nebular disk in the magnetically driven wind typical of newborn stars. Falling back onto the disk, the droplets became chondrules, which formed the building blocks of both chondrites and terrestrial planets.

Other scientists were unimpressed. Recently, though, the astrophysical X-wind model of chondrule formation has been gaining favor as an explanation of at least some nebular processing, thanks to careful studies of another component of chondrites: so-called calcium-aluminum inclusions (CAIs). They are marble-sized inclusions far rarer than chondrules that were melted like their common cousins before being incorporated into chondrites.

Since Wood delivered his lecture, researchers studying CAIs have found signs of short-lived isotopes of beryllium that point to, and perhaps even require, irradiation by the young sun. In conventional thinking, any radioactive isotope that burned out quickly in the early days of the solar system must have come from outside the nebula. Decay products of short-lived isotopes such as aluminum-26 pointed to a supernova blasting a cloud of stellar debris, salting it with short-lived radioactive isotopes, and collapsing it to form the solar nebula.

But in August 2000, Kevin McKeegan of UCLA, Marc Chaussidon of the Petrographic and Geochemical Research Center in Vandoeuvre lès Nancy, France, and François Robert of the National Museum of Natural History in Paris reported finding traces of now-extinct beryllium-10, with a half-life of 1.5 million years. Beryllium-10 isn't made in stars of any sort; it is made by irradiation, suggesting to many researchers that the X-wind had been at work in the solar nebula.

Now, Chaussidon, Robert, and McKeegan are reporting at meetings that they have good evidence of an even shorter-lived isotope—beryllium-7—in a CAI, which would clinch the case for the X-wind model. "This is fantastically exciting," says cosmochemist Donald Burnett of the California Institute of Technology in Pasadena. "If true, it upsets the apple cart." Most researchers are waiting for more details, but after hearing the group's latest presentation at the Goldschmidt Conference in August in Davos, Switzerland, Halliday "suspect[s] the data are good."

If so, scientists will have some explaining to do. Last month in *Science* (6 September, p. 1678), geochronologist Yuri Amelin of the Geological Survey of Canada in Ottawa and colleagues confirmed the aluminum-26 isotopic clock indication that CAIs formed 1 million to 4 million years before chondrules did. Yet both wound up in the same meteorites. "There's a big puzzle how you can possibly store CAIs for millions of years waiting for chondrules to form," says Shu. Marble-sized bits of rock orbiting in the gas of the solar nebula would have been dragged into the sun within tens of thousands of years, he notes, not millions.

Because of such problems, scientists still don't think that X-winds can account for chondrule formation and that a separate mechanism is required. Dozens of possibilities have been proposed, but recent modeling is supporting a longtime favorite: shock waves coursing through the early solar nebula. The theory had languished while it failed to reproduce the entire geologic history extracted from chondrules. Mineralogical and geochemical evidence showed that chondrules had been heated to 1800 to 2100 K for several minutes and then cooled over several hours. A sufficiently powerful shock wave would do the heating, but for years models weren't keeping chondrules hot for long enough after it passed.

This year, two independently developed models—from Steven Desch of DTM and Harold Connolly of Kingsborough College–City University of New York, Brooklyn, in the February *Meteoritics & Planetary Science* and Fred J. Ciesla and Lon L. Hood of the University of Arizona, Tucson, in the August *Icarus*—solved that problem by showing that shocked and heated gas in the solar nebula could have kept the chondrules hot for a few hours before they radiated away all the heat. Shock is now the leading proposed mechanism for chondrule formation. Now theorists are gearing up to explain where the shock waves came from, which is still an open question. The modeling "could have been done before," says Desch. "I think the problem has been, as John Wood said, there haven't been enough astrophysicists working on this."

Wood himself says that he is delighted with "all the marvelous things that have appeared in the last couple of years." He's even getting back into the meteoritics business after several years of chairing committee reports. Perhaps his rocks will tell him more this time.

–RICHARD A. KERR

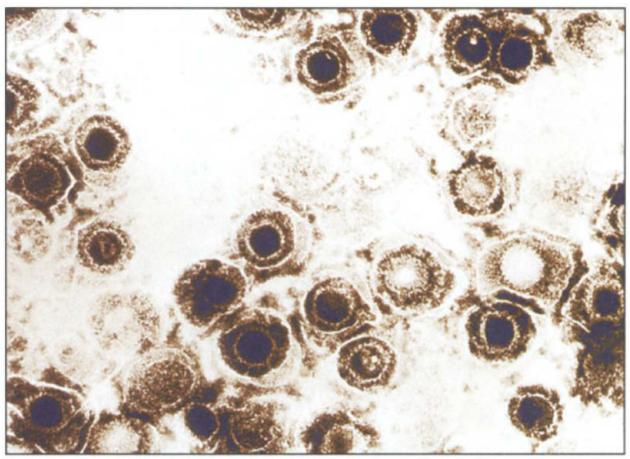
MICROBIOLOGY

# Domino Effects From Battles Against Microbes

**It's not geopolitics, but in the battle of the bugs, strategies of containment and deterrence can tip off unexpected public health consequences**

**SAN DIEGO, CALIFORNIA**—A microbiology megaconference held here last week* made it abundantly clear that invisible dangers lurk everywhere. Antibiotic-resistant bacteria infest hospital catheters, the hands of health care workers, the dirt on supermarket potatoes, and even captive dolphins. Ever more information about how to genetically manipulate microbes could allow terrorists to cause mayhem with bioweapons. And a more mundane threat, nose picking (yes, nose picking), might routinely move dangerous bugs from the skin into the nasal cavity.

But some of the most groundbreaking studies presented at this 4-day meeting—attended by nearly 10,000 researchers and another 2000 exhibitors—emphasized that successes in the eternal battle against microscopic bugs often have far-reaching domino effects. An antiviral medication that eases the symptoms of a sexually transmitted disease might also prevent transmission of the virus that causes it, for instance, as well as transmission of a second, unrelated virus. Another analysis pushed for wider use of the influenza vaccine, arguing that immunizing all infants against the nasty virus could have profound public health benefits. In one negative consequence of widespread vaccinations, however, protecting children against chickenpox might make their grandparents' generation more susceptible to shingles, a painful malady caused by the same virus.



CREDIT: CDC

**Daily dose of prevention.** Valacyclovir inhibits the spread of herpes simplex virus type 2 (above) from infected people to their partners.

* 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, sponsored by the American Society for Microbiology, 27–30 September.

### Halting herpes

According to the U.S. Centers for Disease Control and Prevention (CDC) in Atlanta, herpes simplex virus type 2 (HSV-2) infects about 1 million people each year in the United States. It's a chronic infection, usually genital, that causes periodic blisters and rashes. Researchers estimate that condoms prevent transmission of the virus only about 50% of the time. Some people infected with HSV-2 take antiviral medication to prevent outbreaks, but, until now, the question of whether the drugs also protected infected people's sexual partners from contracting the virus remained up in the air.

A 4-year study that aimed to slow the spread of genital herpes has now provided an answer. The study's principal investigator, infectious-disease specialist Lawrence Corey of the University of Washington, Seattle, explained that the massive study involved 126 sites and recruited 1484 monogamous, heterosexual couples, each of which had one infected partner. All pairs were counseled to use condoms, but fewer than half did. The researchers randomly divided the infected participants into two groups. Some received a placebo, and others received a daily dose of valacyclovir. GlaxoSmithKline, the drug's maker, sponsored the trial.

Treatment cut the transmission of HSV-2 by 50%, Corey's team found. "Unequivocally, it's a breakthrough for many frightened people who have herpes and don't want to infect their partners," said epidemiologist H. Hunter Handsfield, who heads the sexually transmitted disease program for the Seattle & King County Department of Public Health and did not participate in the study. "Although there's a common-sense notion that giving therapy for communicable diseases will help [with] others, it has rarely been documented."

The finding might also lead to a new strategy to thwart the spread of HIV. Several studies have shown that HSV-2 infection makes people much more susceptible to infection with HIV, because sores on their skin ease the AIDS virus's passage into the bloodstream. Reducing the spread of HSV-2 and other diseases that cause open sores "will play a major role in blocking transmission of HIV," said Anthony Fauci, head of the National Institute of Allergy and Infectious Diseases (NIAID). Connie Celum and Anna Wald, who collaborate with Corey at the University of Washington, recently received a $1.3 million grant from NIAID to test this idea, using a cheaper cousin of valacyclovir, in the United States, Peru, Zambia, and Zimbabwe.

### Flu dynamics

Success in protecting against another notorious bug, the influenza virus, has prompted leading researchers to argue that public health recommendations should encourage vaccination of infants. John Modlin, head of pediatrics at Dartmouth Medical School in Hanover, New Hampshire, used data from several studies over the past decade to show that more young children than adults develop serious complications from influenza and end up hospitalized. Current CDC recommendations, however, call for routine immunizations only for adults older than 50 and children at high risk of developing serious disease, such as those with asthma or cardiovascular problems.

Modlin cited studies showing that healthy children under 2 who become infected by influenza virus end up hospitalized more than people in any other age bracket—including those who are 65 and older. He also pointed out that many children at high risk of developing serious complications from influenza go unvaccinated each year and end up hospitalized. Two recently published studies of children with asthma dramatically made this point: In the mid-1990s, 75% or more did not receive the flu vaccine. In contrast, 66% of adults 65 or older received the vaccine in 1999.

**Pox paradox.** Increasing use of the chickenpox vaccine in children may lead to more cases of shingles in the elderly.

CREDIT: CUSTOM MEDICAL STOCK PHOTOGRAPHY

Official CDC vaccine recommendations come from a group that Modlin chairs, the Advisory Committee on Immunization Practices (ACIP). For the upcoming flu season, they changed the vaccination recommendation for children ages 6 months to 23 months to "encouraged when feasible."

After Modlin's talk, pediatrician Ram Yogev of Children's Memorial Hospital in Chicago asked why ACIP had not strongly recommended universal vaccination of children. Modlin explained that it had been "slow to dawn on all of us" that influenza causes as much hospitalization of children as it does, and ACIP had "backed away" from recommending universal vaccination now because of two main obstacles: It remains unclear who would pay for the vaccine, and widescale use further complicates an already complex childhood vaccination schedule.

Both Yogev and Modlin emphasized that vaccinating all children against influenza likely would have many ancillary benefits. In particular, more high-risk children would receive the vaccine, fewer children would transmit the virus to their elderly relatives, and physicians would cut down on prescriptions of antibiotics, which don't fight the flu but are often mistakenly prescribed.

### Generation gap

Vaccinating children does not always benefit adults. On the final day of the meeting, John Edmunds, an epidemiologist at the Communicable Disease Surveillance Centre in London, presented a model suggesting that the success of the chickenpox vaccine might exact a steep tariff. The recently introduced vaccine works so well in children that, paradoxically, it might lead to more cases of shingles, a related form of the disease sometimes called herpes zoster, in adults.

Varicella, the virus that causes chickenpox, stays in a person's body for life. In some elderly people, it reactivates to cause nerve problems and skin blisters. Occasionally the condition is extremely painful and debilitating.

Edmunds explained that recent evidence from studies by his team and others gives "considerable weight" to the longstanding hypothesis that repeated exposure to varicella boosts the immune systems of adults, helping them keep the virus suppressed. His model predicts that as more and more children receive the chickenpox vaccine—which was introduced in the United States in 1995 but is not widely used elsewhere—adults will have less external exposure to the virus and rates of shingles will skyrocket. "This is a serious problem for countries outside of the U.S. considering varicella vaccination," he said.

Edmunds said he has received mixed reactions to his work, and the meeting proved no different. "It was a very interesting presentation and very provocative," said Michael Oxman, a virologist and clinician at the University of California, San

Diego, and the Veterans Administration (VA). But epidemiologist Jane Seward, who heads a CDC division that does surveillance of chickenpox and shingles, stressed that they have yet to see any increase in cases of shingles and questioned some key parameters of Edmunds's model. "It's very early yet," added Seward. "The data from next year will be more important to look at." She added that adults might receive immunological boosts from their own varicella periodically reactivating but not causing disease.

Many researchers suspect that the chickenpox vaccine, if given to adults, might help thwart shingles. The VA has a study under way, headed by Oxman, to evaluate this possibility. The placebo-controlled study will involve 38,000 people, and Oxman said they expect to have the first data in 2004.

Edmunds did emphasize a silver lining. Children who receive the vaccine are less likely to develop shingles, he predicts, because the strain of varicella used in the vaccine is much weaker than the natural virus. Widespread use of the chickenpox vaccine thus should ultimately lead to a decrease in shingles. "It will come down quite dramatically," he said, "after 50 to 60 years."

–JON COHEN

PROFILE DENNY MOORE

# Learning to Speak the Amazon's Languages

**Denny Moore is bringing new linguistic approaches to old, dying languages; the work might elucidate the history of native Amazon Basin peoples**

**THE AMAZON RIVER BASIN**—When Claude Levi-Strauss contacted the Mondé tribe in the Amazon in 1938, he found exactly the kinds of subjects he had been seeking for his research: an isolated tribe not then found in ethnographic literature. But the legendary French anthropologist was so weakened by his journey through the Brazilian outback that he had to give up on properly studying the group he called "my savages." Levi-Strauss did, however, take note of their language, describing it as pleasant. He noted that many words ended with accented syllables: zip, zep, pep, zet, tap, kat. The Mondé, he recounted, peppered their speech with sounds that evoked the clash of cymbals.

More than 60 years later, linguist Denny Moore sits in a ramshackle house in a poor section of Porto Velho. A two-time Amazonian boomtown (first rubber, then mining), the city of 350,000 on the Madeira River has devolved into a sleepy state capital and reputed way station for cocaine. Across a small table, Maria Salomãy sits patiently. Moore, the director of the Amazonian linguistics center at the Goeldi Museum, a leading Brazilian research institute in Belém, tapes Salomãy's halting efforts to recall and articulate words in Mondé. Salomãy forgets most verbs but manages to come up with something for sun, moon, forest, sundry animals, body parts, and household and hunting implements.

One of the last three known semi-speakers of Mondé, Salomãy is older than 60 and hasn't exercised her native tongue in decades. Following a familiar script, the Mondé were plagued with disease, death, and diaspora after coming into contact with Western civilization. Neither of Salomãy's two adult sons speaks a word of the language. "The only existing Mondé tape in the world," announces Moore, pointing to his tape recorder.

The sessions with Salomãy could do more than preserve vestiges of a dying language. By comparing Mondé vocabulary and grammar with that of the languages of other tribes, Moore and his team of researchers hope to reconstruct "Proto-Tupi," the extinct language from which modern Tupian languages like Mondé evolved. Called the Goeldi Comparative Tupi Project, this ambitious endeavor aims to unlock some of the mysteries surrounding the origins of the little-studied native Amazon languages. Because language reveals information about human activities, Moore and his team also hope to dig up clues about the prehistory of a region weak in archaeological evidence.

CREDIT: DENNY MOORE

**Speaker for the dead.** One of the last 10 speakers of Ayuru lifts his arms, sending the spirits of the dead (in a macaw feather) to run errands.

Moore's research might ultimately define the current epoch in linguistic history, predicts anthropologist Michael Silverstein of the University of Chicago. Moore, who grew up in Michigan and earned a Ph.D. at the City University of New York, helps indigenous people preserve their own heritages, unlike many scholars who dash in, gather data, and leave without providing any aid to their informants. In this way, Moore's work "is different not just in terms of consciousness of the languages but also in terms of the self-consciousness of the people who speak them," Silverstein says.

A boxer in college, Moore takes a no-holds-barred approach to protecting the languages and cultures of Amazonian Indians. For 3 decades he's sparred with all comers. He's survived everything from tropical sprue, a rare malady of the small intestine that interferes with the absorption of food, to a murder attempt by a couple of men from a tribe at odds with one he was studying.

For his efforts, Moore won a $365,000 "genius grant" from the MacArthur Foundation in 1999. Although suddenly flush with cash, Moore sticks to a regimen worthy of a graduate student. The 57-year-old scholar recently spent 2 weeks crisscrossing the Amazonian state of Rondônia by bus to seek out informants like Salomãy. One 17-hour leg was marked by the partial collapse of a bridge underneath the bus; later the vehicle ran aground in a gully and nearly capsized. "If I keep my costs down, other researchers at the museum have to watch themselves, too," Moore explains. "They'll be embarrassed if they outspend me."

### Back through time

Snuggled up against landlocked Bolivia, Rondônia state is home to half of the 10 branches of the Tupi language trunk, and most scholars suspect it is the original site of the Tupian people. Moore and a team of Brazilian linguists hope to reconstruct Proto-Tupi using an approach known as diachronic research, which identifies phonological, syntactic, and other features peculiar to a specific