Whipping up an image of a foam's interior

The foam atop a freshly poured glass of beer is so thick with bubbles that it's practically impossible to see through the froth. Yet hidden within this wet, airy maze may lie the key to understanding the structure and behavior of foams, whether used in firefighting, oil recovery, or other applications.

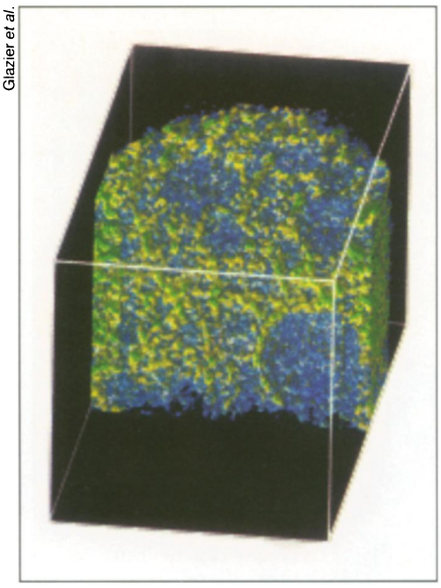
Now, using magnetic resonance imaging (MRI), researchers have for the first time obtained three-dimensional pictures of a liquid foam. Physicists James A. Glazier and Burkhard A. Prause of the University of Notre Dame in Indiana and their collaborators report their work in the Oct. 2 JOURNAL OF PHYSICS: CONDENSED MATTER.

"The question was whether you could reconstruct [from MRI data] a three-dimensional foam with reasonable accuracy in a reasonable amount of time," Glazier says. "The answer is we can, and we think that's going to allow us to study the evolution of three-dimensional foams."

This work represents an important step beyond earlier research involving the use of magnetic resonance technology to obtain a sequence of two-dimensional images of a foam (SN: 7/29/95, p.68).

Glazier and his colleagues performed their experiments on a slowly evolving, fairly stiff gelatin foam that they generated by whipping a solution containing a protein derived from fish skin. Studies showed that isolated bubbles remained suspended in this whipped gelatin for several hours, while the liquid gradually drained out of the mixture.

Glazier *et al.*



Three-dimensional magnetic resonance image of a foam.

— I. Peterson

Secret to birds' mating score: Speedy sperm

Many birds mate and rear young with one lifetime partner, yet occasionally enjoy sexual dalliances with other birds. Indeed, individual out-of-wedlock copulations have a higher fertilization rate than single mating efforts at home.

Fertilization is a numbers game, many ornithologists assert. It becomes less likely the fewer sperm a male ejaculates, and males may release fewer sperm per copulation with their mate than with other females.

But a new study suggests that, while quantity is essential to reproduction, speed matters too. "Sperm velocity is icing on the cake," contend Timothy R. Birkhead and his colleagues at the University of Sheffield in England. When a bird last ejaculated determines the speed of its sperm, the scientists report in the Oct. 5 NATURE.

The study "ties up a bunch of details on the physiology of sperm production and sperm morphology in zebra finches," says David F. Westneat of the University of Kentucky in Lexington.

The team collected sperm by allowing male zebra finches to mate with a freeze-dried female equipped with an artificial sperm receptacle. When prevented from copulating for a week, a male would ejaculate several times into the dead female. Sperm from the second ejaculate moved at half the speed of sperm from the first go-around, a computerized sperm tracker revealed. Quantity decreased as well.

The researchers then examined the sperm storage area of males that had not copulated recently. The fastest, most mobile, and healthiest sperm swam nearest the opening from which sperm emerge. The sperm nearest the opening resembled those in the first ejaculate, while sperm farthest away acted like those in the last one.

"The vagina is an incredibly hostile zone to sperm," so the faster they zip through, the better their chances of surviving, suggests Birkhead, who is now examining whether first-time ejaculate does indeed have the best success at fertilizing eggs.

A male zebra finch has affairs only after he has recovered from copulating repeatedly with his mate during her fertile period. As a result, he releases more sperm during one act of intercourse with his one-time lovers than with his regular gal, Birkhead says.

"Waiting until your own female is no longer fertile before you go looking for extra-pair copulations is part of the male strategy," he asserts. *— T. Adler*

Birch bark has an anticancer bite

Tree-loving Joyce Kilmer didn't foresee this. Last June, the drug taxol, derived from the Pacific yew tree, made headlines as a potent anticancer agent. Now betulinic acid, extracted from the bark of the common white birch, has emerged as the next potential sylvan pharmaceutical.

Unlike taxol, betulinic acid specifically affects melanoma cells. In mice, it blocks the growth of these skin cancers, which often spread to other organs. It also seems to leave normal cells unscathed, say researchers at the University of Illinois at Chicago.

Melanoma, which afflicts 1 in 90 white people over a lifetime, has the most rapidly rising incidence of any cancer in the United States. The drug most often used to treat it, DTIC, helps only a quarter of patients, and its effect soon fades. "We clearly need something else," says pharmaceutical biologist John M. Pezzuto, whose team reports on its studies in the October NATURE MEDICINE.

The researchers extracted the raw material, betulin from the bark of birches culled from a Chicago parking lot.

From betulin they synthesized betulinic acid, and they tested it, along with other drugs, on human cancer cell cultures. These included lymph, lung, liver, and skin melanomas, plus some nonmelanoma cancers. Betulinic acid wasn't the deadliest agent, but it stood out in its dogged focus on the melanoma cells. "We don't know why," Pezzuto says.

That focus may explain the compound's apparent kindness to normal cells, he speculates. Most anticancer drugs attack a variety of cancers but harm some body cells as well. Betulinic acid, however, may interact with something only in melanomas.

The researchers gave betulinic acid to a strain of mice whose weakened immune systems allow introduced cancers to grow readily. When they injected human melanoma cells into these mice, the compound "completely inhibited the growth of tumors," Pezzuto says. In mice with existing melanomas, betulinic acid stalled tumor growth.

Even at high doses, moreover, these effects came with none of the typical side effects of anticancer drugs, such as weight change, diarrhea, or organ damage. "Having such results," Pezzuto says, "is really unusual."

But Antonio Buzaid, a melanoma specialist at the University of Texas M.D. Anderson Cancer Center in Houston, warns against extrapolating from mice to humans. "In most instances, such effective drugs don't pan out in people," he says. Even so, he adds, betulinic acid's specificity may help finger what makes melanoma unique. *— M. Centofanti*