Technology

A quick switch for military uses

A switch that can interconnect any one of eight input lines to any unused output line every 40 billionths of a second is the first working "very high-speed integrated circuit" (VHSIC) chip to result from a major Department of Defense research and development program. The switch, a 0.2-inch-square piece of silicon, was recently fabricated and tested at TRW Inc., in Redondo Beach, Calif. "There have been switch chips before, but none with as many input and output lines operating at this speed," says Fred L. Alexander, VHSIC program manager at TRW. The switch chip is the first of eight different VHSIC chips to be made by TRW for the U.S. Navy's Electronics Systems Command.

TRW is one of six contractors taking part in the first phase of the $400 million, six-year VHSIC program. According to Larry W. Sumney, former program director and now executive director of the Semiconductor Research Corp., this DOD program is "the most ambitious and probably the most important federal program since the United States embarked upon space exploration." The project's goal is pilot production in 1986 of integrated-circuit processors that contain 250,000 transistor gates and perform several million to several billion operations per second. Chips must also fit into existing military electronics hardware and be able to survive large radiation doses. These chips will be used for guidance and communication systems, "fire-and-forget" missiles and other military applications.

To achieve the required speed and circuit density, researchers are scaling down circuit elements, reducing conducting path lengths and insulating oxide layer thicknesses, decreasing supply voltages and developing new designs for arranging the circuit's elements on a chip. In the VHSIC program's first phase, 28 chips are being designed and fabricated. The TRW device contains 13,500 transistors with individual features only 1 millionth of a meter in size.

Electric blue filters and displays

Digital displays for watches, calculators and many instruments usually consist of arrays of light-emitting diodes or liquid crystals. These displays require a constant source of electricity, not only to change the numbers but also to keep the digits from disappearing. Now a University of Florida engineer has perfected a device that, in a sense, remembers the initial input of electricity. The key component is a material, tungsten trioxide, that turns from transparent to electric blue when activated by electricity. This "electrochromic" material stays blue, without additional electricity, until a reversed current erases the color.

In principle, when electrons are injected into tungsten trioxide, they are trapped at sites near the tungsten atoms. These electrons require a small amount of energy to hop from one site to another within the material. Because red light provides just enough energy for this to happen, the material absorbs red light and transmits blue light. Hence, the material looks blue. Pulling out the electrons by reversing the current stops the absorption process.

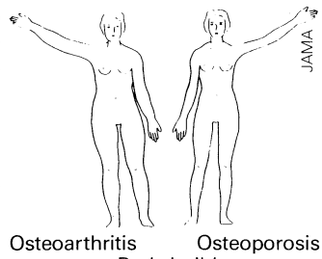
The electrochromic effect was discovered about 15 years ago. Although many people recognized the potential usefulness of this phenomenon, research has continued only in Japan, where a company is marketing a watch with an electrochromic display, and at a few places like the University of Florida in Gainesville. There, Paul Holloway has concentrated on solving two problems found in early forms of these displays: reducing switching times that were on the order of a few seconds and increasing the lifetime of a display unit. "Right now we've developed it to the point where it's commercial," says Holloway.

Holloway sees uses for the device both in displays and for controlling light. For example, electrochromic shields (which can switch from transparent to dark blue) on a welder's helmet can be effective filters for protecting eyes.

Biomedicine

Body build and bone disease

Older women who succumb to osteoarthritis (loss of bone at joints) tend to have a different body build from older women who contract osteoporosis (loss of bone mass in general), Jan Dequeker and colleagues at the University of Louvain in Pellenberg, Belgium, have found.



They compared the body measurements of 25 women aged 50 to 75 years with osteoarthritis with those of 27 women of the same age with osteoporosis. They found that while women in both groups were of comparable stature, at least before the women with osteoporosis lost height due to shrinkage of their spinal columns, women with osteoarthritis weighed more and had more fat, muscle mass and strength than did women with osteoporosis (see illustration).

How body build might contribute to the two diseases isn't clear, the researchers say in the March 18 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. But one possibility is that while excess weight can lead to wear and tear on joints and thus cause osteoarthritis, it may protect against osteoporosis by keeping bone from losing calcium, an effect discovered by other investigators.

Yet another unanswered question is whether body build contribution to osteoporosis and osteoarthritis is genetically determined or acquired. To date, genes do not seem to play any role in osteoporosis and only a limited one in osteoarthritis.

New joint for arthritic big toe

Osteoarthritis is the most common form of arthritis, and one of the most common osteoarthritic problems is a chronically arthritic big toe joint. But such joints can now be replaced by a prosthetic joint made of silicone and rubber, and such prostheses can provide good to excellent pain relief, reports Stanley L. Kampner, an orthopedic surgeon at the University of California at San Francisco.

Kampner studied the pain relief afforded 103 patients by big toe joint prostheses over a 12-year period. He found that 40 of the prostheses provided excellent pain relief, 41 good pain relief, 8 fair pain relief and 14 poor pain relief. And of the 14, pain relief was poor in 10 because the prosthesis had fractured. The fracture problem has been almost entirely eliminated since the prosthesis was redesigned in 1977.

The prosthesis also provides more toe strength and a more aesthetic big toe than do other kinds of surgical correction of the arthritic big toe joint, Kampner said at a recent meeting of the American Orthopedic Foot Society in Anaheim, Calif.

New hormone therapy for breast cancer

About a third of breast cancers in women depend on the female sex hormone estrogen to thrive. Estrogen release in the female body is controlled by a hormone from the hypothalamus, luteinizing hormone-releasing hormone (LHRH). T. W. Redding and Andrew V. Schally of the Veterans Administration Medical Center in New Orleans attempted to see, in female rodents with estrogen-dependent breast cancers, whether three different compounds that inhibit LHRH release might in turn inhibit estrogen release and bring about breast cancer regression.

The answer is yes, they report in the March PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (No. 5), and it suggests that "these compounds should be considered for the development of a new hormone therapy for breast cancer in women."