diagram). For example, Lider found that animals who have never been exposed to myelin basic protein can be made tolerant to it by injecting them with CD8 cells taken from animals fed the antigen. New results suggest, Weiner says, that the immune suppressive effects of the CD8 cells are brought about by their releasing transforming growth factor β, a cytokine that inhibits the activity of certain immune cells.

Whitacre, however, has a very different view of how feeding antigens might lead to tolerance. The Ohio State group has not been able to transfer tolerance from antigen-fed to unexposed animals the way the Weiner group has. Whitacre says that this and her other results lead her to believe that oral tolerance results from the specific deletion or inactivation of the immune T cells that respond to the antigen, rather than from the activation of suppressor CD8 cells.

Both groups are looking for ways to explain the discrepancy in their results. Whitacre notes that there are small differences between the way the two groups do their experiments, but she wouldn't expect them to account for the discordant findings. Weiner suggests that perhaps both suppressor cell activation and T cell deletion might be operating in oral tolerance, but even so that wouldn't explain why Whitacre failed to see tolerance transfer.

Whatever the precise mechanisms of oral tolerance, the researchers have been sufficiently encouraged by the animal results to begin human trials. Weiner and Hafler are just winding down one study in which 30 multiple sclerosis patients took a daily capsule of myelin purified from cow brains. (The animals were healthy, Hafler says, and showed no signs of "mad cow disease.") Completing the data collection and analysis will take at least 6 more months, according to Weiner. Meanwhile, David Trentham of Boston's Beth Israel Hospital has begun a preliminary trial of oral collagen in rheumatoid arthritis patients. And Nussenblatt has approval from the Food and Drug Administration to begin a clinical trial of S-antigen feeding in patients with uveitis, which can cause permanent blindness.

It will be interesting to see over the next few years how antigen feeding will compare with the high-tech modes of therapy, several of which are also moving into clinical trials (*Science*, 20 July 1990, p. 246). The oral approach may have a possible advantage over some of the others, since its success does not depend, as theirs does, on an exact identification of the immune cells causing the autoimmunity. If the oral approach does pan out, says Nussenblatt, it would be "astounding that something as simple as this would work." ■ JEAN MARX

Big Squeeze Points to a Big Quake

Quake country does not end at the Oregon-California border, as is commonly assumed. In fact, the latest evidence from the Pacific Northwest suggests that a big one is in the offing. Seismologists have long known that a huge fault runs off the Oregon and Washington coasts that, in theory at least, could unleash devastating earthquakes like those that ravage Japan. But because none has struck since Europeans arrived 200 years ago, many seismologists had presumed that this fault was harmless. Things took a more ominous turn 4 years ago, when geologists uncovered evidence in marshes and mud flats suggesting that large earthquakes did in fact rock the Northwest in prehistoric times.

Now comes an entirely different sort of disquieting evidence. Geodesists measuring minuscule crustal motions report on page 101 of this issue of *Science* that they have direct proof that the fault in the so-called Cascadia subduction zone is storing energy—energy that will presumably be unleashed in future quakes. The next question, for many seismologists, is whether the coming quake will be merely large or huge.

The new evidence for an impending earthquake in the Northwest comes from stunningly precise measurements of the way drifting tectonic plates are squeezing the coast, literally compressing the earth's crust and forcing the coast upward. Previous measurements had errors almost as large as the squeezing that appeared to be occurring, or else the observations had not run long enough to produce credible results. "What is new is that we have a measurement that isn't marginal," says geophysicist James Savage of the U.S. Geological Survey (USGS) in Menlo Park, who along with colleague Michael Lisowski made the new observations.

Savage and Lisowski had the advantage of using highly precise, laser distance-measuring devices called Geodolites that could rapidly detect the squeezing that is deforming the crust. They measured distances between mountaintop markers in a network laid out in Olympic National Park across Puget Sound from Seattle. Being above the tree line gave their instruments a clear view of other markers in the network, allowing measurements of up to 27 kilometers with a standard error of 6 millimeters.

Savage and Lisowski found that between 1982 and 1990, some markers in the Olympics were squeezed closer together by a few millimeters along a line running North 59° East. At the same time, tide gauges showed the coastline rising a few millimeters per year. This crustal compression and coastal uplift suggest an earthquake is in the works, say Savage and Lisowski. And they lay the blame squarely on the Juan de Fuca plate, which slides toward the North American plate before diving under the continent and into the mantle. If the two plates snagged at the offshore fault where the diving plate scrapes by the other, the Juan de Fuca would squeeze the coast as just observed, they note. A snagged fault would eventually rupture in an earthquake.

There just aren't many ways to interpret this and other evidence, says seismologist William Ellsworth of the USGS in Menlo Park. "A very big earthquake is the most likely explanation. When it comes to public policy, you have to go with that."

The worst case scenario, says Thomas Heaton of the USGS in Pasadena, would be the equivalent of the great 1964 Alaska earthquake (magnitude 9.2), but in an area that houses 10 million people, not a few hundred thousand. The slow rolling of the ground in Seattle and Portland would go on for 3 minutes, with "quite a bit of damage." Even if the 1200 kilometers of fault broke apart section by section in a series of smaller, magnitude 8 quakes, the Northwest would reel for a full minute after each rupture.

On the positive side, there could be a long wait for the next big one. The geologic evidence suggests that earthquakes recur roughly every 500 or 600 years and that the most recent was about 300 years ago. That could, with luck, leave a couple of centuries to prepare for a megaquake in the Northwest. ■ RICHARD A. KERR