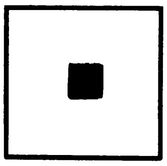
Technology

Computer memory in a chip



Electronics engineers at the University of Utah have developed a new technique to fabricate microscopic circuits used in computers and hand calculators substantially cheaper. The shiny, metallic chips, the exact size shown at left, reveal only a faint colored tint from light diffraction when examined by the naked eye, but they contain 19,000 transistors and can be used to store 16,384 computer "bits" of information.

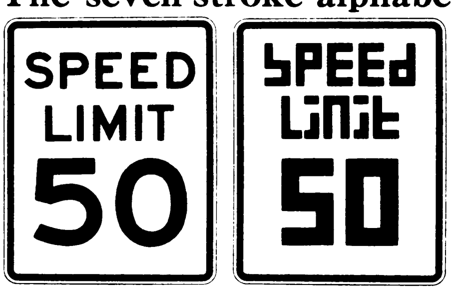
Such microcircuits have been around for a few years, but the complex series of manufacturing steps, which involves focusing a beam of ions through a mask and onto a chip of semiconducting material, is still rather expensive. The Utah engineers have achieved their cost breakthrough by eliminating several of these steps.

Finding the structure of proteins

Using conventional techniques, X-ray pictures of large molecules, such as proteins, can only be resolved to show objects of about 2.5 angstroms in diameter and thus do not show internal structure in fine enough detail to allow identification of specific atoms. With further laborious mathematical analysis, the fuzzy outlines can be forced to yield more information, making individual atom recognition posible, but when a group of X-ray crystallographers at the University of Washington tried it, the procedure took four man-years of effort to succeed.

Now a mathematician at IBM's Watson Research Center, David Sayre, has developed a computer program to solve the same problem in 15 hours. Starting with the Washington group's original data on the bacterial protein rubredoxin, Sayre's program was able to locate and identify 400 of the protein's 424 nonhydrogen atoms.

The seven-stroke alphabet



Some 35 binary "bits" of information are now needed to encode the shape of a letter in the present alphabet. A group called the Design Planning Group of Chicago has found a way to cut that figure by a factor of five. Starting with the six-dot Braille alphabet, the group developed a way of forming letters by drawing no more than seven lines between the dots. The result, called BASIC, is presented in the January-February INDUSTRIAL DESIGN magazine. Besides reducing the number of necessary coding bits to seven, the designers say BASIC will allow development of inexpensive, optical readers and light, compact typewriters that print entirely electronically.

Behavior

Depressing situations

"What's the use? Nothing I do seems to matter. You can't win in this world, so why even try?" Such statements are often heard as a result of inability to cope with repeated stress situations. Some psychologists have called this form of depression "learned hopelessness." The theory is that an organism with no way of escaping stress eventually learns to quit fighting and gives up. Jay M. Weiss of Rockefeller University suggests that such reactions are not learned. They may be physiological rather than psychological, he says.

The inability to act in the face of repeated stress, Weiss explains, could be caused by the depletion of the motor-activating catecholamine norepinepherine, one of the fight-or-flight hormones produced by the adrenal glands. In other words, catecholamines are used up during the first stress and are not available for avoidance action during an immediately following stress. Weiss and his co-workers forced rats to swim in cold water for several minutes. The animals were then exposed to a stress test in which they had to avoid a shock by jumping over a hurdle. The longer the delay between the cold swim and the test, the better the rats were able to cope. They had replenished their supply of catecholamines, says Weiss. In another test, rats had only to aim their noses into a tube to avoid shock—a coping behavior that requires little motor activity. These animals were able to cope after the cold swim. They did not learn helplessness.

Weiss' findings indicate that some forms of human depression and seemingly abnormal behavior may have a biological rather than a psychological basis. In such cases environmental stress seems to produce chemical rather than mental changes.

First animal model of hyperkinesis

Did you ever meet a dog you didn't like? Some dogs are so completely obstinate, disobedient, impulsive and violent that no one can love them. Such dogs don't respond to reward or to punishment and cannot be trained. Samuel Corson of Ohio State University, after much searching, has located a number of these dogs for research purposes. He believes they are an appropriate animal model for naturally occurring hyperkinesis in children. Hyperkinesis, however, is not the major problem for such children. They just can't sit still in school long enough to learn anything. This leads to learning and behavior problems. Many school drop-outs, for instance, have been diagnosed as hyperkinetic children.

Some researchers say that five percent of school-age children have hyperkinesis. Others argue that young children are naturally overactive. The treatment of hyperkinesis is more controversial. Amphetamines have a calming effect on some overactive children, but stimulate others and are dangerous and addictive. Corson has found indications that a behavioral disorder like hyperkinesis does exist, at least in dogs. Not only does it exist, it responds to amphetamine treatment. Normal dogs become hyperactive and untrainable when given amphetamines. Corson's dogs are calmed by the drug and can be trained by traditional Pavlovian methods. After six weeks of drugged training the dogs remain hyperactive but are no longer aggressive, even when the drug is removed. If these dogs are a true model of human hyperkinesis, Corson hopes to breed them and use them for investigations of the possible neurochemical mechanisms of hyperkinesis.