In a separate March 10 CELL report, Keating's team showed that a different gene, this one on chromosome 3, can also underlie long QT syndrome. This gene, called SCN5A, encodes a sodium ion channel, another regulatory protein on the surface of heart cells.

However, this gene's protein product appears to work as an accelerator. A mutant sodium channel thus gives heart cells an accelerator that is stuck in the "on" position, Keating says. This defect can also predispose people to develop a heart rhythm that can cause death within seconds.

The researchers describe a small mutation in SCN5A that appears in two families with this disorder.

Taken together, the flaws in HERG and SCN5A account for about 75 percent of all cases of long QT syndrome, the researchers believe.

Still other genes probably contribute to this disorder. Keating's group continues to search chromosome 11 for another such gene — to no avail, so far.

The present discovery bodes well for people who know this disorder runs in their family, comments Robert Roberts at the Baylor College of Medicine in Houston. Many people with one of these genes go undiagnosed because they have normal-looking cardiograms. Researchers can now test the blood of individuals who have a family history of sudden death or fainting spells to see if they carry either of these mutant genes, says Roberts, a specialist in the molecular biology of the cardiovascular system. If so, doctors can start targeted treatment to counter the genetic flaw.

Hopefully, Roberts says, such therapy will prevent episodes of a runaway heart — and death. — *K. Fackelmann*

Enzyme helps microorganism thrive in heat

Beneath southern Italy's sparkling Mediterranean waters dwell some bizarre life-forms. Beside thermal seafloor vents, a primitive microorganism, the bacteria-like archaeon, basks amid hot springs. Percolating up from Earth's interior, hot, sulfurous water spews forth from seafloor cracks, providing a rich environment for these organisms.

These tiny creatures use sulfur the way we use oxygen and thrive in tremendous heat.

Among them one finds *Pyrococcus furiosus,* which enjoys temperatures around 100°C. Since discovering them, scientists have puzzled over how the microorganisms can stand the heat. What special proteins or enzymes enable them to thrive in this hostile environment? And what keeps their key biological molecules from collapsing or breaking up at temperatures that would destroy those of conventional bacteria?

Delving into this question, Michael K. Chan, a chemist at the California Institute of Technology in Pasadena, and his colleagues report their determination of the structure of one of the bacterium's unusual enzymes, aldehyde ferredoxin oxidoreductase (AOR). Playing a fundamental role in the transfer of energy within the speck-sized organism, the enzyme helps it to flourish at extreme temperatures.

Using X-ray crystallography, the researchers found that the protein consists of two big pieces joined together, each containing a cluster of iron and sulfur atoms. Each piece also has a region containing tungsten and molybdenum, the team reports in the March 10 SCIENCE.

"Since most organisms can't tolerate this kind of heat, we're interested in how life can exist at such high temperatures, as well as the problem of how proteins remain stable and function in such heat," says coauthor Douglas C. Rees, a Caltech chemist. "We also want to know exactly what role tungsten and molybdenum play in this protein. It's not yet clear why they're there or exactly how they're used."

The Caltech team has also observed some unusual features of the AOR enzyme. Compared to other proteins, it has relatively little exposed surface area and an abundance of ions and atoms buried in its core. In addition, the enzyme's tungsten and molybdenum portions appear to help the organism use carbon, nitrogen, and sulfur more efficiently than it otherwise could.


Rees/SCIENCE

The AOR protein.

"By analyzing many of these proteins, we hope to find why they're stable at high temperatures," says Rees. "This could be useful for engineering other proteins and have a technological impact." — *R. Lipkin*

Atmospheric moisture: A warming sign?

The stratosphere at midlatitudes in the Northern Hemisphere has grown wetter over the last 14 years, report scientists at the National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colo. They argue that the change may result in part from global warming.

NOAA researchers Samuel J. Oltmans and David J. Hofmann describe in the March 9 NATURE their measurements of water vapor content in the skies above Boulder. Their findings add to "concerns about the buildup of greenhouse gases and their effects on atmospheric chemistry, as well as climate," they say.

Atmospheric researchers believe that additional water vapor in the normally very dry stratosphere can aggravate destruction of the ozone layer and amplify global warming by trapping heat.

Every month, NOAA scientists at Boulder launch balloons carrying instruments to heights of 14 to 26 kilometers to measure water vapor in the lower stratosphere. Between 1981 and 1994, their data show a statistically significant increase in moisture. At an altitude of 18 kilometers, water vapor content climbed 8.4 percent per decade. At higher altitudes, it increased more slowly.

Although they have made measurements in only one spot, Oltmans and Hofmann believe their data are representative of Northern Hemisphere midlatitudes because water vapor concentrations do not vary as much in the stratosphere as they do in the lower atmosphere. Measurements made by NASA's SAGE II satellite support that conclusion, showing that the seasonal rise and fall of water vapor concentrations over Boulder match those at similar latitudes around the world.

Much of the additional water vapor in the stratosphere derives from methane molecules that filter up and react with oxygen to form water vapor, suggest Oltmans and Hofmann. Atmospheric methane has risen markedly in recent decades, partly because of human activities.

But methane alone cannot explain all the extra water vapor, especially at altitudes of less than 20 kilometers, say Oltmans and Hofmann. They suggest that some of the water vapor comes from increasing moisture in the lower atmosphere due to global warming. Theory predicts that warming of Earth's surface should increase evaporation from the oceans and make the atmosphere wetter.

Chemist Donald R. Blake of the University of California, Irvine, agrees that methane cannot account for the entire measured increase in stratospheric water vapor. Yet he notes that the global warming explanation remains speculation. Whatever the source, increasing moisture in the stratosphere can harm the ozone layer by stimulating the growth of polar clouds, which help pollutants destroy ozone.— *R. Monastersky*