 1970s, "making America less dependent on foreign oil sources."

The 5-year plan replaces a Carter administration program that also encouraged OCS oil exploration but opened only 55 million acres to private leasing. The new program has been praised by oil company representatives. Environmentalists, however, reacted with dismay. "This is basically a giveaway to some of the richest institutions in the world the lands that should belong to all U.S. citizens," said Elliott A. Norse, director of science and policy for the Center for Environmental Education. "At the same time the administration is enacting this program, it is cutting back drastically on the research necessary to assess the impacts of oil and gas development on the marine environment."

More than a year ago when it was first proposed, Watt's plan met with similar criticism. Nevertheless, it was expected to go into effect early this year. A court decision last October, however, stating that even the Carter administration's plan did not include sufficient environmental safeguards to comply with the law, forced Interior to delay and revise its proposal.

"But this program is practically identical to the one proposed last July," says Frances Beinecke, senior resource specialist with the Natural Resources Defense Council. NRDC, with six other environmental groups, has filed a petition for the court's review of the plan. The states of California and Alaska, as well as the local government of Alaska's north slope (where companies expect to find new oil reserves), have filed similar petitions.

The basis for the lawsuits, says Beinecke, is that the Outer Continental Shelf Lands Act requires the government to ensure a "balance between oil and gas exploration and protection of the marine coastal environment" in any leasing program and that Interior has failed to do this. Watt contends that such a balance is incorporated into his plan and that "new leasing will be carried out under rigorous environmental controls." He also stresses that the number of acres that actually will be leased by oil companies is a small fraction of the number he's making available.

— L. Tangley