# Physics

*Ivars Peterson reports from Cincinnati at an American Physical Society meeting*

## Competitive stickiness

Polymers generally have a strong tendency to adhere to surfaces — changing flow patterns in pipes during chemical processing, interfering with water purification and altering the properties of biological implants. However, the details of what actually happens as polymer molecules shuttle back and forth between solution and surface have long remained elusive.

Steve Granick and his co-workers at the University of Illinois at Urbana-Champaign have embarked on a series of experiments to study this process. Their initial results suggest that certain polymer molecules not only readily stick to a given surface but also subsequently rearrange themselves to forge even tighter bonds. Moreover, a slight increase in a polymer molecule's length greatly enhances the polymer's stickiness.

To study the dynamics of polymer adsorption, the team allowed polystyrene molecules dissolved in cyclohexane to coat a bare, specially prepared silicon surface. They then tracked the rate at which labeled polystyrene molecules — with deuterium substituted for hydrogen — displaced the original polystyrene molecules from the surface.

They discovered that displacement occurred rapidly when the initial coating was new. In that case, the labeled polystyrene molecules easily shunted aside and replaced the original polystyrene molecules. But if the researchers allowed the original layer to age, displacement proved much more slow and difficult. This suggests that the extra time allows initially adsorbed molecules either to become more entangled or to anchor themselves more firmly to the surface.

Granick and his colleagues also found that using longer polystyrene chains for the initial coating significantly slowed the displacement process. The displacement's extreme sensitivity to polymer chain length, combined with its dependence on the initial coating's age, helps account for conflicting reports in the past concerning polymer behavior, Granick says.

"We're dealing with a complex phenomenon," he adds. "There are a million experiments left to do."

## Solitons under the sea

Over long distances, information traveling along an optical fiber as a sequence of light pulses can become scrambled. To rectify the problem, communications engineers install "repeaters" along the optical-fiber cable to clean up and amplify the degraded signal. But each repeater must convert the cable's optical signal into an electronic form, then reconvert it to light pulses, slowing the entire system down.

Researchers are now testing an alternative scheme that overcomes these problems and promises extremely rapid communication over very long distances. Their approach uses specially shaped light pulses, described as solitons, along with optical amplifiers to boost the signal when necessary. Created by a small semiconductor laser, optical solitons can travel long distances along optical fibers without spreading out and losing their identity, and can thus counter the normal tendency of light pulses to disperse.

Because solitons furnish an extremely clean signal that remains virtually unchanged over tens of kilometers, optical-fiber cables carrying them convey a much larger volume of data and require fewer repeaters than systems now in use. Furthermore, the replacement of repeaters by optical amplifiers — which in effect turn pieces of the cable into lasers — significantly increases transmission rates by eliminating the need to convert light pulses into an electronic form.

"This began just a few years ago as the purest of physics, and now it's entering engineering development," says Linn F. Mollenauer of AT&T Bell Laboratories in Holmdel, N.J. An undersea cable based on this technology, stretching 9,000 kilometers from Seattle to Tokyo, may enter operation by 1996.

# Science & Society

## Name this little piggy

Mutant flies aren't the only targets of scientists' nomenclatural wit (SN: 1/12/91, p.30). John Phillips, a fourth-year medical student at Yale University, waxes poetic about toes.

Anatomists have bestowed Latin-derived names on nearly every bone in the human body, from the tail bone (coccyx) to the thumb (pollex) and pinkie finger (digitus minimus). Even the lowly big toe (hallux) boasts a dignified appellation. But the remaining piggly-wiggly appendages have never received their own formal monikers, observes Phillips. Instead, anatomists simply lump the toes together as "metatarsal digits" or "metatarsal phalanxes" and number them 1 through 5.

Why, Phillips asks, must toes "merely be counted?" In a Feb. 14 NEW ENGLAND JOURNAL OF MEDICINE letter, he proposes labels for the pedal digits: porcellus fori (big toe), p. domi (second toe); p. carnivorus (third toe), p. nonvoratus (fourth digit) and p. plorans domum (smallest toe). These names — all variations on a theme by Mother Goose — translate loosely into: little pig at market, baby pig at home, meat-eating piglet, small pig that's not eaten, and piggy crying all the way home.

Phillips says a few orthopedic surgeons at the Yale School of Medicine use his porcine nomenclature in their clinical and surgical notes. But Ronald Bohn, an anatomist at George Washington University Medical Center in Washington, D.C., says he doesn't expect others to go hog-wild over the proposed terms. Most medical texts and clinical notes already eschew Latin for the skeleton's more common English names, he explains. For instance, while Bohn admits to joking in class about a "rule of pollex," he says he never calls it anything but a thumb when talking with nurses or writing for physicians.

## Academic choices when budgets are tight

Several outspoken researchers — including Leon Lederman, president of the American Association for the Advancement of Science — have charged recently that the United States risks losing its supremacy in science because Congress isn't giving federal agencies enough money to fund all the worthy research proposals they receive. In a report accompanying the Jan. 11 SCIENCE, Lederman, a University of Chicago physicist, proposed that Congress attack the problem by doubling its funding of academic science, despite the big budget deficit (SN: 1/12/91, p.22). But a new study for Congress argues that such an increase would not solve the academic-funding problem.

Giving more money to federal granting agencies may temporarily ease the funding situation, but it would also "enlarge the system . . . and increase future demands for funding," according to Daryl E. Chubin, a policy analyst at the congressional Office of Technology Assessment, who wrote the report. Unveiled at a March 20 hearing before the House Subcommittee on Science, Chubin's analysis recommends instead that Congress set up a single agency to review all requests for funds from academic scientists and decide which projects to fund.

"Pork barrel" funding of "big science" projects — such as the superconducting super collider — also risks siphoning off funds that might otherwise go to other academic projects, the report says. But the peer-review system is not a good substitute, Chubin says, because it is not suited to set priorities across scientific boundaries. His study, "Federally Funded Research," also questions the value of some megaprojects and predicts that their megabudgets could worsen federal science-funding problems if they reduce funds for "small science."

"At this point, it's completely impractical to expect that [scientists] can really set priorities across boundaries between disciplines," says Robert L. Park of the American Physical Society in Washington, D.C. "All we can do is explain to Congress what our sciences will do," he told SCIENCE NEWS. "Ultimately, Congress is the priority-setter."