

Health is a state of complete physical, mental, and social well-being,
and not merely the absence of disease or infirmity.

Preamble to the Constitution
of the World Health Organization

OCCUPATIONAL HEALTH

Agriculture-COPD Link Bolstered

Smoking is typically considered the cause of 80–90% of chronic obstructive pulmonary disease (COPD) cases, but another significant known source is occupational exposure. Among the suspect occupations is farming, for which there has long been limited evidence of a risk for various respiratory diseases, including COPD. That link has been bolstered by an Austrian study, based on clinical evidence, published in the June 2007 issue of the *American Journal of Industrial Medicine*.

“This is really the first study that shows a clear association confirming the agricultural risk,” says Alfred Munzer, director of pulmonary medicine at Washington Adventist Hospital in Takoma Park, Maryland, who did not participate in the study. Other studies have generally been much smaller or observational, he adds.

Lead author Bernd Lamprecht, a pulmonologist at Paracelsus Medical University in Salzburg, says this is the first population-based study to evaluate COPD on the basis of measured postbronchodilator lung function, in combination with questionnaire data on occupational exposure. In the study, the team evaluated 1,258 Salzburg-area residents aged 40 and older, and found that 23% had any type of farming experience (farms in the area tend to be small, with a mix of various crops and animals). Substantially fewer farmers (46.2%) than nonfarmers (54.6%) were current or former smokers. But 30% of the farmers had at least mild COPD, as determined by spirometer measurements of lung function before and after

inhalation of a bronchodilator drug, compared with 22% of the nonfarmers. Using criteria for more severe COPD, the relative difference was even greater, with 14% of farmers and 8% of nonfarmers impaired. For mild COPD, the differences began showing up at about age 50, and held beyond age 80; corresponding data for more severe COPD were not reported.

The authors acknowledge numerous limitations of their study, such as the lack of information on the type, duration, and intensity of exposures for the farmers, the limited range in geography and farm type, and the lack of long-term spirometry data for the study subjects. They could not

speculate on what exposures may have caused the elevated COPD, but note that other studies have linked agricultural dusts with various respiratory problems.

Another important consideration is that the method of classifying COPD used in the study is relatively new and has not been validated against the methods historically used to apply a COPD diagnosis, says Neil Schachter, a professor of medicine in pulmonary and critical care at Mount Sinai Medical Center. The new criteria were developed by the WHO and the National Heart, Lung, and Blood Institute through their Global Initiative for Chronic Obstructive Lung Disease (GOLD) and

were released in 2001. The criteria are designed to provide more rigorous guidelines for a COPD diagnosis, putting substantial emphasis on spirometry results and relying less on patient history, symptoms, other tests, and a doctor’s judgment, as has been the case to date.

Schachter points out that 5% of all the study subjects, both farmer and nonfarmer, reported having a doctor’s diagnosis of COPD, which is far lower than the 30% and 22% numbers reported by Lamprecht’s team. This finding highlights the long-running controversy over how to diagnose COPD, and what specific disease labels—such as emphysema, chronic bronchitis, some forms of asthma, and hypersensitivity pneumonitis—should be included under the COPD umbrella.

Nonetheless, with COPD the fourth leading killer worldwide, identifying the causes of this disease is an important task. The limitations of the Austrian study need to be addressed, but Schachter says, “I think they found a real phenomenon: farmers are a high-risk category.” —**Bob Weinhold**



Soil risk? Exposure to mineral dusts stirred up by working the soil could contribute to COPD, a progressive disease characterized by limited airflow, chronic cough, and increased bronchial mucus secretion.

José Miguel Ferreira/Shutterstock

DIET AND NUTRITION

Temperance in Green Tea

Throughout China and Japan, green tea is considered a staple beverage. Many epidemiologic studies have linked frequent tea intake with a lower incidence of cancer, cardiovascular disease, and neurodegenerative disorders. Consumer interest in the tea's



Did you know? Field workers pluck only two leaves and a bud (shown above) during the thrice-yearly tea harvest. To make green tea, leaves of the *Camellia sinensis* plant are specially processed to prevent oxidation. Black, oolong, and white teas are made from the same plant, just using different processes.

health benefits has led to the inclusion of green tea extracts in multivitamins and other dietary supplements. But too much of a good thing could prove harmful, according to a review in the April 2007 issue of *Chemical Research in Toxicology* that analyzed the toxic potential of green tea polyphenols.

Currently there are no published epidemiologic studies on the toxicity of green tea supplements. But laboratory research with both rodents and dogs has shown that high doses of the most heavily studied green tea polyphenol, (-)-epigallocatechin-3-gallate (EGCG), cause liver, kidney, and gastrointestinal toxicities.

Case reports on the toxic effects of green tea extracts in humans are also beginning to emerge. "To date, there have been nine anecdotal case reports of liver toxicity in humans associated with consumption of high doses [700–2,000 mg/day] of green tea from dietary supplements," says lead author Joshua Lambert, an assistant research professor in the Department of Chemical Biology at Rutgers University. "In some cases, the subject stopped taking the supplement and the symptoms resolved, and then the subject started taking the supplement again and liver toxicity returned." Such

observations, albeit anecdotal, suggest that green tea supplements are not without risk.

Cell culture studies have shown that EGCG can cause oxidative stress, although these data now need to be confirmed in animal models. The Rutgers team speculates that some susceptible individuals may carry a particular polymorphism of the gene that codes catecholamine-*o*-methyltransferase, an enzyme critical to the protection of cells against EGCG-mediated oxidative stress and hepatotoxicity. About a quarter of the population have a polymorphism that is associated with low activity of this enzyme. "This is just a hypothesis that we are testing," says coauthor Chung S. Yang, a chemical biology professor at Rutgers.

Toxic effects tend to arise when people take green tea supplements, which can contain more than 50 times as much polyphenol as a single cup of tea. "People who take less than 500 mg [of green tea concentrate or preparation] per day and spread the dose out over the course of the day are unlikely to have toxic side effects," says Yang.

Yang adds that some Japanese publications report beneficial effects for the consumption of 10 cups of green tea a day with no apparent harmful effects. At most, people may experience stomach irritation after drinking strongly brewed green tea on an empty stomach. Commercial preparations such as the bottled green teas found in the United States and green tea-flavored gum, bread, candy, ice cream, and desserts found in Asia have very low levels of polyphenols.

At the present time there is no established upper tolerable limit for green tea consumption. The Rutgers review points to the need for epidemiologic studies to test the potential concerns of taking green tea supplements at 500-mg doses or higher. Yang and Lambert hypothesize that people with oxidative stress-related liver diseases such as hepatitis or cirrhosis may be at greater risk of toxic side effects from ingesting high doses of green tea polyphenols. "When a person's liver is already under stress, toxic effects tend to become amplified," Yang says. Conversely, he notes there are data showing that low or moderate amounts of green tea have a protective effect against both toxicity and carcinogenesis in target organs—once again supporting the adage "everything in moderation, nothing to excess." —**M. Nathaniel Mead**

EPA Testing Program Raises Concerns

In June 2007 the EPA released for public comment a draft list of 73 chemicals to be screened for their potential as endocrine disruptors. With a comment period extending to 17 September 2007, a number of scientists and health advocates already have weighed in with their concerns about the testing program as a whole. They are alarmed by what they see as undue influence by the chemical industry on the development of the testing process, a claim rebutted by the EPA, which retorts that the process has been open and transparent. An article in the 5 July 2007 *Dallas Morning News* lists, among other issues, concerns that the tests as designed may miss chemicals that could cause health effects, that testing is not required to include prenatal exposures, and that incorrect dosage ranges will be tested, possibly missing certain effects.

Lead Swabs Miss the Mark

Lead can cause significant health effects in children at blood concentrations lower than 10 µg/dL. One significant source of lead in homes is dust created by crumbling lead-based paint. To detect lead in household dust, homeowners, landlords, and health advocacy groups often use LeadCheck® Swabs as a cheap and quick alternative to more expensive and time-consuming EPA-approved dust wipes, which must be analyzed by a laboratory to confirm results. But in the June 2007 issue of *Environmental Research*, University of Rochester researchers testing the swabs under typical field conditions found that more than 60% of dust samples deemed to have passed muster actually contained hazardous concentrations of lead. The authors write that household dirt may affect the swabs' sensitivity and suggest that guidance for the use of such kits "should clearly explain the risks of false negatives and lay out appropriate follow-up actions when negative results are achieved."

Have Another Cup

Good news for coffee lovers! Researchers from Sweden's Karolinska Institute report in the May 2007 issue of *Gastroenterology* the results of a meta-analysis of eleven studies over the past two decades. Their findings show an inverse relationship in all the studies between the amount of coffee consumed and risk of liver cancer. The association was statistically significant in six of the studies. More specifically, a 43% reduced risk of liver cancer was observed with an increase in consumption of two cups of coffee per day. The researchers note that the effect could be due to the presence in coffee of large amounts of chlorogenic acids—antioxidants that reduce oxidative stress and have inhibited liver cancer in animal studies.



AIR POLLUTION

Urban Grime Recycles Toxics

Grime clinging to windows and other surfaces in cities may be an unrecognized source of toxic nitrogen oxide (NO_x) pollutants that can damage lung tissue, according to research in the 1 June 2007 issue of *Environmental Science & Technology*. Atmospheric chemist James Donaldson and colleagues at the University of Toronto found that when sunlight strikes grime, inactive nitrogen compounds may be transformed into active forms that become airborne. This view challenges the long-standing notion that nitrogen compounds trapped in grime (also known as urban surface film) are washed away by rain and are no longer available to produce ozone and smog.

The combustion of fossil fuels by automobiles and power plants forms NO_x , which combines with volatile organic compounds to produce smog. Donaldson and colleagues observed that nitrogen compounds sequestered in urban surface films seemed to disappear faster than could be explained by rain washing them away into soil or groundwater. To test this idea, Donaldson's team coated slides with a few key chemicals found in grime and exposed them to gaseous nitric acid. This main form of nitrogen is considered to be an atmospheric end product; it sticks to windows, where it is assumed to be inert. When the slides were irradiated with visible light, nitric acid was removed, likely



converted to nitrogen dioxide, nitric oxide, and nitrous acid—all major players in ozone and smog formation.

The discovery suggests that “nitrogen oxides are being recycled and are not lost as people have thought,” Donaldson says. He plans to repeat the experiment with actual grime scraped from dirty windows to verify whether sunlight releases NO_x from complex natural urban surface films. These films are composed of several broad classes of chemicals, some with hundreds of identified compounds, according to research published in volume 63, issue 1 (2006) of *Chemosphere*. If the initial results hold up, computer models of urban air quality may need to be adjusted to account for this overlooked supply of photochemically activated compounds.

“This is not the first suggestion that nitric acid can be recycled back into photochemically active forms in the gas phase,” says Barbara Finlayson-Pitts, a professor of chemistry at the University of California, Irvine. “Renoxification” reactions were proposed back in the 1990s, and Finlayson-Pitts's own group has done work in this area. However, she adds, “The idea that chemistry on the surfaces of buildings plays a significant role in the chemistry of the atmosphere has not been given much attention,” and Donaldson's study nicely illustrates that it could prove to be critically important for developing accurate computer models of air pollution. —Carol Potera

TRANSPORTATION AND FUELS

Ethanol Boosts Gas Engines

The gasoline internal combustion engine has more than 100 years of intense development behind it. But now three researchers from the Massachusetts Institute of Technology (MIT) have modified it in a way that elevates efficiency by a remarkable 25%, an advance that could greatly mitigate greenhouse gas emissions and offers compelling advantages over hybrids and diesels. “This has real potential,” says David Cole, chairman of the Center for Automotive Research, a non-profit organization of the University of Michigan.

The design logic is simple. One can alter an engine to create greater compression of the fuel/air mixture within each cylinder, raising thermodynamic efficiency. One can also add a turbocharger, which force-feeds more fuel/air mixture into the cylinders. This makes it possible

to get more power out of an engine, or to downsize an engine without losing power, making it still more efficient.

The problem: boosting compression also boosts temperature, and too much heat can ignite the fuel/air mixture prematurely,

causing potentially damaging engine “knock.” But Daniel Cohn and Leslie Bromberg of MIT's Plasma Science and Fusion Center, and John Heywood of MIT's Sloan Automotive Lab figured out that a little squirt of ethanol into the

How Alternative Engines Stack Up (compared with conventional gasoline engines, except as noted)

	Clean Diesel	Electric Hybrid	Ethanol
Cost	\$3,000–3,500 ^a	\$3,500–5,000 + possible battery replacement cost ^a	\$1,000–1,500 ^a
Efficiency Gain	20–30% more efficient ^a	30–40% more efficient ^a	20–30% more efficient ^a
Emissions	25% lower CO_2 emissions ^b	Up to 50% lower CO_2 emissions ^c	NO_x and PM reduction, compared with clean diesel ^a
Technological Advantages	Better engine performance ^d	Better engine performance ^e	Reduced engine weight, more space in engine compartment, compared with electric hybrid ^a
	Less complex and easier to install than EH engine ^b	Larger battery means more safety and luxury electronic systems can be added on ^e	Higher torque and horsepower, compared with clean diesel ^a

^a<http://www.ethanolboost.com/Technology.htm>

^bhttp://www.signonsandiego.com/uniontrib/20060207/news_1n7diesel.html

^chttp://www.ama.ab.ca/cps/rde/xchg/ama/web/advocacy_safety_envt_hybrid.htm

^dhttp://www.discoveralternatives.org/Alternative_Fuel_Autos_Technology.php

^ehttp://www.alliancebernstein.com/CmsObjectABD/PDF/Research_WhitePaper/R37755_Hybrid.pdf

ehpnet

WiserEarth

In 2004 the Sausalito, California-based Natural Capital Institute began developing the World Index for Social and Environmental Responsibility (WISER) to bring together the more than 1 million organizations working to improve environmental and human health. WISER has launched a website targeted specifically at nonprofits at <http://www.wiserearth.org/>. Business and government sites are planned for later.

WiserEarth provides tools and a platform for NGOs, funding sources, and individuals to network and develop awareness of each other's work.



Individuals can post personal profiles, and NGOs are given space to build a web presence.

Visitors can post events and job openings, or participate in discussion forums on such topics as holistic health, sustainable agriculture, and climate change. The website features 44 main areas of focus, termed "portals," which

are further subdivided into 372 more specific topics. Among the portals are agriculture and farming, greening of industry, fisheries, pollution, poverty eradication, and sustainable development. Each portal page links to organizations, users, resources, jobs, and events associated with that topic. The page devoted to organizations allows visitors to browse for information a number of ways including by country, type of organization (e.g., community-based organization, NGO), area of focus, and activity type (e.g., research, activism).

A news section features rundowns of the latest updates to the website, postings by the media and press center, new multimedia offerings, volunteer openings, and a calendar of upcoming events around the world. Each day the site spotlights a different portal, organization, resource, and event.

—Erin E. Dooley

cylinder from a separate tank could cool it in the same way that rubbing alcohol cools the skin—by vaporizing, then absorbing excess heat. The researchers have formed a company, Ethanol Boosting Systems (EBS), and have drawn several prominent figures on board, including Neil Ressler, former chief technology officer of Ford Motor Company.

According to *Calculations of Knock Suppression in Highly Turbocharged Gasoline/Ethanol Engines Using Direct Ethanol Injection*, a 2006 MIT report, bench engine tests by Ford show that the knock limit can be vastly alleviated, and unpublished results indicate that a 25% increase in efficiency should therefore be attainable. That would reduce carbon dioxide emissions by about 20%, says Cohn. The engine's alcohol consumption would be minimal, because the extra cooling is unnecessary under light loads, such as steady driving at low to moderate speeds.

Although not quite as efficient as the best full hybrid systems, the EBS is far simpler, because it needs no electric motor, extra batteries, or complex

software. Cohn says those factors would shave \$2,000–4,500 off the cost relative to a full hybrid. The EBS and full hybrid systems would have similar emissions profiles.

An EBS engine would also be a couple of thousand dollars cheaper than a diesel engine. The two engines would produce roughly the same amount of greenhouse gas emissions, but the EBS would otherwise be cleaner, emitting fewer nitrogen oxides (NO_x) than the diesel engine, and less particulate matter. Many U.S. cities have nonattainment zones for NO_x, which contributes to ground-level ozone and can damage lung tissue and vegetation.

In a column in the July 2007 issue of *Car and Driver*, editor-in-chief and engineer Csaba Csere praises the EBS technology and says that if some seemingly manageable problems are solved—for example, maintaining fuel economy under real-world conditions of elevated temperatures and substandard fuel—EBS engines could be powering cars early in the next decade. —David C. Holzman

Rethinking Sources of Perchlorate

Although best known as a pollutant linked to its use in rocket fuel, perchlorate also made its way into U.S. agricultural soils from Chilean nitrate fertilizers that came into use in the early 1900s. But the chemical, which disrupts thyroid function, also occurs naturally in the environment, notably in South America's Atacama Desert. Scientists now know that perchlorate hot spots are not limited to known contamination or natural sources. In an *Environmental Science & Technology* article published online 6 June 2007, Texas Tech and USGS researchers report that a substantial reservoir of natural perchlorate exists in unsaturated zones (between the land surface and the water table) of the U.S. Southwest, and that this reservoir is large enough to affect drinking water, groundwater, and crops when irrigation or precipitation flushes the chemical from the soil. The authors write that this may help explain increasing reports of perchlorate in dry-region agricultural products.

New Guidance for Supplements

On 22 June 2007, the FDA released its long-awaited final rule on dietary supplement good manufacturing practices. The move was hailed by many in the industry, although some policy makers and consumer advocates believe the regulations don't go far enough to ensure the safety of supplements, now a \$22 billion industry. The rule focuses on accurate representation of ingredient content on labels, production process quality, and elimination of impurities and contaminants from products. The FDA may also inspect manufacturing plants for compliance. Manufacturers are charged with keeping records documenting that ingredients have undergone appropriate testing. The rule also applies to supplements produced outside the United States. However, according to the Consumers Union, the rule "still does nothing to ensure that supplements are safe or effective before they go on the market."

No Link between Hair Relaxers and Breast Cancer

Hair relaxers are used by millions of black women, often over many years. Researchers from Boston University and Howard University studied the use of these products to determine if they may play a part in why breast cancer incidence is higher among young black women than young white women. An article in the May 2007 issue of *Cancer Epidemiology, Biomarkers & Prevention* reports no increase in breast cancer risk among women who use hair relaxers, even those who had used them frequently and for long periods of time. The study is the first to assess hair relaxers as a potential contributor to cancer.

