

# Children's science conference



Photos by William J. Ryan



About 300 elementary school students experimented with moon rocks, bubbles, and paper airplanes, not in a toy store, but at a science fair recently.

The students, from 30 schools in Gaithersburg and Rockville, were given a break from the textbooks and an opportunity to view real-life scientific experiments at the Children's Science Conference on May 17.

Researchers, scientists, authors, teachers, and business professionals shared with students information in their fields of expertise.

Dozens of the presentations were scattered throughout Wootton High School for the students and their parents. From left (top photo), Jordan Goodman, a professor at the University of Maryland, teaches a class on the properties of light color and reflection.

In his "Holocaust in the Sky" presentation (center photo), William Dodge of Winston Churchill High School explains how the O-ring on the Space Shuttle Challenger failed because of extremely cold temperatures.

And, what would science be without a little fiction? Karen Winston (bottom photo), of Damascus Elementary, demonstrates her "homework doer." Winston's machine is every student's dream—push a button, and voila, homework's done!

## 'Almost human' tissue: breakthrough in cancer research

A synthetic substitute for natural tissue may prove invaluable in cancer research.

The new synthetic, which performs like living body tissue when exposed to the electromagnetic waves from medical instruments, has been developed by polymer scientists at the Commerce Department's National Bureau of Standards.

It is an organic material and will be used as a "phantom" substitute for living muscle tissue in studies by the Food and Drug Administration.

The FDA will use the material to evaluate the heating patterns of various medical devices used in diathermy hyperthermia treatments.

These machines generate electromagnetic waves that heat body tissue for physical therapy, to re-warm animals after low-temperature surgery, and to treat many types of cancers.

"In cancer treatments for example, an increase of only 6 to 8 degrees above normal body temperature is enough to kill the cancer cells," says Whit Athey of

FDA's electrophysics group.

Cancer tissue is unable to thermally regulate itself like normal tissue with a circulating blood supply. But it is important that energy from medical devices does not damage healthy tissues.

NBS polymer physicist Martin G. Broadhurst was asked by the FDA's Center for Devices and Radiological Health to design a wholly synthetic material that could be made from commercially available products by the FDA as well as by instrument manufacturers and other researchers.

To obtain basic measurements on the electromagnetic responses of typical living biological tissue with a cellular structure, Broadhurst selected leaves from a jade plant. The scientific literature shows that plant leaves have the same responses to muscle tissue to high-frequency stimulation.

Most biological tissues contain roughly the same amount of water and salt concentrations, and they have cell walls that inhibit ion motion.

Broadhurst, an expert in the performance of dielectric materi-

als—that is, materials that are weak conductors of electrical current—explained that the molecular structure and internal properties of a material affect the way it performs when exposed to different frequencies such as radio waves and microwaves. Some of the energy from these waves is absorbed by the material and converted into heat.

For the leaf studies, very small specimens, between three and four millimeters thick with their epidermis removed, were exposed to electrical frequencies ranging from 10 to 1,000 megahertz by three different instruments.

The results of these measurements showed the dielectric behavior of the jade leaves matched authoritative published data on the responses of living muscle tissue when exposed to the same electromagnetic frequency ranges.

With the assistance of George T. Davis and C.K. Chiang, also NBS polymer scientists, Broadhurst formulated the new synthetic polymer-based phantom material.

The natural water in living tissue was simulated by a mixture of 50

percent propylene carbonate and 50 percent ethylene carbonate, the same non-evaporating stabilizers used in some cosmetic products to preserve their freshness.

The salt content in living tissue cells was simulated by adding an inorganic salt, tetraethyl ammonium tetrafluoro borate. The effect of cell walls was created by adding 1.5 micron-thick (1/16,000 of an inch) flakes of a polyester film. The synthetic polymer-based phantom was thickened by adding fumed silica particles, produced by a vaporization process, and polyethylene glycol dimethacrylate to bind the material into a low vapor-pressure jelly.

Broadhurst said, "We have tailored our material so that its heat response from electromagnetic waves is the same as natural living tissue. Laboratory tests of the phantom shows that its performance is the same as muscle tissue over the desired frequency range."

FDA scientists and technicians will use the NBS measurement material as a dosimetry tool to evalu-

ate the heating patterns of medical devices starting at room temperature and up to 35 to 40 degrees Celsius. Temperature probes will be inserted into masses of the material molded into anatomical shapes, such as arms, legs, and torsos, to measure the distribution of heat and power absorption in muscle from the medical devices.

Athey points out that the NBS formulation will provide FDA with a more stable material with a much longer "shelf-life" than any of the currently available biopolymers. These materials use salt water and metal particles for their dielectric performance and must be tailored for specific electromagnetic frequencies.

The NBS-developed material can be used over the entire range of electromagnetic frequencies for dielectric heating and is free from attack by mold, bacteria, and corrosion.

The FDA will place the NBS phantom in test kits for the National Cancer Institute and others to use in checking the quality assurance of their medical devices says Athey.

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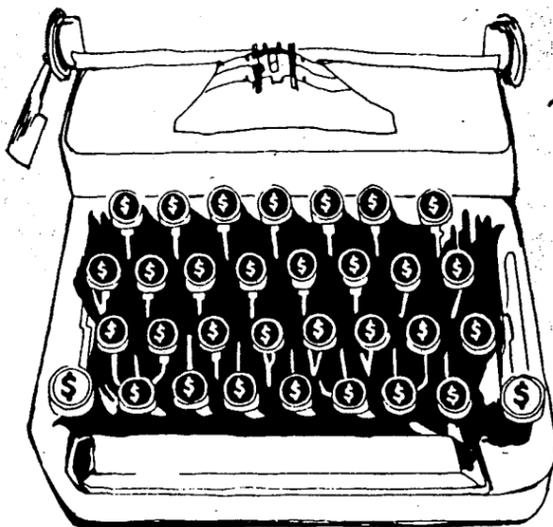
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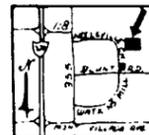
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