For a WEB EXTRA with a link to the video about testing well water, see dartmed.dartmouth.edu/w09/we06.

Dartmouth's Norris Cotton Cancer Center ranked among the top 5% of institutions nationwide in total research dollars from the National Cancer Institute in FY09—earning over $34 million.

Arsenic might be a factor in H1N1 severity

Arsenic in drinking water is a long-established cause of lung cancer. Until recently, however, there was suspicion, but little or no scientific evidence, that arsenic can promote nonmalignant lung disease. A lab at Dartmouth is helping to rectify the lack of evidence.

Chile: The Dartmouth researchers' interest was piqued by a 2006 study of a Chilean city, Antofagasta, that had a drinking water supply high in arsenic. Investigators in Chile and California compared its death records to those for the rest of Chile and found significantly higher death rates in Antofagasta due not only to lung cancer but also to inflammatory and obstructive bronchial disease.

The mice in the control group regained weight much more quickly.

After reading the 2006 paper, Courtney Kozul, a DMS graduate student in experimental and molecular medicine, collaborated with two DMS immunologists—Richard Enelow, M.D., and Kenneth Ely, Ph.D.—to test the finding.

Kozul conducted the study using three groups of mice. One group got drinking water containing 100 parts per billion (ppb) of arsenic. A second group got water with 10 ppb of arsenic—the current Environmental Protection Agency maximum for arsenic in drinking water—and a control group got water with no arsenic.

JOSEPH MEHLING

Kozul showed that arsenic can affect immunity.

At the end of five weeks, the lungs from all the mice were removed and analyzed by a process called whole genome transcriptome profiling, in which the RNA products of each mouse's genome—40,000 RNA transcripts—were identified using a microarray. The resulting data was then crunched by a computer to see which RNAs increased with exposure to arsenic and which decreased.

Kozul was struck by the fact that many of the RNAs that decreased are known to be associated with genes that are important regulators of innate immunity. This was a significant finding in and of itself, but Kozul and her colleagues wanted to know more. "We were interested to know if there was a functional consequence of these changes in gene expression," says Kozul. In other words, would the changes affect immunity in a live mouse?

Flu: So the arsenic-exposure part of the experiment was repeated, this time with two groups of mice—one that got 100 ppb and one that got none. This time, at the end of the five-week period the mice were infected with H1N1 flu virus. The researchers then observed how quickly the mice recovered from the flu, using weight gain as a measure. The results were clear-cut. All the mice lost weight as a result of the flu, but the animals in the control group regained it much more quickly than those exposed to arsenic—strongly suggesting that arsenic exposure results in compromised immune function.

Kozul notes that in New Hampshire, municipal water supplies are regularly tested for arsenic, but testing of private wells is up to homeowners. To help homeowners, some of Kozul's colleagues recently produced a video about how to have well water tested. ROGER P. SMITH, Ph.D.

Octogenarian outcomes

The number of U.S. octogenarians is predicted to double between 2000 and 2050. Many people in this demographic eventually develop heart disease, raising the question of whether the benefits of surgery to treat it outweigh the age-related risks. In a large study, Donald Likosky, Ph.D., and colleagues found that patients over 80 who underwent aortic valve surgery did, on average, benefit, with over half surviving more than six years. "This study presents the largest experience to date of octogenarians undergoing surgical treatment of aortic stenosis," the authors wrote in *Circulation*.

Counting all costs

According to DMS researchers, changes in surgical technologies may have hidden costs. They compared open colectomies—an older approach—to laparoscopic colectomies—a newer, minimally invasive technique. There is little difference in the dollar cost of performing the two procedures, but the laparoscopic approach takes about 27 minutes longer. The lost time, say the researchers, adds up to between $240 and $700 more in opportunity cost per procedure. "Although frequently overlooked, opportunity cost is a potentially very important element in assessing the true costs of surgical innovation," they wrote in *Surgical Endoscopy*. ■