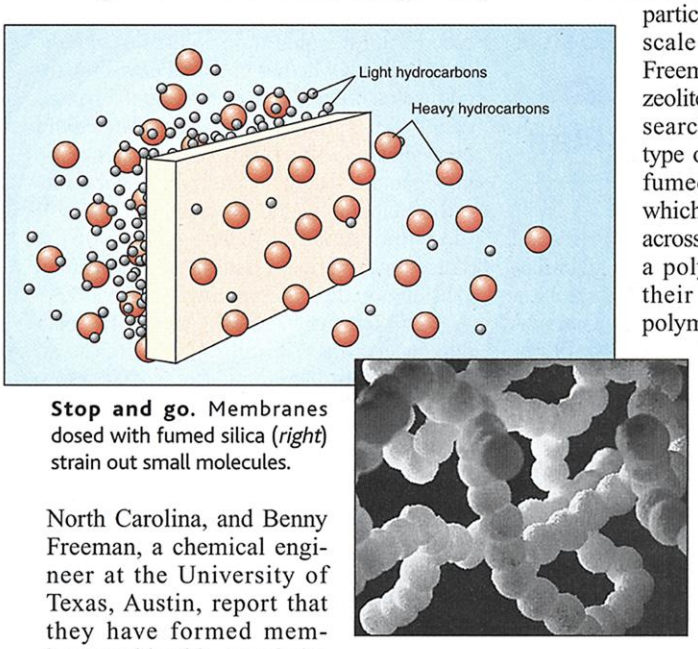
through, an energy-intensive and costly proposition. But now a team of researchers from the United States and Australia has found a surprising way out of the dilemma.

On page 519, the researchers, led by Tim Merkel, a chemical engineer at Research Triangle Institute in Research Triangle Park, North Carolina, and Benny Freeman, a chemical engineer at the University of Texas, Austin, report that they have formed membranes with wide-open holes that, paradoxically, allow large molecules through far more readily than smaller ones. Normally, enlarging a membrane's pores opens the gates to a flood of molecules, both large and small. The new membranes are both more selective and faster acting than previous versions.



Stop and go. Membranes dosed with fumed silica (*right*) strain out small molecules.

"This is a very interesting result" that could open new industrial uses for membranes, such as separating gases like oxygen from air, says Narcan Bac, a chemical engineer and membrane separations specialist at Northeastern University in Boston, Massachusetts. Bac adds that extending the same approach to other membranes may make current industrial separations cheaper. "Any time you can improve the efficiency of separations, you are improving the economics of the process," says Bac.

Merkel, Freeman, and their collaborators were aiming to get that efficiency boost by spiking a conventional membrane polymer with tiny particles. That combination isn't novel: For years, other groups had been adding small, porous particles called zeolites to membranes to try to increase their selectivity. Because zeolites come riddled with various-sized pores, they can serve as filters to allow slim molecules through while blocking their hefty cousins. But zeolite particles themselves are at least a micrometer across, making them "like giant boulders" compared with the polymer chains in the membrane around them, Freeman says. When the particles are added to polymer films, the tiny polymer building blocks pack tightly around the zeolites and produce dense films that make it difficult for gases to make their way through, leaving the hulking zeolites as the primary passageways through the membrane.

"We wondered what would happen if the particles were on the same size scale of the polymer chains," Freeman says. Because smaller zeolites weren't available, the researchers opted instead for a type of fine-grained sand called fumed silica, each particle of which was only 13 nanometers across, roughly the same size as a polymer chain. They mixed their fumed silica with rigid polymer chains, each akin to a strand of uncooked spaghetti. The small sand particles acted like meatballs strewn among the stiff spaghetti strands.

"That forced the polymer chains apart and increased the permeability" of the membrane, Freeman says. The arrangement gave the membranes an array of gaping holes, which by all accounts should sieve molecules quickly. The researchers braced themselves for the seemingly inevitable influx of chemical intruders.

It never came. In fact, the new membranes proved twice as good as previous versions at allowing larger gaseous organics such as benzene to pass through while straining out smaller gases such as hydrogen. The counterintuitive result, Freeman explains, occurs because molecules move through a membrane in two stages. First they must dissolve into the membrane, and then they must wiggle their way through it. And whereas smaller molecules are faster wigglers, larger molecules are quicker to dissolve. In densely packed membranes, that knack for dissolution doesn't turn large molecules into speed demons, because they still get hung up on their way through. But thanks to the wider holes in the new membranes, Freeman says, the bigger molecules have the elbow room they need to take full advantage of their head start and zip across before the smaller molecules.

The new membranes aren't perfect. One conventional membrane made from a polymer abbreviated PTMSP remains more permeable than the new variety. But PTMSP membranes degrade quickly in the presence of gaseous hydrocarbons such as methane, making them poor candidates for separating unwanted compounds from natural gas. The new hybrid version uses a far more stable polymer, abbreviated PMP. Merkel, Freeman, and colleagues are now testing whether their new membranes will separate out unwanted compounds commonly found in natural gas. If so, the hybrid membranes could open the door for energy companies to exploit vast natural gas reserves that currently harbor too many unwanted gases to be useful.

–ROBERT F. SERVICE

CREDITS: (TOP TO BOTTOM) ILLUSTRATION: C. SLAYDEN; BENNY D. FREEMAN/UT-AUSTIN; TOBY TALBOT/AP

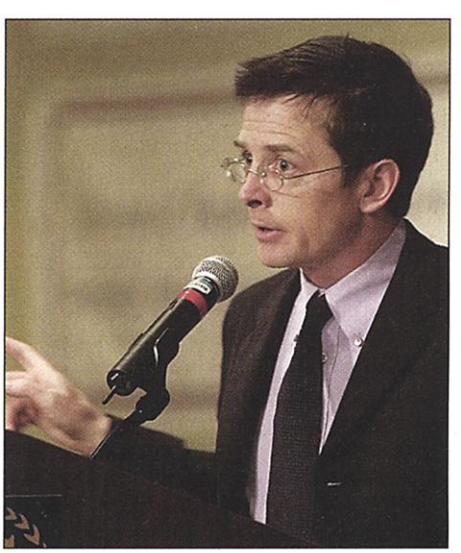
PARKINSON'S DISEASE

Coincidence or Connection?

When actor Michael J. Fox revealed in 1998 that he has Parkinson's disease (PD), it caused a stir: a celebrity in his prime afflicted with a degenerative disorder associated with old age. Now a new twist to the story has emerged, and scientists are debating what, if anything, it means. A Canadian TV documentary has reported that three people who worked with Fox at a TV studio in the late 1970s also have been diagnosed with Parkinson's. One, like Fox, first showed symptoms in her 30s.

The cluster of four cases out of a 125-person production crew may not have a common cause. Indeed, disease clusters often turn into scientific dead ends. But the two instances of the rare early-onset form, in particular, have experts intrigued. "When you start seeing young patients, the odds increase dramatically" that a cluster is not due to chance, says J. William Langston, scientific director of the Parkinson's Institute in Sunnyvale, California.

A handful of PD experts have known about the cluster for roughly a year. It first came to public light in a documentary, "The Parkinson's Enigma," aired last month by Canada's CTV. Fox and the three others had



Cluster conundrum. Three people who worked with Michael J. Fox in the late 1970s also have Parkinson's disease.

worked together in Vancouver, Canada, when the actor was taping the short-lived Canadian Broadcasting Corporation (CBC) sitcom *Leo and Me*. All of the patients except Fox are being treated by PD specialist Donald Calne, former director of the Neurodegenerative Disorders Centre at the University of British Columbia (UBC) in Vancouver.

On the case. Donald Calne thinks an "event" triggered the Fox cluster.

Scientists have long known that PD, characterized by tremors and muscle rigidity, results from cell death in the substantia nigra, a brain region that produces the neurotransmitter dopamine. The vast majority of PD cases, many researchers believe, occur when genetic or environmental factors accelerate a gradual die-off of nigral neurons. Gene mutations are thought to be responsible for many cases of the early-onset form.

Calne and some others, however, argue that a brief environmental exposure, or "event," may kill some neurons in the substantia nigra and damage many others. "As these wounded soldiers die, you start to see symptoms," says Calne, who argues that a toxin or a virus could trigger such a cascade. Calne believes that the Fox cluster fits that hypothesis. All four patients first showed symptoms 7 to 13 years after working together—a lag one would expect to follow an event, he says. In addition, Calne says, "concern has been expressed about the ventilation" in the new, CBC sound-insulated studio they were working in at the time. CBC confirms that it has called in a UBC epidemiologist to examine this concern. To Calne, these facts represent "intriguing straws in the wind that the cause could be viral"—although he cautions that a toxin or other environmental factor is equally plausible.

The explosive mix of Michael J. Fox and speculation about a possible PD virus proved irresistible for many news organizations, including CNN. The coverage has triggered a "deluge" of inquiries, says Langston, who is also chief scientific adviser to the Michael J. Fox Foundation for Parkinson's Research in New York City. The foundation has posted a statement on its Web site, signed by Langston, that plays down a viral link. "Lacking strong scientific evidence, ... the viral theory is not widely held by PD researchers and clinicians," the statement asserts.

The Fox cluster may turn out to be mere coincidence, but neurotoxicologist Peter Spencer of Oregon Health & Science University in Portland says a search for potential toxins or pathogens "should be vigorously pursued. Sure, it could theoretically have been something in the building, but TV crews eat, drink, and perhaps experience other things together." Langston agrees. If you could unravel just one cluster, he says, "boy, you could learn a tremendous amount."

–RICHARD STONE

ENVIRONMENTAL HEALTH

National Tracking Plan Picks Up Speed

Parkinson's disease, autism, childhood leukemia, lupus, asthma: They are all chronic diseases caused by multiple factors—including, some suspect, environmental pollutants. Now an ambitious, $200-million-plus-per-year national plan to ferret out such disease links is gaining momentum among agencies and Congress. At a public meeting last week in Washington, D.C.,* the proposal met with enthusiastic support, although a few participants voiced caveats—such as the need to define environment broadly to include lifestyle factors as well as chemicals.

The Nationwide Health Tracking Network, as it's known, was first proposed as a federal project 2 years ago by a group of environmental health researchers funded by the Pew Charitable Trusts. They wanted to find ways to firm up suspected links between diseases like cancer and pollutants such as heavy metals and pesticides. "We need to move away from speculation about disease to interventions and action," says commission member Lynn Goldman of the Johns Hopkins School of Public Health in Baltimore, former chief of the pesticides office at the U.S. Environmental Protection Agency (EPA).

ELEMENTS OF PROPOSED HEALTH TRACKING NETWORK

National and state tracking of chronic diseases and environmental exposures

Nationwide environmental health rapid response service

National environmental health report

At least five biomonitoring labs; five environmental health centers; an environmental health scholarship program

To do this, the Pew commission proposed that the federal government spend $275 million a year to build or expand mandatory state registries of diseases such as cancer, Parkinson's, and autism. The money would also be used to add more pollutants to databases such as EPA's inventory of chemical releases by industry. It would add more local data and more contaminants to existing exposure studies, such as a Centers for Disease Control and Prevention (CDC) national survey that measures levels of lead and other pollutants in participants' blood. And it would train a corps of experts to investigate whether potential environmental disease outbreaks are linked to the hazard data that has been amassed. The data would be available (with privacy protections) to the public and researchers. But just how the various databases would be connected "is still in evolution," says Shelley Hearne of the Trust for America's Health, a nonprofit in Washington, D.C., promoting the network.

CDC has put its weight behind the plan and received $17.5 million in 2002 as an earmark from Congress. Richard Jackson, head of CDC's National Center for Environmental Health, says the agency will fund pilot projects such as state tracking of immune diseases. The plan has also won the support of lawmakers such as Senator Hillary Rodham Clinton (D–NY), who in March co-introduced a bill to establish a national network that mirrors the Pew report (see table). Clinton says it "will help get to the bottom of" problems such as unusually high cancer rates in Fallon, Nevada, and on Long Island.

At the meeting last week, several participants, who included attorneys and toxicologists, cautioned that environment in the strictest sense could miss the bigger picture, because diet and lifestyle factors such as occupation and smoking are just as likely to contribute to these chronic diseases. "We may miss the actual" trigger if the network assumes that pollutants are to blame, said Carol Henry of the American Chemistry Council, an industry group. Others worried that epidemiology simply can't deliver the kinds of answers policy-makers want, because it may be impossible to pinpoint cause and effect for some diseases. "Some of the promises we're making make me a bit uneasy," said EPA toxicologist Harold Zenick.

At a logistical level, participants also pointed to the difficulty of coordinating activities in at least a half-dozen agencies. Some said that a federal-level committee is needed. "This is a very broad and complex initiative, a very ambitious idea. It's going to take a lot of patience and time, not just one or two symposia," said Sam Wilson, deputy director of the National Institute of Environmental Health Sciences.

Those familiar with the Clinton proposal say it already addresses most of these concerns: For example, it mentions collecting lifestyle data. "It's all been thought of," says Susan Polan of the Trust for America's

CREDITS: (TOP TO BOTTOM) THE MEDIA GROUP/UBC; SOURCE: NATIONAL HEALTH TRACKING ACT OF 2002

* Environmental Health Indicators, sponsored by the Roundtable on Environmental Health Sciences, Research, and Medicine, Institute of Medicine, 10–11 April.