uated cavity, thus creating a vacuum tube, but it's not as small as the Cambridge tube, Akinwande says.

For tubes of the Cambridge type to play a role in digital circuits, their traits must improve, says Ivor Brodie of SRI. The maximum current is low—about 10 nanoamperes—and too irregular, he says. Akinwande estimates that the tube's roughly 10-volt operating voltage probably can be reduced to around 2 volts, a level at which some low-voltage semiconductor devices now function.

Vacuum tubes handle high-frequency signals better than semiconductor components do. Unlike electrons in a semiconductor, which are slowed by collisions with crystal-lattice atoms, electrons in a tube fly unobstructed through the vacuum.

Consequently, arrays of nanotriodes may find use as amplifiers and oscillators for high-frequency, high-power signals, such as those in cellular phone systems or military radar, Ahmed says.

Other possible roles include pressure and acceleration sensors and satellite microthrusters, Akinwande adds. *—P. Weiss*

Each nostril smells the world differently

Much as each eye sees the world from a slightly different angle, each nostril takes a somewhat different sniff, reports a California-based research team.

Unlike the eyes, however, nostrils switch roles several times a day, seesawing peak sensitivity between two groups of odors, the researchers argue in the Nov. 4 NATURE.

The basic difference between left- and right-nostril sniffs depends on airflow, explains Noam Sobel of Stanford University. A little tissue bulge, called a nasal turbinate, dangles in each nostril. While one turbinate engorges with blood and chokes down airflow, the other shrivels to permit big sniffs.

To feel the difference, block off each nostril in turn and inhale, Sobel says. Checking again several hours later often reveals a switch. To see the turbinates, just look up somebody's nose, Sobel advises.

Researchers have known for more than 100 years that nostril airflows differ, notes Sobel. What's new, he says, is the evidence that this nasal quirk affects sensitivity to odors.

To register as a smell, molecules wafting into a nostril must cross a mucous membrane and hit a receptor. In earlier studies on bullfrogs, other researchers found that some compounds, so-called high-sorption odorants, zing through that membrane quickly, but others only creep.

To see if airflow affects perception of either odorant class, Sobel and his colleagues asked Stanford undergraduates to sniff a mix of two compounds and estimate their ratio. One component, the peppermint L-carvone, zips across the nasal membrane, but the other, the aniselike odorant octane, dawdles.

Although they told students that proportions of the compounds would vary, the experimenters kept the mix at 50-50. For each trial, the researchers measured the flow of air as a student sniffed through one nostril.

Airflow did change the sensitivity, the team reports. Seventeen of the 20 students ranked the slow-traveling anise higher when they inhaled through their low-air nostril. When sniffing through the high-air nostril, these 17 ranked the fast peppermint at a higher proportion.

To see if some peculiarity of a nostril caused the difference, the researchers retested eight of the students after their airflow patterns had switched. Seven showed the same link between odor perception and airflow as in the earlier trial.

"It's not that one [nostril] smells oranges and the other smells apples," Sobel emphasizes. "The difference is subtle."

Richard Doty of the University of Pennsylvania in Philadelphia praised the creativity of the experiment but pointed out that Sobel used only a two-component mixture, while most smells are far more complex.

Many people don't show consistent airflow-change cycles, and the cycles dwindle with age, Doty has found. He muses that airflow response "is more akin to visual illusions that, while interesting, play little role in day-to-day visual processing."

However, study coauthor John D.E. Gabrieli of Stanford proposes that nostril shifts boost nose power by allowing two simultaneous sniffs that have their sensitivities tuned to different kinds of chemicals. As he puts it, "Two heads are better than one." Gabrieli also raises the possibility that slow- and fast-moving compounds could provide a key to understanding how olfactory processes are organized in the brain.

Brain mapping is only one aspect of the study of smell that lags behind studies of other senses, grumbles James M. Bower at California Institute of Technology in Pasadena. "There's a national eye institute, but there's not a national nose institute," he points out. He welcomes the Sobel study as a useful step. "People have known that they have two nostrils, but no one has known that it mattered," he says. *—S. Milius*

Genetic variants may ease leukemia risk

People with acute lymphocytic leukemia are more likely than healthy people to have the common version of a gene that plays a role in regulating folic acid metabolism in the body, a new study shows.

The gene encodes the enzyme methylene-tetrahydrofolate reductase (*MTHFR*), which acts on folic acid, a vitamin critical for DNA synthesis and repair. The common *MTHFR* gene produces a version of this enzyme that directs some of the folic acid toward other biological processes, reducing the amount available for proper DNA maintenance, the researchers find. Scientists have evidence that poor DNA repair triggers the growth of cancerous cells.

Folic acid deficiency may thus play a role in acute lymphocytic leukemia, a team of U.S. and British scientists report in the Oct. 26 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (PNAS). As many as two-thirds of people have the common form of the *MTHFR* gene.

Using blood DNA, the researchers compared the genetic makeup of 308 patients in England that have various leukemias with that of 491 healthy adults matched for sex, age, lifestyle, and geographic location. Most of the patients had acute myeloid leukemia and were no more likely to have the gene variation than healthy volunteers were.

However, the 71 patients with acute lymphocytic leukemia were significantly more likely to carry the common gene version than were 114 matched healthy people, says study coauthor Christine F. Skibola, a toxicologist at the University of California, Berkeley School of Public Health.

The healthy people were four times as likely to have a variation at a site on the gene called *MTHFR-677* than were patients with lymphocytic leukemia, also called acute lymphoblastic leukemia. The healthy participants were also three times as likely to have a change at another site, *MTHFR-1298*, as these leukemia patients, Skibola says.

The study "is very provocative and may provide some insight into the development of [acute lymphocytic leukemia]," says Joseph R. Bertino, a pharmacologist at Memorial Sloan-Kettering Cancer Center in New York.

Earlier work showed that folic acid deficiency causes breaks in chromosomes, which contain DNA, and that folic acid supplements can prevent such breaks. Also, two previous studies linked the less common *MTHFR-677* form with a reduced risk of colon cancer.

The new study reinforces the value of dietary folic acid, says Bruce N. Ames of the Department of Cell and Molecular Biology at Berkeley in the same issue of PNAS. "Chromosome breaks could contribute to the increased risk of cancer associated with [folic-acid] deficiency in humans," he says.

Bertino cautions, however, that the same variants of *MTHFR* that may help protect people against lymphocytic leukemia also seem to hike blood concentrations of homocysteine, a chemical linked to cardiovascular problems. *—N. Seppa*