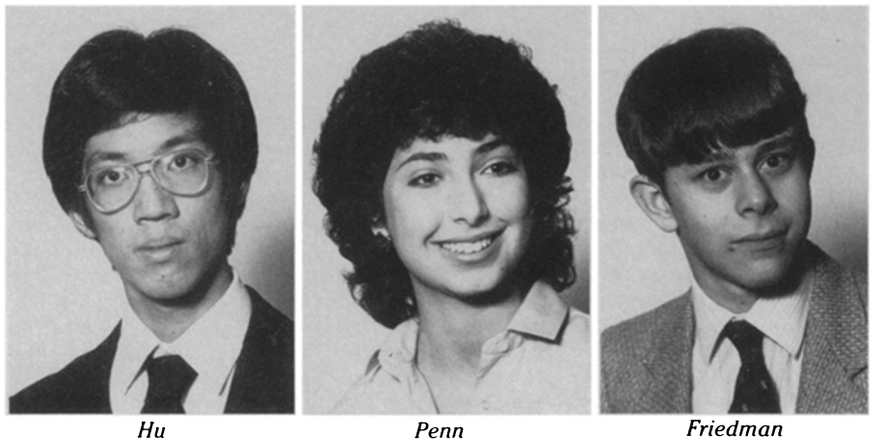
Top 10 announced in Science Talent Search



Hu *Penn* *Friedman*

Alan John Hu mixed mathematics with computer science and came up with the winning combination in the 44th annual Westinghouse Science Talent Search this week. Hu, of La Jolla, Calif., took first place and a $12,000 scholarship. First in his class at La Jolla H.S., Hu topped the select group of 40 seniors from 13 states and Puerto Rico by devising a method to speed the location of information in a specific computer file. Hu's system minimizes the time spent making comparisons in a file and moving tape. He plans to study mathematics and computer science at Stanford University.

Anna Asher Penn of Chicago, a student at the University of Chicago Laboratory Schools H.S., was awarded second place and a $10,000 scholarship. For her project, she produced DNA clones of one segment of a bacterial virus that can be used to study how viruses, such as influenza, reproduce in host cells. Penn is continuing research in flatworm regeneration at her high school and plans to study molecular biology at Harvard University.

In another combination of mathematics with computers, Michael Friedman of Brooklyn, N.Y., won third place and a $10,000 scholarship. By running his own number-theoretic formulas through a computer, Friedman demonstrated that an odd perfect number must be at least 10 to the 79th power. An odd perfect number is one for which the sum of its factors is twice the original number. No such number has yet been found. Friedman, a student at Stuyvesant H.S., plans on majoring in computer science at the Massachusetts Institute of Technology.

The winners of fourth through sixth places are each awarded $7,500 scholarships. A test of brain hemisphere function while concurrent tasks are performed won fourth place for Michael Steven Graziano of Buffalo, N.Y., a student at City Honors H.S. His results challenge the accepted theory that when someone performs two tasks at once, the tasks are always controlled by opposite brain hemispheres. John Shu-Shin Kuo of Whitestone, N.Y., a student at Bronx High School of Science, was awarded fifth place for a study of a genetic element of a microbe that can jump from one host to another and make genetic rearrangements possible. Sixth place went to Anthony Mario Ciabarra of Wyncote, Pa., a student at Cheltenham H.S. He studied an unusual DNA repair mutation which he believes explains mechanisms involved in the action of carcinogens and viral infections.

Scholarships of $5,000 go to the winners of seventh through tenth place. They are Mark Kantrowitz of Brookline, Mass., a student at Maimonides School, Michael William Gesner of Avon, Mass., a student at Cardinal Spellman H.S., Audrey Zelicof of New York City, a student at Stuyvesant H.S., and Allan Moises Goldstein of Wyncote, Pa., a student at Cheltenham H.S.

Two alternates were also named in case any of the top 10 winners is not able to accept a scholarship. They are Jonathan Michael Passner of East Brunswick, N.J., a student at the Jewish Educational Center, and Mark Raboin Swain of Manassas, Va., a student at Stonewall Jackson H.S. Along with the remaining 28 national winners, they will receive cash awards of $500 each.

The competition, with a total of $89,500 in Westinghouse Science scholarships and awards, is conducted by Science Service, Inc. □

Human white blood cells as carcinogens

Blood cells that normally protect the body from bacterial infection sometimes can produce enough germ-killing toxic substances over a long enough time to cause normal tissue to become malignant, researchers at Massachusetts General Hospital and Harvard Medical School in Boston report in the March 8 SCIENCE. They believe some cancers can be caused not only by toxic substances in the environment but also by toxic substances released by cells called phagocytes to fend off environmental carcinogens.

The researchers showed that human neutrophils — phagocytic white blood cells that ingest bacteria and foreign substances — release toxic free radicals (oxygen metabolites) that can cause normal mouse connective tissue to become malignant. They injected 43 mice with cells treated with human neutrophils activated to produce toxic oxygen metabolites and injected a control group of 53 mice with untreated cells. Five of the mice given treated cells developed malignant tumors and six developed benign tumors. None of the control mice developed tumors.

Humans need phagocytes to protect against bacteria in the environment. The body has several elaborate chemical mechanisms to detoxify phagocytes' oxygen products, "but it's a relative resistance," says Sigmund Weitzman, who directed the research. "If there are too many of these metabolites, they can damage normal tissue."

The most common human model in which phagocytes accumulate and ultimately cause cancer is ulcerative colitis, a chronic bowel inflammation. After about 20 years of constant bathing with toxic phagocytic products, colorectal cancer may result.

The researchers believe the mechanism of phagocytic accumulation and production of toxic metabolites might also help explain the origins of lung and breast cancer.

People who smoke gather particles of soot and nicotine in their lungs. Phagocytes then accumulate and release their toxic products, which may interact with the chemical carcinogens in cigarettes to cause lung cancer, says Thomas P. Stossel, an author of the paper.

The mechanism's role in breast cancer is more tenuous, Stossel says. Female breast tissue is regenerated every month as cells of breast ducts are replaced by new ones. Phagocytes are called in to get rid of the degenerating cells, releasing their "nasty chemicals" in the process. Repeated exposure to toxic phagocytic products over time could contribute to the development of breast cancer, Stossel says.

The researchers do not know the specific molecules ultimately responsible for causing normal tissue to become malignant. Phagocytes produce superoxide, hydrogen peroxide and hydroxyl radicals, as well as other toxic substances. These substances can interact with membrane components of phagocytes or their target cells to generate other toxic products, such as peroxides and aldehydes. Although earlier work suggests an important role for hydroxyl radicals in the overall process, according to the SCIENCE paper "the ultimate carcinogen remains to be defined."

—D. D. Bennett