Excess Iron Linked to Heart Disease

High levels of iron stored in the body may boost the risk of heart disease, according to a new study by a team of Finnish researchers. In fact, stored iron may prove a more significant risk factor for coronary disease than total blood cholesterol levels, they say.

The new study, published in the September CIRCULATION, provides the first empirical evidence for this theory. "It is the first time that iron stores have been looked at as a risk factor," comments Jerome L. Sullivan of the Medical University of South Carolina in Charleston. Sullivan first proposed the iron and heart disease hypothesis more than a decade ago.

Basil Rifkind of the National Heart, Lung, and Blood Institute calls the Finnish findings "interesting." He points out, however, that this is the first time scientists have shown a link between iron stores and heart disease. Other researchers must confirm the finding before public health experts can make any recommendations to reduce iron stores, he adds.

Epidemiologist Jukka T. Salonen of the University of Kuopio and his Finnish colleagues focused on 1,931 middle-aged men who showed no sign of heart disease at the study's start in 1984. The researchers drew blood to test for stored iron and cholesterol and asked the men about other risk factors for heart disease. The team then estimated dietary iron intake by asking the men to record their food choices during a four-day period.

After adjustment for risk factors such as cholesterol, the data revealed that men with high concentrations of ferritin in their blood (more than 200 micrograms per liter) were twice as likely to suffer a heart attack as men with lower ferritin values. Ferritin is a molecule that stores iron in the blood and other parts of the body. The researchers found that every 1 percent increase in blood ferritin was associated with a more than 4 percent rise in the risk of heart attack.

Men who typically ate iron-rich foods faced a higher likelihood of heart attack than did those who had an iron-poor diet, Salonen says. Red meats, which also contain a lot of fat, are rich in iron.

There's no doubt that iron-depleted blood can cause anemia, a medical disorder that can result in fatigue. But Sullivan and Salonen propose that, although people need a trace amount of iron in their diet to remain healthy, too much iron can promote the formation of free radicals.

Free radicals may injure the cells lining artery walls and damage heart muscle, Sullivan says. Free radicals may also lead to the formation of a dangerous type of cholesterol known as oxidized low-density lipoprotein (LDL). Scientists believe that oxidized LDL cholesterol is more likely than nonoxidized LDL to stick to artery walls and thus to trigger the buildup of fatty plaque that can clog arteries and lead to heart attacks.

The iron theory may help explain the mysterious gender gap in heart disease rates. Cardiologists have long noticed that premenopausal women remain largely protected from the ravages of heart disease, whereas men start suffering heart attacks in their forties. Many scientists believe the sex hormone estrogen helps women ward off heart disease until menopause, when the production of estrogen tapers off and heart attack rates go up.

Sullivan remembers puzzling over that gender gap during his medical training. At the same time, he was studying normal iron metabolism. "When I saw those curves for iron acquisition in men and women, I really had a eureka moment," he says, noting that men build up iron stores steadily, while women don't start accumulating iron until menopause.

Sullivan thinks that young women are shielded from heart disease because they lose iron every month during menstruation. After menopause, the stored iron in a woman's body builds up rapidly – and women's advantage in terms of heart disease gradually disappears, he adds.

The iron theory might also explain why aspirin and fish oil help protect people from heart attacks, Sullivan adds. He notes that both substances may increase chronic blood loss through minor bleeding and thus loss of iron.

The findings, if confirmed, could force public health experts to rethink dietary recommendations for iron ingestion. Even normal levels of stored iron may prove damaging, Sullivan says. Over-the-counter vitamin supplements often contain iron, as do some enriched foods such as cereals, he notes.

Sullivan offers a few simple solutions for people worried about the iron-heart disease connection. "I think we can say that adults should avoid iron supplements unless they have iron-deficiency anemia," Sullivan says. "Also, I think people should consider blood donation."

– K.A. Fackelmann

UV hazard: Ozone lost versus ozone gained

Living amid polluted air can cause serious health problems, especially for the elderly and asthma sufferers. But bad air also has its good side. Measurements in New Zealand and Germany reveal that a polluted environment can provide significant protection against the harmful ultraviolet (UV) radiation streaming through Earth's damaged ozone layer.

"We found unexpected, big differences in the UV radiation at the two sites," New Zealand and Germany, says Gunther Seckmeyer, an atmospheric scientist with the Institute for Biochemical Plant Pathology in Neuherberg, Germany. Levels of UV light were nearly twice as high in the relatively clean air of New Zealand as in the more polluted air of Germany, report Seckmeyer and Richard L. McKenzie of the National Institute of Water and Atmospheric Research, Ltd., in Omakau, New Zealand.

UV light from the sun can cause skin cancers and cataracts and can lower immunity to diseases. The ozone layer in Earth's stratosphere filters out most of this harmful radiation, but scientists warn that UV levels will climb as human-made chemicals thin the ozone layer.

In the last several years, satellite and ground-based instruments have detected significant thinning of stratospheric ozone over much of the world. However, it is not clear how UV levels at Earth's surface have changed, because no worldwide measurement network exists.

Reports from limited regions differ on whether UV levels have risen. While measurements in the Alps show a strengthening in UV intensity, those in the United States show a weakening, causing some to wonder whether pollution masks the loss of stratospheric ozone. (SN: 2/20/88, p.119; 4/14/90, p.228).

In their study, Seckmeyer and McKenzie compared UV levels during cloud-free days in New Zealand at 45 degrees south latitude and in Germany at 48 degrees north latitude. By using the same spectroradiometer in both locations, the researchers eliminated errors caused by comparing data from two instruments.

Seckmeyer and McKenzie found that on a summer day at each site, DNA-damaging wavelengths of UV were 90 percent higher in New Zealand, while wavelengths capable of producing sunburn were 60 percent higher there. Although many factors can control the amount of UV light reaching the surface, analysis of the light's strength at various wavelengths indicates that ozone differences accounted for the big discrepancy between the two sites. Wavelengths of light not affected by ozone were virtually the same at the two sites.

To examine whether the UV levels on the days studied were typical of an entire summer, the researchers used a model to calculate average UV levels on the basis

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of such factors as ozone amount, latitude, and weather variables. The calculations suggest that DNA-damaging wavelengths of UV light were 81 percent stronger and sunburn-producing wavelengths were 44 percent stronger in New Zealand, they report in the Sept. 10 NATURE. The researchers say they had not expected such a large hemispheric difference.

Ozone measurements for the two regions indicate that the air over the New Zealand station had roughly 15 percent less ozone than did air over the German station. Instruments carried by balloons reveal two separate causes underlying that difference. In the troposphere, or lower atmosphere, Germany has much higher levels of ozone pollution; this accounts for about half the total ozone difference between the two sites. The rest stems from inequities in the stratosphere, where Germany also has greater concentrations of ozone.

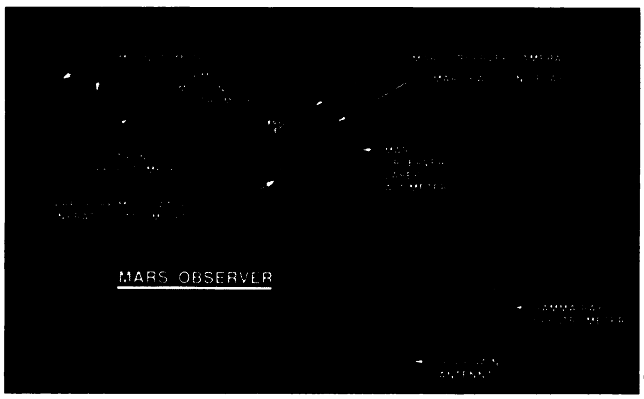
To explain the stratospheric discrepancy, Seckmeyer notes that New Zealand lies close to Antarctica, where vast amounts of ozone are destroyed each September during the formation of the ozone hole. Indeed, ozone levels in Antarctica are currently dropping at a record rate, suggesting that this year's ozone hole will be particularly severe. When the hole breaks up during October and November, pockets of ozone-depleted air drift northward and mix with air over New Zealand and other regions in the southern hemisphere.

The same chemicals that cause the ozone hole also eat away at the global ozone layer. But so far, increases in tropospheric ozone pollution at the German site have largely offset the stratospheric loss there, the researchers say.

UV levels in Germany and other industrialized countries might actually be lower today than they were in preindustrial times, says Sasha Madronich of the National Center for Atmospheric Research in Boulder, Colo. Aside from considerable tropospheric ozone pollution, these regions also suffer from sulfuric acid haze, another factor that filters out UV light, says Madronich.

In a recent study, Madronich and colleagues calculate that the haze factor alone should have reduced UV levels by 5 to 18 percent in rural parts of industrialized countries (SN: 1/4/92, p.5). As nations begin to reduce air pollution, the cleaner skies will combine with stratospheric ozone loss, permitting more ultraviolet radiation to reach the surface, Madronich says. *– R. Monastersky*

Mars Observer: Return to the Red Planet



NASA

Mars Observer and its instruments

Global dust storms, boulder-strewn terrain, a landscape scarred by ancient channels – these images of Mars were made familiar by the spacecraft that flew past, orbited, or landed on the planet in the 1960s and 1970s. Yet explorers such as the Mariner fleet of spacecraft and the 1976 Viking missions mapped in detail only 15 percent of the surface of Mars, the most Earth-like body in the solar system.

Now, for the first time in 17 years, a U.S. craft will again journey to the Red Planet. Scheduled for launch Sept. 25, the Mars Observer comes equipped with an arsenal of seven scientific instruments that emphasize geology and climate studies over biology. The Observer "will map parts of Mars better than we have mapped parts of Earth," says program scientist Bevan M. French at NASA headquarters in Washington, D.C.

Intended to pave the way for future human and robotic explorations of Mars, the $511 million craft will reach the planet next August. For at least one Martian year (687 Earth days), it will circle the planet every 118 minutes in a polar orbit 378 kilometers above the surface. And in so doing, the craft will gather information about the composition, volcanic activity, and atmosphere of Mars that has eluded planetary scientists for decades, French adds.

For example, one of the craft's detectors may settle the debate over whether Mars has a magnetic field. Even a weak field would indicate that the planet still has a partially liquid core, an apparent prerequisite for generating magnetic activity, French says. In addition to hunting for an active field, the mission's magnetometer/electron reflectometer will search for remnants of an extinct field. If Martian rocks retain some residual magnetism from an ancient field, that magnetism may reverse the path of solar-wind electrons heading toward the planet.

Two instruments will attempt to unveil the chemical composition of the Martian surface. A gamma ray spectrometer will measure radiation emitted by the nuclei of atoms, identifying the elements contained in soil and rocks. Another detector, the thermal emission spectrometer, will examine infrared emissions from the surface to determine its mineral content and the layering of ice and dust. This spectrometer can also detect infrared radiation emitted during the dust storms that sometimes engulf the planet.

The craft will take the sharpest pictures ever recorded from a Martian orbit. Two pairs of fish-eye lenses will offer 140-degree views of the planet, resolving horizon features as small as 2 kilometers across and indicating changes in weather patterns. Using another set of optics, the camera system will also take narrow, ultra-sharp pictures of the Martian surface with a resolution better than 3 meters across. Because of the huge amounts of data involved, scientists will take high-resolution images sparingly, homing in on ice caps, volcanos, and channels.

Bouncing infrared laser light off the planet, the craft will determine the heights of volcanos, highlands, and other surface features to within a few meters. Such measurements can help scientists map the planet's gravitational field. Radio signals beamed from the craft to Earth will also probe Martian gravity. When the craft passes by a portion of the planet that has a relatively higher mass density, it will speed up slightly, shifting the frequency of the radio signal received on Earth.

By sending radio signals through the atmosphere, scientists also can determine the electron density and temperature of different layers. Another device, the pressure modulator infrared radiometer, will examine the atmosphere below the craft and off to the horizon. This detector will measure temperature, the composition of Martian clouds, pressure, water vapor, and dust concentrations.

If, as expected, the craft lasts longer than its three-year design lifetime, it may play a unique role as the main communications link between Earth and the next explorer to visit Mars. A Russian craft known as Mars 1994, scheduled for launch in two years, will release several surface probes as it enters its Martian orbit in 1995. Mars Observer would relay signals from those probes back to Earth. *– R. Cowen*