BIOLOGY

Laura Tangley reports from Cambridge, Mass., at the MIT Sea Grant Seminar "Biotechnology and Genetic Engineering in the Marine Sciences"

Tumor testing: Jaws, too

"This could be a use for sharks other than making movies," says Robert Langer, a biochemical engineer at the Massachusetts Institute of Technology. He and a graduate student, Anne Lee, extracted a substance from shark cartilage that, when placed in rabbit corneas along with pieces of cancerous tumors, reduced the rate of vascularization of those tumors to 30 percent of a control. Vascularization, the proliferation of blood vessels, is essential to tumor growth. Thus, while large three-dimensional tumors grew in untreated corneas, tumors implanted in eyes along with shark extract stayed the same size.

Presence of a tumor vascularization inhibitor in cartilage is not new to Langer. He and others have been studying it for about 10 years (SN: 3/22/80, p. 189). A major problem they have had, however, is getting enough cartilage to test the extract or purify it. Langer used to grind up veal bones — up to a ton to test the inhibitor on just six rabbits. Sharks could change all this. Not only do they have skeletons made entirely of cartilage, but, says Langer, "initial evidence suggests that there is more inhibitor per unit volume of cartilage as well."

Protoplast fusion for agar

Agar, a colloid derived from algae and important as a laboratory culture medium, sells for up to $32 a pound. Agarose, a component of agar used in biomedical molecule separations, can be even more expensive — $1,500 a pound. These prices reflect a "roller coaster supply situation," says Donald Cheney, a biologist at Northeastern University. While agar is found in some North American seaweeds, U.S. businesses have been reluctant to cultivate these plants, and most agar is imported from nations where supply is unpredictable. "Unless a stable source is found, there will be a critical shortage of these important phycocolloids," says Cheney, who is working on a solution to the problem. His idea is to cross two species of the red alga *gracilaria* — one that contains high quality agar and the other a fast-growing variety — to produce a hybrid that will be more commercially attractive. Because red algae are hard to cross sexually, Cheney is working on fusing protoplasts of somatic cells. Protoplast fusion is a new technique that has been successful with a few land plants. So far, Cheney has removed cell walls and isolated protoplasts. The next step is to fuse the protoplasm and regenerate the whole plant. "I think this will work," Cheney told SCIENCE NEWS. "And if it does, it will revolutionize the agar industry."

Pollution problems: Horseradish

Horseradish peroxidase, an enzyme, can remove over 40 phenols and aromatic amines from industrial wastewater samples, reports Alexander Klibanov, an MIT biochemist. Currently, these toxic pollutants are removed with methods like microbial degradation and adsorption on activated carbon. But all of these techniques "suffer from some serious shortcomings," says Klibanov, and "new methods are very much needed."

Hydrogen peroxide, using peroxidase as a catalyst, oxidizes phenols and aromatic amines and changes water soluble organics to insoluble ones in the process. Solid precipitates then can be easily filtered out. While removal efficiencies for most of the pollutants tested were high (nearly 100 percent), they were low for some. This suggested, at first, limited practical applicability. But Klibanov and his colleagues found that in solutions containing mixtures of compounds the presence of easily removed pollutants aided removal of not so easily removed ones. Because real industrial wastewaters always contain mixtures, Klibanov suggests that horseradish peroxidase may have "an important practical implication."

SPACE SCIENCES

Jonathan Eberhart reports from Houston at the Lunar and Planetary Science Conference

Missing moons of meandering Mars

Phobos and Deimos, the two moons of Mars, may be merely the last survivors of a far larger satellite family whose other members crashed into the planet over the eons, according to Peter H. Schultz and Anne B. Lutz-Garihan of the Lunar and Planetary Institute in Houston. Furthermore, the elongated craters cited by the researchers as possible evidence for the old moons' grazing impacts run in directions suggesting that the Martian crust may have shifted with time around the planet's interior.

Such grazing blows, the scientists report, typically leave craters that are oblong in the direction of impact, tossing out surface material into the shape of a butterfly whose "wings" spread perpendicular to the impact trajectory. If such features were due to collisions with asteroids circling the sun, according to the authors, the number of "grazers" ought to be about the same percentage of the total crater population as on Mercury or earth's moon. Instead, more than 175 have been identified in Viking orbiter photos of Mars, while fewer than a dozen are known on either Mercury or earth's moon. If the Martian grazers resulted from fragments of a single, tidally disrupted object, says Schultz, it could have been about 200 kilometers across.

The possibility of the shifting crust was actually raised by the same researchers a year ago, prior to the many-moons idea. Also using Viking photos, they identified three near-equatorial regions on Mars whose curved valleys, pedestal craters and laminated terrain are all similar to characteristics of the planet's present poles (SN: 4/4/81, p. 216). The inference was that the crust had moved around from its earlier positions, with the pole's relatively fixed position tracing a signature across the landscape.

Examining the elongated craters, the scientists now find that the newest ones (based on the state of preservation of surrounding ejected material) appear to have resulted from impacts in an east-west direction — in the orbit plane, in other words, of Phobos and Deimos. The older impacts, however, are aligned in progressively more northerly directions, suggesting that the crust has shifted their orientation.

"As these satellites gradually spiraled in and collided with Mars," the authors conclude, "they recorded the ancient orientations of the Martian crust much as the remanent magnetism in rocks on the earth has recorded the shifting continents."

Organic chemistry on Europa?

Smoother than a billiard ball, Jupiter's moon Europa has been called "perhaps the most enigmatic of the Galilean satellites." One of its strangest features — indeed, almost the only visible marking on the ice-clad surface — is a widespread network of twisting, brownish streaks, stark against the otherwise much lighter-colored terrain and so flat as to appear almost painted on. Various fracturing mechanisms have been proposed to explain the streaks' presence, but why are they brown? One possibility, suggests Ernest Schonfeld of NASA's Johnson Space Center in Houston, may be the presence of organic molecules.

Various organic polymers are brownish, he notes, and share the deep absorption in the 3-to-4-micron portion of Europa's infrared spectrum. (Oxidized iron could produce a similar color, such as seen on the surface of Mars, but that is "cosmologically less likely," Schonfeld says.) Primordial methane and ammonia trapped in the depths of Europa's ice, he reasons, could be released by internal heat as bubbles in the resulting melted water, percolating to the surface where solar ultraviolet radiation and Jupiter's trapped charged particles could trigger the organic synthesis. The same radiation can also destroy organics, he admits, but liquid water can shield them and even help with additional reactions, "such as hydrolysis to make amino acids."