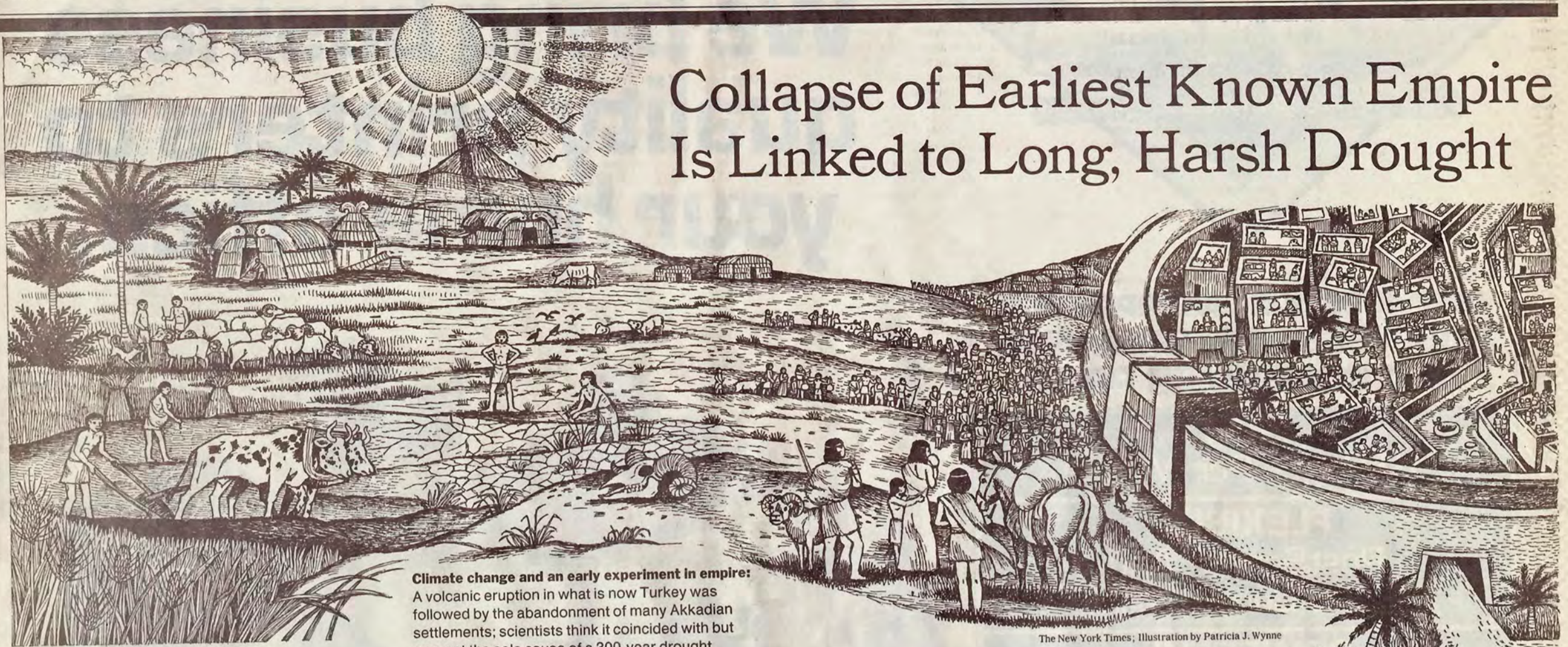


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Climate change and an early experiment in empire:
A volcanic eruption in what is now Turkey was followed by the abandonment of many Akkadian settlements; scientists think it coincided with but was not the sole cause of a 300-year drought.

The New York Times; Illustration by Patricia J. Wynne

Collapse of Earliest Known Empire Is Linked to Long, Harsh Drought

By JOHN NOBLE WILFORD

UNDER the renowned Sargon and his successors, the Akkadians of Mesopotamia forged the world's first empire more than 4,300 years ago. They seized control of cities along the Euphrates River and on the fruitful plains to the north, all in what is now Iraq, Syria and parts of southern Turkey. Then, after only a century of prosperity, the Akkadian empire collapsed abruptly, for reasons that have been lost to history.

The traditional explanation is one of divine retribution. Angered by the hubris of Naram-Sin, Sargon's grandson and most dynamic successor, the gods supposedly unleashed the barbaric Gutians to descend out of the highlands and overwhelm Akkadian towns. More recent and conventional explanations have put the blame on overpopulation, provincial revolt, nomadic incursions or managerial incompetence, though many scholars despaired of ever identifying the root cause of the collapse.

A team of archeologists, geologists and soil scientists has now found evidence that seems to solve the mystery. The Akkadian empire, they suggest, was beset by a 300-year drought and literally dried up. A microscopic analysis of soil moisture at the ruins of Akkadian cities

in the northern farmlands disclosed that the onset of the drought was swift and the consequences severe, beginning about 2200 B.C.

"This is the first time an abrupt climate change has been directly linked to the collapse of a thriving civilization," said Dr. Harvey Weiss, a Yale University archeologist and leader of the American-French research team.

Such a devastating drought would explain the abandonment at that time of Akkadian cities across the northern plain, a puzzling phenomenon observed in archeological excavations. It would also account for the sudden migrations of people to the south, as recorded in texts on clay tablets. These migrations doubled the populations of southern cities, overtaxed food and water supplies, and led to fighting and the fall of the Sargon dynasty.

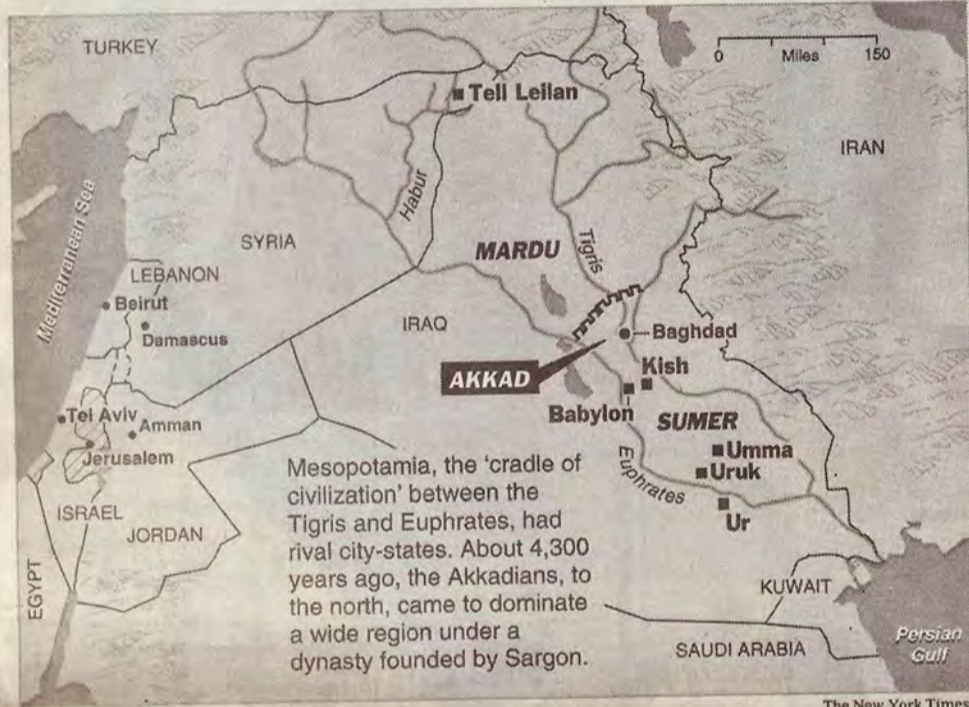
The new findings thus call attention to the role of chance — call it fate, an act of God or simply an unpredictable natural disaster — in the development of human cultures and the rise and fall of civilizations.

Among the drought's refugees were a herding people known as Amorites, characterized by scribes in the city of Ur as "a ravaging people with the instincts of a beast, a people who know not grain" — the ultimate put-down in an economy based on grain agriculture. An 110-mile wall, called the "Repeller of the Amorites," was erected to hold them off. But when

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Migrations to escape privation:
Clay tablets recorded migrations of people to the south, where the influx doubled the population of cities, overtaxed food and water supplies and led to civil unrest, fighting and the fall of the dynasty founded by the Akkadian ruler Sargon. Some of the refugees, a group of migratory herders called Amorites, eventually assumed leadership at the rising city of Babylon, founding a great empire.



The New York Times

Lyme Disease: Does It Really Linger?

Those who claim long-term ailments pose a puzzle.

By ELISABETH ROSENTHAL

FROM her bed at Northern Westchester Hospital Center, Vicki Logan begs to differ with academic scientists who claim that there is no such thing as chronic Lyme infection and that Lyme is cured with at most four weeks of antibiotics.

Since 1987, Ms. Logan has battled headaches, fevers, fatigue, progressive paralysis, seizures, periods of dementia and memory loss so severe that she remembers only the previous three weeks out of the last year. For much of her illness doctors told her she could not possibly have Lyme disease and prescribed no antibiotics.

Two years ago Dr. Kenneth Liegner, a Westchester internist, decided to buck conventional wisdom and try giving her prolonged courses of antibiotics that could kill the Lyme spirochete. She improved somewhat during each course of the drugs, and relapsed when they were stopped. Dr. Liegner became convinced that Ms. Logan had chronic active Lyme infection that could be controlled but not cured through daily drug treatment.

Others, including consultants at the Mayo Clinic, disputed the diagnosis, saying that after months of antibiotics, Ms. Logan — if she ever had Lyme — had certainly been cured. But recently, Dr. Liegner was vindicated: scientists at the Centers for Disease Control and Prevention in Atlanta found the Lyme spirochete, *Borrelia burgdorferi*, swimming in a sample of Ms. Logan's spinal fluid.

"My life prior to the last three weeks is a blank," Ms. Logan said in a halting voice. "I've lost everything and I'll be going to a nursing home when I get out of the hospital. If you think you have Lyme disease, you have to pursue the diagnosis."

A handful of cases like Ms. Logan's are challenging conventional assumptions about Lyme disease and igniting a fiery debate about the usual course of this increasingly common infection: Are disastrous experiences with Lyme like hers the rare exception or the rule?

Most people who are treated shortly after a tick bite tend to recover uneventfully, but a small number go on to develop chronic symptoms which they attribute to Lyme infection despite extensive antibiotic treatment. These patients, who sometimes receive months of home intravenous treatments and experience serious disability, account for the lion's share of the health care dollars spent on the illness. They fill the growing number of Lyme support groups.

And yet doctors are unsure which, if any, of them actually has active Lyme. Many of the country's leading Lyme experts believe that the number is microscopic. "I think persistent infection occurs but it is very, very rare," said Dr. John J. Halperin, professor of neurology at North Shore University Hospital on Long Island. "There are a lot of people being labeled chronic Lyme with very little evidence of it. They don't have Lyme and so they won't respond to a zillion months of antibiotics." Some of the patients' complaints — generally fatigue, joint aches and cognitive problems — may be due to permanent tissue damage from Lyme sustained before antibiotic treatment, Dr. Halperin said, or to some poorly defined

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Seismologists Debate Los Angeles's Faults

By SANDRA BLAKESLEE

BURIED deep beneath the freeways, shopping malls and luxurious homes of Los Angeles there lies a network of faults that could literally turn parts of this city upside down.

The faults are oriented in such a way that should they suddenly snap and produce a large earthquake, energy would be focused upward, moving like rockets fired from millions of submerged submarines. Objects and people directly overhead would be lifted into the air, momentarily weightless, as the earthquake waves shuddered past.

The faults are called blind thrusts. They are "blind" because they do not break through to the surface, and scientists cannot see them directly.

They are thrusts because when they break, one side of the fault moves up over the other at a steep angle, focusing energy toward the surface. Mountains, hills, folds and scarps are formed in the process.

Thrust faults tend to focus energy directly toward the surface, said Dr. David Schwartz, a researcher at the United States Geological Survey in Menlo Park, Calif. If enough energy is released, people and objects overcome the earth's gravitational field and rise into the air. During the 1971 Sylmar earthquake in the San Fernando Valley, earthquake researchers say, a fire truck lifted off the ground inside the firehouse before plopping back down.

On the other hand, the faults may slip gradually so that energy is released upward ever so slowly, giving gentle birth to hills like those that dot the Los Angeles basin. Malibu, Beverly Hills and the Hollywood Hills are all products of blind-

thrust faults.

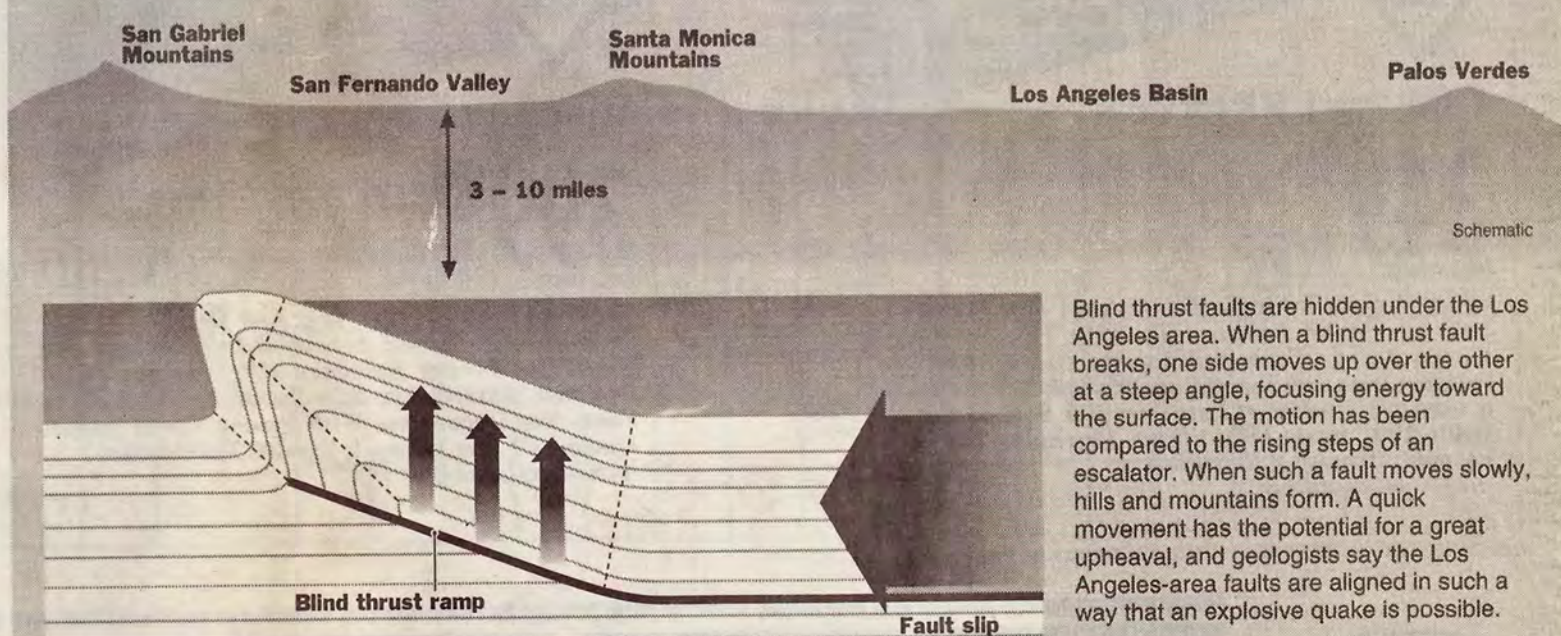
Geologists call it the "Los Angeles earthquake dilemma" and among geophysical problems, it is a big one. Experts agree that there are major faults under the city, but they do not know how dangerous they are, when they last broke and how big an earthquake, if any, they could produce.

So each day for the last couple of years, local scientists have fanned out over the basin in search of answers. They are measuring infinitesimal ground motions, peering into excavations freshly cut for storm sewers and underground parking lots, and examining oil seeps in Malibu and Beverly Hills.

They are also "thumping" surface streets to obtain sonographic images of the earth's crust.

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Escalating Pressure Under California Cities



Blind thrust faults are hidden under the Los Angeles area. When a blind thrust fault breaks, one side moves up over the other at a steep angle, focusing energy toward the surface. The motion has been compared to the rising steps of an escalator. When such a fault moves slowly, hills and mountains form. A quick movement has the potential for a great upheaval, and geologists say the Los Angeles-area faults are aligned in such a way that an explosive quake is possible.

Sources: United States Geological Survey; Scientific American

The New York Times; Illustration by Baden Copeland

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Experts Debate Whether Lyme Can Linger

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immune reaction set off by prior infection. He and many other doctors say they believe that the majority never had Lyme at all.

On the other side are Dr. Liegner and other doctors who say their practices are filled with Lyme patients who do not get better. They say academic experts are so blinded by what they "know" that they cannot see the evidence piling up in front of their eyes.

"I think that Lyme is an incurable disease in many patients — there's no question in my mind about that — and I think that's being suppressed and denied," Dr. Liegner said. "Cases like Vicki Logan's are not exceptions; they reveal the problems with our current paradigm."

The resolution of this scientific question has tremendous implications for patients and has spilled over into economics and politics as well.

Although some doctors prescribe long-term, high-dose intravenous antibiotics, most do not. And many insurers refuse to pay for these long courses, which cost over \$100,000 annually, citing scientists who do not believe that extended therapy is necessary. Politicians at both the state and Federal levels, including the Labor and Human Resources Committee, are holding hearings in part to address patients' complaints that the practice is unfair.

"I think the jury is still out on what chronic Lyme disease is and is not and that has resulted in quite a controversy," said Dr. David Dennis, head of the Lyme disease effort at the C.D.C.

Carl Brenner, a marine geologist who has been unable to work for two years due to the neurologic effects of Lyme, said: "A lot of people aren't getting better. I'm not sure if that's because of persistent infection or not — I happen to think it often is — but I think it's disingenuous for experts to say, you're done, you're cured. Sure, the evidence for persistent infection is anecdotal, but if 100 people tell you that your fly is open, you look down."

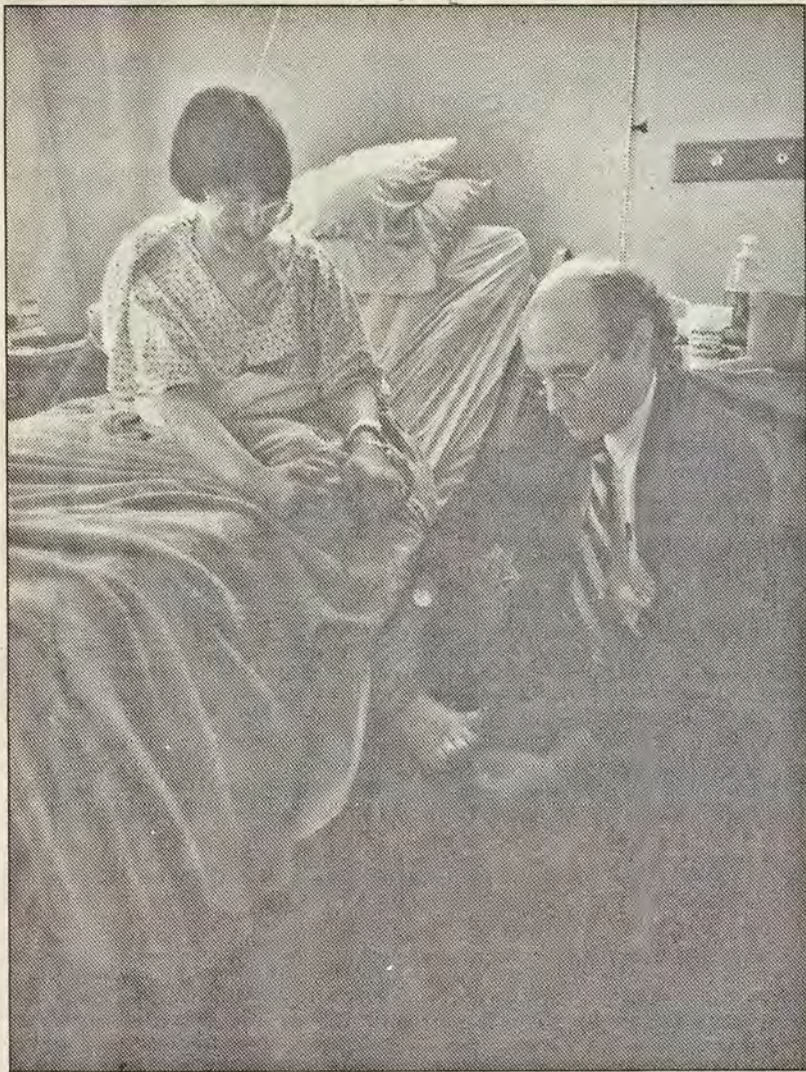
New Diagnostic Tests

The debate will probably eventually be resolved by a number of exquisitely sensitive new tests currently under development to detect the normally hard-to-find spirochete by recognizing its DNA or the proteins on its surface. In studies these probes have discerned traces of the organism in some people who have suffered chronic symptoms but who were told they did not have Lyme or that they had been successfully treated.

While patients' groups are quick to use such results as evidence that chronic Lyme might well be common, the doctors who developed them are a good deal more cautious. They say that the new tests, which are still experimental, are in some cases prone to contamination and in any case may be detecting the remnants of organisms that have already been killed by therapy.

"Clearly this is a research tool which still has to be validated," said Dr. Patricia Coyle, a neurologist at that State University of New York at Stony Brook who has developed a test that detects one of the Lyme organism's proteins. "But we think we are legitimately finding the spirochete in some cases, and we do clearly find it in some patients who say they are having persistent problems. And I do think that means they have viable organisms."

Doctors have long described a subset of Lyme patients whose symptoms are only partly resolved with treatment and another group of patients who seem to get better when on antibiotics but relapse after the medicine is stopped. In a study by Dr. Robert Steere, director of rheumatol-



Joyce Dopkeen/The New York Times

Dr. Kenneth Liegner examining Vicki Logan, who has Lyme disease, at the Northern Westchester Hospital Center in Mount Kisco.

ogy and immunology at Tufts-New England Medical Center in Boston, one-third of patients complained of symptoms after treatment.

Scientists have been unsure what to make of these complaints. Dr. Steere, who identified Lyme disease 15 years ago, does not believe they result from longstanding or relapsing infections. But some prominent researchers have come to believe that at least a few patients with lingering symptoms indeed still harbor the bacterium.

"The issue of post-infectious syndrome is very difficult and I suspect it is a mixed bag," said Dr. Coyle. "Some are due to an immune or inflammatory reactions. But I do think that some are due to persistent infection. I certainly think that relapsing Lyme can happen."

Clues to Prolonged Infection

The Lyme organism is extremely difficult to culture, particularly when the disease is advanced, so doctors are left relying on indirect and imperfect tests to determine if a patient with continuing symptoms is infected. The current Lyme test detects the patient's immune response to the parasite and is prone to false readings. In most cases it is impossible to say with certainty that a patient harbors the bacterium. Even among patients whom all doctors would agree have Lyme infection of the central nervous system — who have a known tick bite, a typical Lyme rash and test positive on all current tests — only 10 percent have spinal fluid samples in which scientists can find the germ.

"In most infectious diseases, you don't diagnose until you identify the organism — which is the *sine qua non* — anything else is inferior," said Dr. Mark Klempner, a Lyme expert at Tufts-New England Medical Center. "But in many cases of Lyme we're stuck. We can't find the bacterium.

Until we have a better diagnostic test that actually finds or measures multiplying bacterium, we're going to have problems knowing which if any of these patients have an ongoing infection and who might benefit from treatment."

Labs working on the new DNA and antigen tests to detect the parasite itself have been deluged with fluid samples from patients with late-stage symptoms but no clear lab results. In some of these cases the tests have come up positive.

Scientists are just beginning to un-

'If you think you have Lyme disease, you have to pursue the diagnosis.'

derstand now, despite treatment, either lingering immune reactions or prolonged infection might occur. Dr. David Nelson and his colleagues at the University of Rhode Island have recently reported that the Lyme spirochete contains a certain type of protein, called HSP60, that is so structurally similar to a protein in human cells that some patients' immune systems can not readily distinguish between the two. When the immune system attempts to identify and destroy the Lyme spirochete, it inadvertently destroys human tissue as well.

Scientists suspect that genetic factors that govern the immune response may explain why some patients with Lyme recover uneventfully without treatment, and others are disabled for life despite antibiotics.

Researchers have come to believe

that chronic Lyme may be difficult to detect and treat because it is caused by a very few free floating organisms that are confined to the joint spaces and central nervous system — sites that many antibiotics do not reach. Recent work in Dr. Klempner's lab has shown that the spirochete may well spend at least part of its life cycle inside cells, where they are similarly protected.

Concerns About Profiteering

Unfortunately, scientific advances have not clarified whether the small number of well-documented cases of chronic Lyme represent anomalies or the tip of a huge iceberg.

Dr. Dennis said: "Is there evidence of persisting infection despite antibiotics? Yes, there are a few case reports. But when you look into it, some didn't have adequate treatment, and there are things about some of these people that make you think they don't have a normal host immune reaction. And like anything in medicine, there are a few outliers."

But Carol Stolow, who runs the Lyme Disease Network of New Jersey, says her hotline is "ringing off the hook" with calls from desperate people with chronic Lyme who are battling insurers and having trouble finding doctors who will prescribe antibiotics. "Until you completely understand this spirochete, don't tell me you know it can be cured in four weeks," said Mrs. Stolow, who has three children who have been treated for chronic Lyme.

There are similarly loud disagreements about how often people who test negative on the standard Lyme antibody tests can nonetheless have Lyme disease. It was because Ms. Logan initially tested negative on this test that she went untreated for years. The newer lab methods have proved that this is possible, but no one is sure how common it is.

Dr. Halperin, whose own lab has uncovered a few such cases using a genetic technique, takes issue with the spin that Lyme activists put on his results. "We all feel that this is very rare, but getting the statistic is like trying to estimate the number of angels on the head of the pin," he said.

He and others worry that while a few people may have chronic Lyme disease, thousands more are being treated for the condition with high — sometimes dangerously high — doses of antibiotics.

"I'm concerned that there are people who are marketing very long courses of antibiotics to treat Lyme without a good prospective study, and I am very concerned about profiteering," said Dr. Klempner.

Hoffmann-Roche Inc., the maker of ceftriaxone, an intravenous drug marketed as Rocephin that is commonly used to treat advanced Lyme, has underwritten teaching videos about Lyme disease featuring doctors who believe in extended treatment. Many of the patient support groups and "grass roots" information networks rely on these companies to underwrite their phones, their faxes, their 800 numbers. On the other hand, some of the doctors who advocate only limited treatment have become paid consultants to insurers.

With the diagnosis of late Lyme generally uncertain, authorities caution that doctors must be rigorous in attempting to prove their case. Dr. Liegner sends specimens to labs all over the country in an effort to properly diagnose his patients. But Dr. Coyle laments that many patients referred to her carrying the diagnosis of chronic Lyme of the central nervous system have had inadequate testing, lacking even spinal taps. She said: "This is a terrible area and people are being treated with prolonged courses of antibiotics without any attempt to find out what's going on."