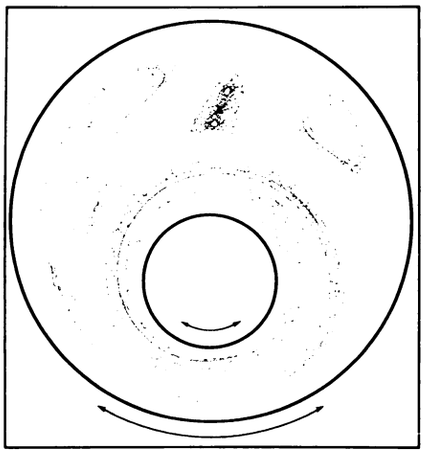

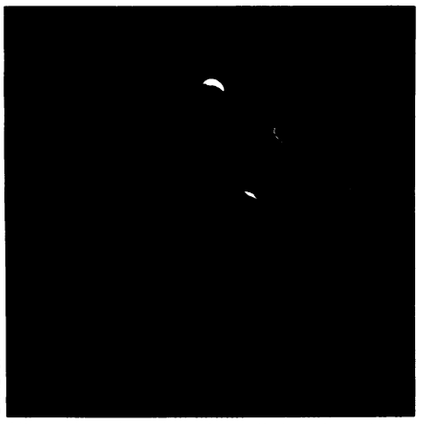

Shinbrot

Viewed under ultraviolet light, glycerine glows with a blue color (bottom). A drop of dye injected into the body of the liquid spreads out into an intricate maze of pale blue threads. A differently colored dye injected into one particular region of the liquid stays in roughly the same spot (seen as a small, bright region near the top of the photo). The resulting patterns of fluid motion resemble those seen in computer simulations predicting the occurrence of this type of flow (top).

folds within a certain region, a drop of dye injected into that region would essentially stay put (see diagram and photo).

By modifying the rotation sequences, the two researchers can independently control the location of a coherent structure and any movements that occur inside it. Conversely, they can also specify the type of stirring needed to guard against incomplete mixing.

These results, which apply to flows within a closed system, represent only a first step toward understanding structures – like the Great Red Spot, Jupiter's remarkably stable whirlpool – that arise in turbulent flows. The researchers are considering ways of extending their work to more complex situations such as wakes produced by fluid moving past an object.

Shinbrot will describe his findings later this month in Albuquerque, N.M., at a meeting of the American Physical Society's fluid dynamics division.

– I. Peterson.

Digging up cleaner-burning cooking fuels

More than half the world cooks and heats with biomass fuels – usually wood, dung, or crop wastes. Often inexpensive and readily available, such fuels emit smoke and other noxious pollutants when they burn. Indeed, these fuels probably foster much of the respiratory disease seen in rural women and children in developing countries, the World Health Organization reported last year.

"We're all trained to think of wood as the premier biomass fuel," says Eugene B. Shultz Jr. of Washington University in St. Louis. But his data indicate that for arid climes, a healthier gold standard might lie underfoot: the roots of wild melons and gourds.

Shultz happened onto the idea of root fuels while looking for plant sources of alcohol that people could grow in dry lands without irrigation. Among the most promising was buffalo gourd, *Calabacilla loca.*

Driving past a research plot of the viny plants one day, Shultz spied what he took to be a pile of kindling. Having a fireplace, he stopped to pick some up. What he found were actually discarded *C. loca* taproots that had dried to wood-like hardness in the New Mexico sun. He took some home anyway, and when he saw how well they burned in his fireplace, "the wheels started turning," the combustion scientist recalls.

That was eight years ago. Since then, he and anthropologist Wayne G. Bragg, of Enable International in Wheaton, Ill., have enlisted scientists on several continents to scout local flora for regional surrogates. The star performer is *Cucumis hirsutus.* Zimbabwe-based botanist Mary Wilkins/Ellert collected samples of this wild plant, indigenous throughout much of southern Africa.

In May, she, Shultz, and a development researcher from Lutheran World Service recruited village women in Zimbabwe to compare *C. hirsutus* and another root against a local wood. Working over a simple fireplace in the middle of a poorly ventilated, thatched dwelling, the women prepared a batch of sadza – a thick cornmeal mush that serves as a dietary staple – using each fuel. *C. hirsutus* not only ignited most readily, but also produced almost no smoke.

During the tests and at a later debriefing, a translator recorded comments by the cooks – and onlooking village skeptics. The women judged the roots superior to the local wood and asked for seeds to begin cultivating *C. hirsutus,* Shultz reported last month in Fort Collins, Colo., at the International Conference on Sustainable Village-Based Development.

In August, Shultz's team conducted root-fuel tests at four rural sites in central and northern Mexico. Here, women prepared a full meal, including tortillas, over stoves fueled with *Cucurbita foetidissima.* As in Zimbabwe, Shultz says, all preferred the easy-to-ignite roots and their relatively smokeless fires.

Though roots tend to burn more slowly than wood – requiring a lowering of the pots on most stoves – cooks found they needed only two-thirds as much root as wood to cook a meal. And cultivation trials with buffalo gourd in Arizona indicate that a three-month crop delivers almost twice the yield of mesquite grown for one year on dryland sites – 11 metric tons per hectare for the root versus 6 metric tons for mesquite.

"If it's in the ballpark of being twice as productive as mesquite, [root fuel] may be a good choice of biomass crops," says Jonathan Scurlock, a biomass-energy expert at King's College in London, England. Moreover, he applauds the fact that Shultz involved social scientists and extension agents in his research. Their absence, he notes, has doomed the success of many technology transfer projects in developing countries.

Shultz/Washington Univ.

Top: Claudia, one of Shultz's "research associates," cooks tortillas over root-fired stone-and-sheet-metal stove. Below: Sun-dried buffalo-gourd roots.

Shultz's team "is in the forefront with a totally new idea," says Noel Vietmeyer of the National Academy of Sciences in Washington, D.C. "Only time will tell as to how [root fuels] catch on."

But "costing virtually nothing" and offering potentially important health benefits, the fuels "could change the lives of some very desperate people – the poorest of the poor" – Vietmeyer maintains.

– J. Raloff