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Forecast: Medicine/biotechnology; Forecast: Computer power; Forecast: Computers

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FORECAST

Medicine/ Biotechnology

There is today an explosive growth in high-technology application. For example, advances in medicine, based in part on technologies borrowed from the physical sciences, are rapidly generating new commercial apparatus and techniques useful in diagnosis and treatment, including nuclear magnetic resonance, scanning electronic microscopes, a variety of lasers, and new sources of synchrotron radiation. □ Already we see emerging the commercialization of biotechnology as a result of basic research work done during the past ten years. Potential applications appear to be most imminent in pharmaceuticals and agriculture. In the pharmaceutical industry, it will proceed most rapidly in such product areas as human insulin, antibiotics, vaccines, and protein compounds, with full-scale application in perhaps ten years. The initial application of biotechnology in agriculture will likely occur in the areas of animal disease treatment. The production of chemicals, environmental applications, and bioelectronics holds great promise over a longer time frame.

DR. FRANK PRESS
President
National Academy of Sciences

Computer Power

By 1990, the drive for computer power within the academic-scientific community, in association with the national laboratories, will have succeeded in achieving a completely new type of supercomputer architecture. These special-purpose devices will represent increases in computer power by factors of 100 to 10,000 over what one might expect from mainframe manufacture. Applications of these developments to other fields are certain to repeat the strong impact of this kind of research on the scientific industry that occurred in the early sixties.

LEON M. LEDERMAN
Director
Fermi National Accelerator Laboratory

Computers

The development of computers and their applications will continue to be very rapid during the coming decade. Microelectronic circuit costs will continue to fall rapidly, making very powerful microcomputers available for under $100 each. Enormous parallel computers comprised of thousands of cooperating microcomputers will also be built and will attain computation rates of tens of billions of instructions per second. Though our understanding of what will ultimately be involved is still limited, these giant machines will spur progress toward artificial intelligence—that is, the realization of systems able to duplicate such central human functions as the understanding of spoken language, the visual location of objects in complex scenes, and the ability to deal in sophisticated ways with natural language text of the sort that appears in magazines and newspapers.

JACOB T. SCHWARTZ
Director, Computer Science Division
Courant Institute of Mathematical Sciences
New York University

Computer Literacy

Continuing advances in semiconductors, computer peripherals, and, in particular, computer architecture and software will provide a dramatic increase in computer literacy by 1990. Major advances are likely to be made both in the physical means of communicating with a computer and in the languages one must use. Speech recognition and speech generation by computers will be relatively commonplace, but keyboards and other electromechanical input devices will remain popular because of their extreme flexibility. ☐ The most significant change will be in computer languages. Techniques derived from artificial-intelligence research will likely be developed to permit a novice to do useful work on a computer in a relatively short period of time and with a low level of anxiety. This will be made possible not just by languages but by the basic architecture and by the manner of interacting with the computer.

BURTON J. MCCARTY
General Partner
Technology Venture Investors

Integrated Circuits

It has now been 25 years since the invention of the integrated circuit—a long time in the history of electronics. Normally one would expect a replacement to be on the horizon. ☐ Instead, we find that the complexity and capability of modern integrated circuits continue to double every year, with corresponding decreases in cost. Although this rate of progress cannot continue forever and decreases have frequently been predicted, no real change in progress has become apparent. ☐ Eventually, real barriers will be reached. When they are, the integrated circuit will be replaced with a new concept and the pattern of change will continue, although the developments themselves are now unpredictable.

J. S. KILBY
Consultant

Robotics

The most significant development in high technology is the development of the robot. Apparently, the Japanese have a dominant position in the first generation of robots. These robots are "dumb" robots. They cannot see or think, and do not have good sensing capacity. By 1990, we will have robots that not only will see and think but also will have a highly developed sensing capacity. Using microprocessors, these machines will be capable of doing almost any of the tasks that we now believe to be uniquely human. The development of these robots will make America a leader once again in most manufacturing processes. Robots will enable the cost of production to be significantly reduced and will, at the same time, result in products of much higher quality. ☐ These developments will obviously have a tremendous impact on our society. It is my view that we will move from 22 percent of the labor force in manufacturing to perhaps 15 percent by 1990, and to 5 percent by the year 2000. There will be ramifications for income distribution, and, over the next 20 years, we may see the greatest changes in our society of any 20-year period in the past.

RICHARD M. CYERT
President
Carnegie-Mellon University