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**THE BEST ENGINEERED COMPUTERS IN THE WORLD**
To:         Robin
From:       Roger
Subject:    IBM Technology

I've been reviewing some of our past and present technological achievements, and it occurred to me that the scientific, engineering, and academic communities might like to know more about them. Will you select a topic from the following list or suggest another one? Thanks.

- Vacuum tube digital multiplier
- IBM 603/604 calculators
- Selective Sequence Electronic Calculator (SSEC)
- Tape drive vacuum column
- Naval Ordnance Research Calculator (NORC)
- Input/output channel
- IBM 608 transistor calculator
- FORTRAN
- RAMAC and disks
- First automated transistor production
- Chain and train printers
- Input/Output Control System (IOCS)
- STRETCH computer
- "Selectric" typewriter
- SABRE airline reservation system
- Removable disk pack
- Virtual machine concept
- Hypertape
- System/360 compatible family
- Operating System/360
- Solid Logic Technology
- System/360 Model 67/Time-Sharing System
- One-transistor memory cell
- Cache memory
- Relational data base
- First all-monolithic main memory
- Thin-film recording head
- Floppy disk
- Tape group code recording
- Systems Network Architecture
- Federal cryptographic standard
- Laser/elecrophotographic printer
- First 64K-bit chip mass production
- First E-beam direct-write chip production
- Thermal Conduction Module
- 28K-bit memory chip
- Robotic control language
- Masterslice and the Engineering Design System

Roger - IBM's researchers have developed a powerful new technique for studying surfaces at the atomic level. Let's tell this story!

Robin
Figure 2. IBM's new microscopy technique makes use of a phenomenon called vacuum tunneling, which involves the passage, or tunneling, of electrons between two conducting or semiconducting solids that are narrowly separated by a vacuum. Tunneling occurs because electrons have wavelike properties as well as particle properties. This means, according to quantum theory, that electrons appear as electron clouds that spill out slightly beyond the surfaces of the solids in which they originate. As a result, there is a finite probability that electrons will tunnel through the vacuum.

Miniaturization is the driving force behind the computer revolution. As computer chips continue to evolve, their structural details are becoming so small that it is vital to understand them at the atomic level.

Recently, IBM researchers have succeeded in examining structures at the atomic level by developing an absolutely new kind of microscopy technique—scanning tunneling microscopy, or STM. Specifically, they have produced three-dimensional images of the surface topography of solids that show vertical position differences as small as 0.1 angstroms (one angstrom is one ten-billionth of a meter) and horizontal position differences as small as six angstroms. Such simultaneous resolution is unprecedented.

The new microscopy technique makes use of a quantum-mechanical phenomenon called vacuum tunneling, which involves the passage, or tunneling, of electrons between two conducting or semiconducting solids that are narrowly separated by an insulator or a vacuum.

Figure 1. This three-dimensional representation of a silicon surface was obtained by scanning tunneling microscopy, developed by IBM. The individual hills or bumps indicate actual atoms separated by as little as six angstroms. (One angstrom is one ten-billionth of a meter.)
Tunneling through solid insulating barriers was first demonstrated in 1957; it was only early in 1982 that controlled vacuum tunneling was demonstrated by IBM in an experimental configuration suitable for microscopy.

In principle, the scanning tunneling microscope takes advantage of the strong dependence of the tunnel current on the separation between two solids. One solid has its surface under investigation; the other, a metal tip, is a probe electrode. As the probe moves laterally across the surface while separated from it by about ten angstroms, the tunnel current will vary in accordance with changes in the tip-to-surface distance. The tunnel-current variation in effect is a measure of the surface topography.

In practice, the vertical position of the probe is changed to keep the tunnel current, and thus the tip-to-surface distance, constant for all points. In that way, monitoring the position of the tip while scanning yields a topographic picture of the surface. The technique is so sensitive that a change in tip-to-surface distance by the diameter of a single atom produces a tunnel-current change by a factor of 1,000.

By providing a more detailed view of surface structures, STM has already significantly advanced the understanding of important materials such as silicon. However, STM is more than a surface structural tool with atomic resolution; it also images surface parameters (such as composition and oxidation state) and can determine electronic properties. This opens fascinating possibilities in many areas of science and technology.

STM can be performed at ambient pressure and can see surfaces covered by nonconducting liquids. The ability to operate under such conditions makes STM attractive in many different fields, from engineering to biology.

Scientists at the IBM Zurich Research Laboratory developed the world's first scanning tunneling microscope. Their contributions are only part of IBM's continuing commitment to research, development, and engineering.

For free additional information on STM, please write: IBM Corporation, Dept. R065, P.O. Box 5089, Clifton, NJ 07015.
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Catalog #RIK 8798

Contents:
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- Rabbit antiserum specific for alpha-hANP (lyophilized powder)
- 125I alpha-hANP (lyophilized powder)
- Goat anti-rabbit IgG serum (lyophilized powder)
- Normal rabbit serum (lyophilized powder)
- Instructions/flow sheet for the RIA protocol
- Instructions for calculating the results and graph paper for plotting the results.

Peninsula Laboratories results show plasma levels of ANP-like immunoreactive material from rat plasma to be 444 +/- 160 pg/ml +/- SD (N = 12)

CAUTION: Investigational Device. Limited by federal law to investigational use.
FOR RESEARCH USE Not for use in diagnostic procedures.

SENSITIVITY:
IC50 19 pg/ml tube

SPECIFICITY:

<table>
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<th>Peptide</th>
<th>% Cross-Reactivity</th>
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% B/Bo

100
80
60
40
20

1pM 5pM 10pM 24pM 50pM 100pM 500pM

U.S. ARMY MEDICAL RESEARCH & DEVELOPMENT COMMAND

BROAD AGENCY ANNOUNCEMENT

Basic research proposals are solicited in five major program areas in support of the medical research activities of the U.S. Army: (i) Military Disease Hazards; (ii) Combat Casualty Care; (iii) Army Systems Hazards; (iv) Combat Dentistry (Maxillofacial Injury, Dental Disease and Materials); and (v) Medical Chemical Defense.

Program booklets are available, by written request only, from Commander, U.S. Army Medical Research Acquisition Activity, ATTN: SGRD-RMA, Fort Detrick, Frederick, Maryland 21701-5014.

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