

With seven years to go, Ontario is well on its way to meeting the Food Systems 2002 goal. Future reductions in pesticide use will be fine tuning, Wilson says, which depends on new research and technology.

Is Bottled Water Better?

Bottled water is one of the fastest-growing beverages on the market. In 1992, consumption of bottled water surpassed that of tea, wine, liquor, powdered drinks, and juice. In 1993, 2,257.7 million gallons of bottled water were sold in the United States, according to Lisa Prats, vice president of the International Bottled Water Association, the trade association of the bottled water industry. Consumers of bottled water cite taste as their primary reason for buying bottled water, but other reasons are safety and concerns about chemicals in tap water, says Prats. The question is, is bottled water worth the difference in cost, at an average cost of 700 times more than plain tap water?

A majority of Americans say they are pleased with the quality of the water that comes from their taps, according to a 1993 national survey on how Americans rate their drinking water by the American Water Works Association. As reported in the winter 1994 issue of *On Tap*, the AWWA survey found that 62% of Americans rate the quality of their drinking water as good (41%) or excellent (21%), while 75% believe that the water in their local community meets (57%) or

exceeds (18%) the federal standards for quality and safety. Still, the AWWA survey found that 43% of respondents drink bottled water at least some of the time, although tap water is still their main source of drinking water, and 8% use bottled water exclusively.

Strict regulations govern both bottled and tap water industries. Unlike well water, which isn't subject to regulation, public water supplies are regulated by the EPA. Bottled water, on the other hand, is considered a food, and is regulated by the Food and Drug Administration. In 1989, the Environmental Policy Institute concluded that the "regulations for bottled water were not on par with those for tap water," say Linda Allen and Jeannie Darby of the University of California-Davis in an April 1994 article in the *Journal of Environmental Health*. In addition, regulations for tap and bottled water are not standardized: tap water has uniform national regulations, but "bottled water is still subject to federal regulations with limited applicability and inconsistent state regulations," say Allen and Darby.

In 1989 the Environmental Policy Institute concluded that bottled water is not necessarily any safer than tap water. In fact, EPI says that storage of bottled water, often for weeks or months at room temperature and higher, promotes bacterial growth in the water. Elevated levels of bacteria in water can cause health problems for infants, the elderly, and immunocompromised people. Still, Stephen Schaub,

senior microbiologist in the EPA's Office of Groundwater and Drinking Water, stresses that although studies are inconclusive on the issue, bacteria in bottled water doesn't seem to be a significant problem.

However, an incident in February 1990, in which benzene, a chemical known to cause cancer in humans, was detected in bottles of Perrier at levels that exceeded by four times the EPA standards for tap water, points out that bottled water may have other problems. Perrier recalled more than 170 million bottles as a result of the contamination, and the incident prompted the U.S. General Accounting Office to charge the FDA with failing to set "adequate safety standards for chemical contamination of bottled water."

In 1994, the FDA passed regulations that impose the same standards on bottled water as the EPA imposes on tap water. An exception is lead: lead content may not exceed 5 parts per billion in bottled water, whereas EPA limits lead in tap water to 15 parts per billion. Bottled water may help to bypass other potential problems brought about by the practice of public water suppliers of adding chlorine to drinking water to remove bacteria. Although chlorine kills bacteria effectively, it can react with organic matter in water to form by-products such as trihalomethanes which have been linked to bladder and rectal cancers. Chlorine is not used as a disinfectant in bottled water, according to Prats.

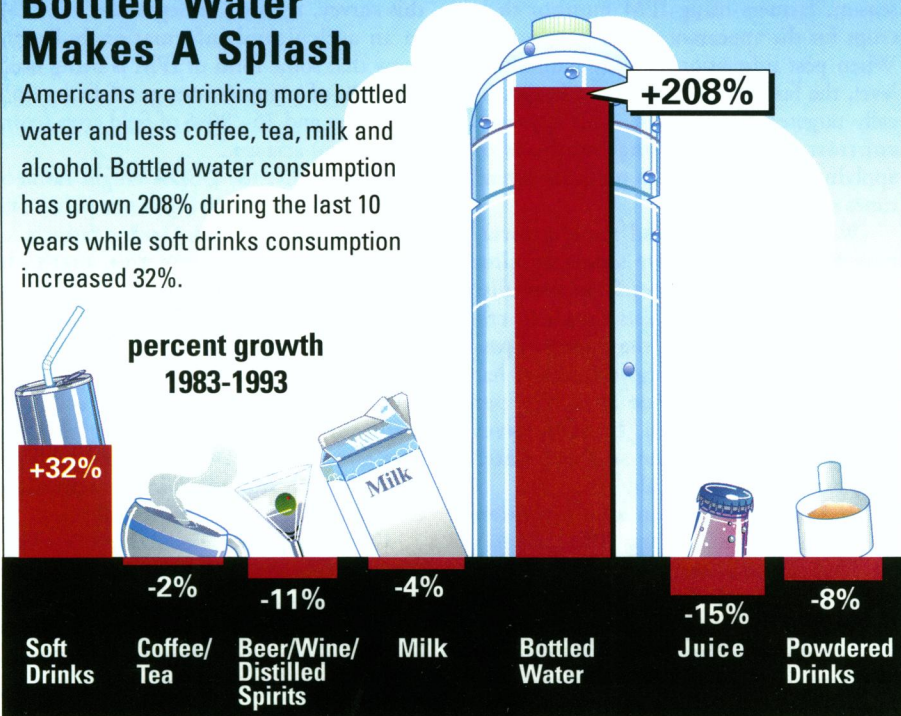
Despite almost half (49%) of the respondents to the AWWA survey saying they believe bottled and tap water to be equal in quality, 37% responded that bottled water is safer and healthier to drink than tap water, as opposed to only 10% who said the opposite, a perception most chalk up to clever advertising by the bottled water industry.

Americans drink bottled water primarily for aesthetic reasons: the taste, smell, and appearance of the water. Tap water supplies are often treated with chlorine, which can leave an aftertaste or odor. Bottled water, on the other hand, is usually treated by ozonation and filtration, processes that leave no aftertaste. Besides taste considerations, the EPA says that drinking bottled water is appropriate when the levels of contaminants in the local water supply exceed health standards, and when household problems, such as lead in the pipes, can cause contamination. Otherwise, researchers argue that bottled water just isn't worth the price, especially considering that it must be purchased, transported, and stored by the consumer. Canadian water researcher Pierre Payment, of the Armand-Frappier Institute, said in an article by the Associated Press that municipalities should advertise the quality

Bottled Water Makes A Splash

Americans are drinking more bottled water and less coffee, tea, milk and alcohol. Bottled water consumption has grown 208% during the last 10 years while soft drinks consumption increased 32%.

percent growth
1983-1993



Source: Industry Analyst John C. Maxwell, Beverage Industry's Annual Soft Drink Report, March 1994.

of their water the way bottled water companies do, because "North American tap water is the best you can get."

Studying Cell Death

Apoptosis is an ancient Greek word meaning "the falling off" of petals from flowers or leaves from trees. In modern scientific terms, apoptosis refers to the natural or programmed death of cells, as opposed to death caused by injury or necrosis. The failure of programmed cell death to occur has been linked to a variety of illnesses including cancer, dementia, and even AIDS. NIEHS scientist John Cidlowski has been exploring pathways by which apoptosis occurs in hopes of developing screens to reveal how environmental agents affect this process.

"I liken apoptosis to editing," says Cidlowski. "It's what causes us to lose the webbing between our fetal fingers and toes. It's also responsible for male pattern baldness in adults. It even has a suspected role in Alzheimer's disease."

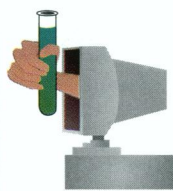
Apoptosis is an energy-demanding process, requiring ATP and the activation of an endonuclease that degrades the chromosomal DNA into small particles. This process culminates in fragmentation of the cell into discrete membrane-bound apoptic bodies that are engulfed by surrounding cells and macrophages.

In contrast, necrosis occurs in response to a variety of harmful conditions and toxic substances. It typically affects groups of contiguous cells, and an inflammatory reaction usually develops in the adjacent viable tissue in response to the release of cellular debris.

There are numerous pathways by which apoptosis can occur, as evidenced by the diversity of signals that stimulate the process. Cidlowski estimates there are 400–500 different ways to stimulate apoptosis, and different stimulants yield varying responses in different cell types. "In some cells, the oncogene *c-myc* is an inducer of apoptosis, yet in other cells it prevents it," Cidlowski says. "Our picture of the signal transduction pathways is not clear. They are going to be cell specific."

Cidlowski has spent the past 16 years researching apoptosis at the University of Vermont and the University of North Carolina, where he focused on three areas: how apoptosis is induced by stress; physiological adaptations to stress, particularly the role of glucocorticoid receptors, in activating apoptosis in lymphocytes and maintaining homeostasis in the rest of the body; and the role of nutrients, especially vitamins, and gene expression in apoptosis.

It is known that certain environmental chemicals, including dioxins, heavy metals,



EHPnet

April 22 marks the 25th anniversary of Earth Day. A World Wide Web site allows Internet surfers to explore and retrieve information related to a variety of environmental issues and interests. The site, located at http://akebono.stanford.edu/yahoo/Environment_and_Nature/, has something for everyone.

For the environmentally health conscious, there are links to organizations concerned with health effects research related to the release of hazardous substances. Most of the links are directed to the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR provides information on its biennial reports to Congress, conferences, congressional testimony, and services such as ToxFAQs, a series of summaries about hazardous substances excerpted from the ATSDR Toxicology Profiles and Public Health Statements, and the Science Corner, a simple support tool for scientists searching the Internet for environmental health information.

For those who religiously recycle glass, paper goods, and other materials and have always wondered how these materials are reincarnated, there is a link to the Recycle Cycle, an electronic exhibit based on a display of the same name by the Northwestern University Recycling Program. The exhibit explores the stages materials go through during the recycling process from disposal to their reemergence as new products.

For those in search of inspiration during Earth Day, there is the John Muir exhibit, (http://ice.ucdavis.edu/John_Muir/Sierra_Club_fact_sheet_on_John_Muir.html). The exhibit documents the history of conservationist John Muir and his profound effect on heightening the public perception of nature. The exhibit includes a biography, images, and tributes.

For those who want to sound off on environmental issues, there is an on-line soapbox onto which they may climb called Envirochat. Envirochat allows all users logged into the site to talk about any issue pertaining to the environment.

In remembrance of Earth Days past, users might ponder the "40 Tips to Go Green" pamphlet distributed by the Jalan Hijau ("Go Green" in Malay) Environmental Action Group during Earth Day 1992 in Singapore. Although the pamphlet is three years old, the information is still relevant and serves as a pleasant reminder to keep up "green" practices.

Finally, for those really thinking globally, there is a link to the Enviroweb—a project of the Envirolink Network, the largest on-line environmental information service on the planet, which reaches over 400,000 people in 93 countries.

and peroxides, lead to apoptosis in a variety of cells. At the NIEHS, Cidlowski is testing various chemicals to see what components of apoptosis pathways they activate. "We are analyzing the motors of apoptosis," he says. "We are focusing on the enzymes and genes that lead to cell shrinkage, DNA fragmentation, chromatin condensation, protein and RNA turnover, and inhibitors of apoptosis."

The role of apoptosis in cancer, AIDS, Alzheimer's, and other diseases has spawned an explosion of research on the subject. Cidlowski estimates there were as many as 1,000 articles on apoptosis published last year, as opposed to perhaps 50 papers a decade ago. But he cautions against the implication that apoptosis is the answer to everything. "There may be other mechanisms of cell death," Cidlowski says. "We are testing whether apoptosis is the physiological counterbalance to mitosis."

Although Cidlowski emphasizes that he and his colleagues are not cancer researchers, some of their research is of particular interest to cancer researchers, such as analysis of the effects of various chemi-

cals, including steroids, metabolic poisons, and immunosuppressants, on apoptosis in the immune system. It was originally thought that such chemicals simply inhibited cell replication. Cidlowski's team has been able to separate inhibition of replication from cell death and has proven that these chemicals act on cancers by inducing apoptosis.

Many chemotherapeutics act by stimulating apoptosis. A major problem with this treatment, however, is that over time cells tend to develop resistance to some chemicals. Cidlowski theorizes that this resistance may result from a loss in the capacity of the tumors to undergo apoptosis. If this theory is true, it places in doubt the prospect that chemotherapy can be refined to be the ultimate treatment for cancer. "We don't know what causes this resistance," Cidlowski says. "If cells lose one of the fundamental motors of apoptosis, it may be difficult to bypass resistance to chemotherapy. Then we'll have to look to new alternatives."

Cidlowski's goal is to define the key components in apoptosis and develop screens for these components in tumors.