Is alcohol the key to the French paradox?

A compound resulting from the normal metabolism of alcohol may explain why having a drink or two each day lowers the risk of heart disease. Researchers now have evidence that the chemical, acetaldehyde, interrupts a harmful cascade of reactions that lead to blood vessel damage.

Yousef Al-Abed of the Picower Institute for Medical Research in Manhasset, N.Y., described the study last week at a meeting of the American Chemical Society in New Orleans.

The observation that moderate alcohol consumption can protect against heart disease is the basis for what is known as the French paradox: Despite a typical diet rich in fat, France doesn't seem to have as high a rate of heart disease as the United States. The difference may be that the French consume more red wine.

Researchers have tried to determine which chemical in wine might be responsible. Some studies single out antioxidants called flavonoids (SN: 10/30/93, p. 278), but others focus on the alcohol, since beer and liquor also appear to reduce heart attack risk (SN: 12/2/95, p. 380).

Al-Abed and his colleagues looked at the effect of alcohol on the Maillard reaction, which occurs in the body when a sugar links up with a protein. These sugar-protein molecules are known as Amadori products. Weeks or months after forming, these molecules break up and rearrange their parts to form a wide variety of compounds called advanced glycation end products, or AGEs.

The compounds go on to cause cardiovascular damage—for example, by cross-linking proteins in arterial walls, making them less elastic. Studies have also implicated AGEs in triggering complications associated with diabetes, such as blood vessel damage in the eyes and kidneys.

Al-Abed notes that scientists have identified at least two dozen AGEs.

In their latest study, the Picower group found that acetaldehyde from alcohol might stop the formation of AGEs. Al-Abed and his colleagues determined that in the test tube, acetaldehyde can react with the Amadori product made when the sugar glucose links to hemoglobin, the iron-carrying protein in red blood cells.

"The Amadori product is a very flexible molecule. It can open or close," explains Al-Abed. "The closed form is not dangerous, but the open form can react. Acetaldehyde stabilizes the unreactive [closed] form of the Amadori product," preventing it from forming AGEs, he says.

By studying rats that had been treated with a drug to make them diabetic, the researchers also found evidence that acetaldehyde helps prevent the formation of AGEs. Diabetic rats fed alcohol produced half as much of the AGEs as rats fed no alcohol.

Acetaldehyde's bad reputation makes it "a provocative answer to the French paradox," notes Raja G. Khalifah of the University of Kansas Medical Center in Kansas City. "Acetaldehyde is a very nasty chemical," he says. "It reacts with many things, not just Amadori products."

Khalifah cautions that acetaldehyde's reactivity makes it difficult to determine whether the compound stops AGE formation in rats by interfering with an Amadori product. "It's possible that . . . it may proceed through other mechanisms," he says.

Khalifah cites the example of aminoguanidine, an experimental diabetes drug that researchers thought was blocking AGE production by forming complexes with Amadori products. "Subsequent studies could not show that that's what's actually happening in vivo," says Khalifah.

Now, scientists suspect that aminoguanidine acts on compounds created in the later stages of AGE synthesis, after the Amadori products fragment. The drug is currently being tested on people without much success, says Al-Abed.

He says that his group's research may lead to new compounds that disable Amadori products without the harmful effects of acetaldehyde. —*C. Wu*

Weather balloons deflate climate blow-up

Measurements made with weather balloons may cool a debate raging among climate scientists over the degree of global warming. A new study suggests that the past 20 years have been a climatologically curious time, when Earth's surface and the lower atmosphere have warmed at different rates.

Researchers first caught wind of the difference several years ago while analyzing atmospheric temperatures taken by a series of satellite instruments called the Microwave Sounding Unit (MSU). The MSU data seemed to indicate that temperatures several thousand meters above the surface were falling even as weather station readings showed a significant warming at ground level. In recent years, researchers have questioned the reliability of both data sets, especially the satellite record, which reaches back only to 1979 (SN: 8/15/98, p. 100).

"This caused quite a controversy because the people who don't believe in global warming use any data which doesn't show it, such as the MSU data," says James K. Angell of the National Oceanic and Atmospheric Administration in Silver Spring, Md. "The other people, who are in the majority, feel there is evidence for a warming based on the surface data," he adds.

"I seem to be bridging the gap here and saying that they may both be basically correct," says Angell, who reports his results in the Sept. 1 GEOPHYSICAL RESEARCH LETTERS.


Robert Thompson/National Weather Service

A weather balloon being launched.

Angell analyzed twice-daily temperature measurements made at 63 sites around the globe since 1958. He compared readings taken at the surface with balloon data giving an average tropospheric temperature, representing conditions between about 1,500 and 9,000 meters above the ground.

Over the entire 41-year period, the surface temperatures climbed at a rate of 0.14°C per decade, while the atmosphere warmed at 0.10°C per decade. The rates are roughly equal, given the wide range of uncertainty, says Angell.

Since 1979—the period during which satellites have collected data—the surface and atmosphere have behaved quite differently, according to Angell. The surface has warmed at a rate of 0.15°C per decade, while the lower atmosphere temperatures have increased only 0.04°C per decade.

"This is extremely consistent with what we have seen," says John R. Christy of the University of Alabama in Huntsville, who analyzes the MSU data. Christy attributes the discrepancy between surface and troposphere to a series of climate-disrupting episodes. "We're talking about a 20-year period that had very unusual events: two of the largest El Niños of this century and two volcanic eruptions that are the largest of this century," he says. "The surface and the troposphere respond to these things differently."

Over several decades, Christy predicts, the two trends will realign themselves.

Even as it supports the satellite data, the new study also bolsters the surface data that have come under attack from greenhouse skeptics. "One of the things that bothers me is that people were using the MSU data to say that the surface isn't warming," says Frank J. Wentz of Remote Sensing Systems in Santa Rosa, Calif. "Clearly, the surface is warming," says Wentz, a member of a National Research Council committee examining the difference between surface and satellite data. —*R. Monastersky*