cus. The lens seems to have formed so soon after the Big Bang that theories of structure formation in the universe don't give it time to come together.

When the quasar system, known as Q2345+007, was first spotted, most researchers thought its lens would be obvious. Separated by 7 seconds of arc, the images are more widely separated than those produced by any other gravitational lens. Deflecting light so sharply would require a vast concentration of mass—an entire cluster of galaxies, which should be easy to spot. But when Tyson and his co-workers took their first crack at the system in 1986, they drew a blank. "That was puzzling. A lot of people looked at the absence of anything big and massive as evidence against the lensing hypothesis," recalls Tyson.

For his latest lens search, Tyson joined with AT&T colleague Philippe Fischer, Gary Bernstein of the University of Arizona, and Puragra Guhathakurta of the Space Telescope Science Institute. To find extremely dim objects that might not have been evident in previous single images, they superimposed 19 different images taken over a period of 10 years. The group then carefully subtracted the light of quasar A from quasar B and vice versa. If these images truly are the same quasar, their light should be equal; any light remaining after the subtraction must come from objects previously obscured by quasar's brightness.

When quasar B was taken out of the picture, a very faint galaxy popped into view about 1 arc second from the center of its image. The team labeled it G1. They also found hints of clusters of distant galaxies in front of the quasar. The researchers placed these objects a similar distance from Earth and began to model these components into a lens. Two models involving G1 and a cluster of galaxies could produce the 7-arc-second separation seen in the images.

If those models are correct, notes Tyson, it means that "one riddle has been replaced by another." The new dilemma is that a compact structure that could provide enough light-bending mass for the lens, more than 10^{13} solar masses, shouldn't have condensed as early in the history of the universe as the models assume. Based on G1's dimness and other clues, Tyson and his colleagues argue that the galaxy and thus the overall lens are a vast distance from Earth: a redshift of 1.49, in astronomers' usual measure of distance. Since looking further away in the universe is like looking back in time, this distance is only a few billion years after the Big Bang.

Most theories of the universe's history have difficulty producing such large concentrations of mass that quickly, says Tyson. The lens, he adds, would be particularly hard to reconcile with a "closed" universe, one that has enough mass to stop expanding eventually; closed universes form structure even later than open universes, he explains. "In any model of the universe, 1.5 would not have been the optimal choice for the redshift of the lens," agrees CFA's Ramesh Narayan.

The only way to settle whether the twin quasars are really lensed may be to detect a "time delay" between brightness changes in the two quasar images, because the light path of one image to Earth should be slightly longer. Since the time lag could be years, it may take another decade to settle the debate over this unlikely pair of quasars.

–**John Travis**

PARASITOLOGY

Mistreating a Long-Time Host

The evolutionary arms race between disease-causing pathogens and their hosts eventually ends in détente—or so scientists have long believed. New aggressors, such as the fungus that attacked Dutch elms in the United States, are particularly vicious at first. But over time, successful parasites are supposed to evolve to become less of a threat. Killing off your host is not only bad manners, but also deadly to the parasite itself. "People have believed that to harm the host is to harm the parasite," says evolutionary biologist Dieter Ebert of the Centre for Population Biology, Imperial College at Silwood Park in England.

But now, on page 1084, Ebert reports a case in which parasites maintain a high level of viciousness towards their long-time hosts, while treating new acquaintances more kindly. In a lab study of a minuscule parasite that infests water fleas in the ponds of Europe, he found that the parasite was most virulent when it came from the same pond as the fleas. But the parasite was more benign towards less familiar water fleas, from more distant ponds.

Ebert's findings support an emerging theory that pathogens can evolve to be either more or less virulent in a long-time host—depending on the way the parasite is transmitted to the host and on the environment in which they live. The findings also bolster results reported last year by Allen Herre of the Smithsonian Tropical Research Institute, who found that a parasitic roundworm that afflicts fig wasps becomes more virulent over time if it can move easily from host to host (*Science*, 5 March 1993, pp. 1402 and 1442). Ebert's discovery "is consistent with the new view that virulence can be maintained in parasites," says Emory University population biologist Bruce Levin, who studies the evolution of bacteria and viruses. "It says niceness and everyone getting along is not a necessary outcome."

T.E. ADAMS/VISUALS UNLIMITED

Familiarity breeds virulence. Long association between a parasite and these water fleas does not make the parasite any more benign.

The unlucky host in this case is a common water flea in Europe, *Daphnia magna*. Some, but not all, of these flea populations have long been plagued by a protozoan called *Pleistophora intestinalis*, which reproduces in the flea's intestines, causing diarrhea. The parasite is spread "horizontally" to other fleas through diarrhea in the pond water. In his lab, Ebert used fleas from England, Germany, and Russia to breed nine distinct uninfected populations. But he only used parasite strains from England. And when Ebert introduced these parasites to each flea population, he found they produced more spores in fleas from English populations to which they were already adopted.

This flies in the face of conventional wisdom that hosts and parasites who have had time to adapt to each other should get along better, says Ebert. Now, it seems that anything is possible: behavior like that of the Dutch elm fungus may actually be the exception, and not the rule. "This is the first time we've shown that any level of virulence may be possible (over time) in an animal where you have purely horizontal transmission," he says. But many studies have shown that when parasites are passed in "vertical" transmission—from parents to offspring—they still appear to evolve to become more benign, Ebert says, because they need a host healthy enough to reproduce and pass them on to the host's progeny.

The implications of these findings are far-reaching, says Ebert. One alarming thought is that the behavior of disease-causing pathogens in humans, such as the virus that causes AIDS, may be even less predictable than previously believed. "Now, the deeper question is under what conditions will natural selection favor greater virulence?" asks Levin. A lot of people not interested in water fleas will be very interested in that answer.

–**Ann Gibbons**