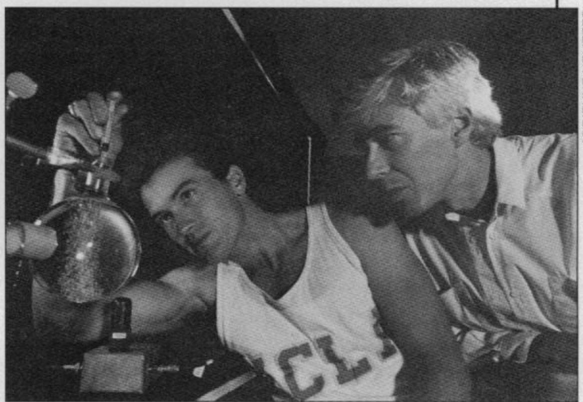
asks. In the filamentous phase, "these organisms can grow towards it," he says. The precise molecular mechanism of the switch awaits further study, but Fink and his colleagues have shown that they can induce the change of yeast lifestyle at will—simply by altering the nitrogen level in the cultures.

Fink isn't the only one who was bowled over by *Saccharomyces'* new phase. "The surprise is that a major developmental path had gone undiscovered in an organism so intensively studied by thousands. It is quite remarkable," says Boeke. Yeast expert Ira Herskowitz of the University of California, San Francisco, calls the discovery a "fascinating new piece of yeast biology that shows the relatedness of yeast and filamentous fungi."

And that relationship could make *Saccharomyces* an important medical model as well as a lab model for molecular genetics, since many of the fungi that cause disease in plants and animals have a filamentous phase. A typical example is ***Candida albicans***, which causes vaginal infections, thrush, and often afflicts immunosupressed patients. In some cases, the filamentous phase is critical in allowing the pathogen to invade its host. And of all possible yeasts, ***Saccharomyces*** is best positioned to serve as a model, according to Fink, who notes, "The advantage here is that the genetics of ***Saccharomyces*** are so well worked out that the mechanism can be studied at the molecular level." And the elucidation of that model could provide yeast genetics with the beginning of an entirely new phase. ■ MICHELLE HOFFMAN

Making Light of Sound



The light fantastic. *Seth Putterman (right) and Bradley Barber use ultrasound to coax light from liquid.*

ADRIENNE HELITZER

Imagine concentrating all of the cheers from 20 million jammed stadiums, each packed with 50,000 spectators, into a brief but gargantuan shout from a single solitary fan. That might give you a feel for the phenomenon that has captivated Seth Putterman for the past 2 years. The more the University of California, Los Angeles (UCLA), physicist and his colleagues learn about the phenomenon, in which the energy of ultrasound beamed into a liquid is apparently concentrated a trillion-fold to produce fleeting flashes of light, the stranger it gets.

Putterman's latest measurements of these light pulses "knock my socks off," remarks University of Illinois sonochemist Ken Suslick. The measurements, which Putterman and his UCLA colleagues Robert Hiller and Bradley Barber reported this week at the American Physical Society (APS) meeting in Indianapolis, suggest that the light pulses last just trillionths of a second. That's hundreds of times faster than experts in the physics of fluids can explain by standard theories.

The basic phenomenon, called sonoluminescence, was first reported 58 years ago by German scientists. Having noted the sound-to-light conversion, though, they didn't pursue it, says Putterman. "They thought it was boring." Since then, other researchers tried developing a rough explanation for the light emission. They've proposed that the tiny gas-filled bubbles created by the ultrasound collapse violently, spurring energetic molecular fragments within the bubbles to perform light-emitting slam-dances. For years, sonochemists like Suslick have been exploiting the violent conditions of the bubbles to drive chemical reactions and to make new materials. But the erratic, flash-in-the-night nature of sonoluminescence hampered physicists' efforts to nail down the mechanisms of light production.

By the end of the 1980s, physicists were gaining tighter control over the brilliant bubbles, opening the way to more precise measurements of their workings. The key development came from Lawrence Crum of the University of Mississippi and Felipe Gaitan, now at the Naval Postgraduate School in Monterey, who varied the viscosity of their liquids and the frequency of the ultrasound until they had a single, tiny bubble emerging, expanding, and contracting at the frequency of the ultrasound, all the while emitting light. "You can see it with your naked eye," Crum notes.

The two reported their work at a conference in 1989, "but nobody thought it was extraordinary," says Crum. Nobody, that is, until Putterman entered the sonoluminescence picture about a year later. He had begun looking into the phenomenon following a cafe conversation with physicist Tom Erber of the Illinois Institute of Technology. Erber, then a visiting professor at UCLA, had challenged Putterman, who had a longstanding interest in fluid mechanics, to figure out how in the world "do you get light out of sound."

Back of the envelope calculations indicated that for the diffuse energy of sound to excite light-emitting electrons in the fluid, it has to be concentrated by a whopping 12 orders of magnitude. "I immediately saw that this is amazing," Putterman says. To get a sense of what physical mechanisms might be at work, one of the first things he wanted to do was measure the length of the flashes. He set Barber the task of modifying their own experimental efforts à la Crum and Gaitan. Using what Putterman believes are the world's fastest photo multiplier tubes, the UCLA workers recorded a clockwork sequence of pulses lasting less than 50 trillionths of a second each. Says Putterman, "This is shocking to us."

It's shocking to other researchers in fluid mechanics, too. Andrea Prosperetti, a fluid mechanics expert at Johns Hopkins University, has tried and, so far, failed to find a way of explaining how energized molecules in the bubbles could produce flashes shorter than a few nanoseconds—hundreds of times longer than the pulses measured by the UCLA workers. "I can't make it work," says Prosperetti. And that is leading him to say reluctantly that some brand of new physics "seems a little more possible" as an explanation for the phenomenon.

Other measurements the UCLA group reported at the APS meeting have only deepened the mystery. By recording a spectrum of the emitted light, the researchers found it didn't tail off even at high-energy, ultraviolet wavelengths. That leads Putterman and his colleagues to think the bubbles may also be emitting at even shorter, more energetic wavelengths that went undetected because they are absorbed by the liquid.

If so, any theory of sonoluminescence may have to explain an energy amplification even higher than had been thought. But once such a theory is in hand, says Putterman, scientists may be able to exploit the process to pull off even more dramatic feats of energy focusing, an ability that could prove useful in both basic and applied research. ■ IVAN AMATO