Originally Processed With FOIA(s): **FOIA Number:**
S

FOIA MARKER

This is not a textual record. This is used as an administrative marker by the George Bush Presidential Library Staff.

Record Group/Collection: George H.W. Bush Presidential Records
Collection/Office of Origin: Speechwriting, White House Office of
Series: Aarhus, Carol, Files
Subseries: Alpha File, 1990-1992

OA/ID Number: 13866
Folder ID Number: 13866-007

Folder Title:
Science and Technology

Stack:	Row:	Section:	Shelf:	Position:
G	19	2	5	7

I rec'd this too late to include in the Westinghouse speech — passing it around for anyone to use in the next science or volunteer or education speech.
-cc

ive

1991

Ms. Carolyn Cawley,
Office of Communications,
The White House,
Washington D.C. 20500

Fax No: (202) 456-6218

Dear Ms. Cawley,

Earlier this week, my daughter Rowan and I met with the publisher of 'Fortune' magazine, Mr. James B. Hayes, to discuss a new industry-college volunteer program called SMArT, for the Science and Math Achiever Teaming program, that she is piloting at Yale in the New Haven schools.

Mr. Hayes suggested that the White House might be interested in this program as a part of its Points of Light program, because it addressed the twin national needs, as he saw them, for more volunteers and for an effective, business-led, method of 'going national' with a program to fulfil the President's pledge for the U.S. to lead the world in this area by the next decade.

Rowan, as an ex-Westinghouse winner, was going to be in Washington D.C. this weekend, March 2 & 3, for the 50th Anniversary Science Talent Search Awards, and she knew the President would be involved in the STS functions. She therefore thought she should let the Science Advisor, Dr. Bromley, know about SMArT, because we had submitted an article to 'Fortune' in the form of an open letter to the President and because the White House might be interested in this initiative.

I faxed her letter and FedExed the material to Dr. Bromley's office yesterday, but, in following up today, found that it hadn't reached anyone yet. Accordingly, I contacted your office and, per your office's request, am faxing herewith her letter, the draft article and a Yale Daily News article on the New Haven/Yale pilot program she is running for your information. I have also faxed this material to Ms. Janice Howell at the Office of Science and Technology Policy.

If you feel the White House may be interested in this, please give me a call at (815) 226 7913 (business) or (815) 397-0584 (home) and I would be pleased to discuss it further with you.

Thank you for your interest.

Yours sincerely,

John G. Lockwood

Scientists Help Youngsters Get SMArT

By Bob Datta
YDN Staff Reporter

Rowan Lockwood '93 wants kids to get SMArT.

Lockwood's efforts don't involve Max and Agent 99, but the Science and Math Achiever Teaming program. SMArT, which will begin next semester, will allow students at Troup Middle School to research fundamental science with help from Yale student mentors, Yale professors and New Haven industrial scientists.

Twice a week after school, the Yalies will visit Troup to help the students design and reseach their own science projects. The Troup students will also receive guidance from professors and scientists who will let the students visit their labs and workplaces.

The students will work in all sorts of fields, ranging from solar power to DNA research to dinosaurs and evolution, using the lab space at Troup.

"I want the kids to get a good view of what science really is, and know what it is all about," Lockwood said.

Students are frequently turned off from science by bad textbooks, or "a single lousy math or intro-science class," she said, adding that hands-on experience can teach students as much as can classroom time.

"There is this misconception that in order to do real science you must have five years of study," she said. "I think that you learn the most as you go along, picking up skills along the way"

Bruce Guenin, a scientist at Olin and a volunteer for SMArT said the program will do much more than make the kids interested in science. "It enhances their self-esteem if people are interested in them," he said, adding that industry should play a role in New Haven education "to give kids an idea of the skills they have, and need, to succeed."

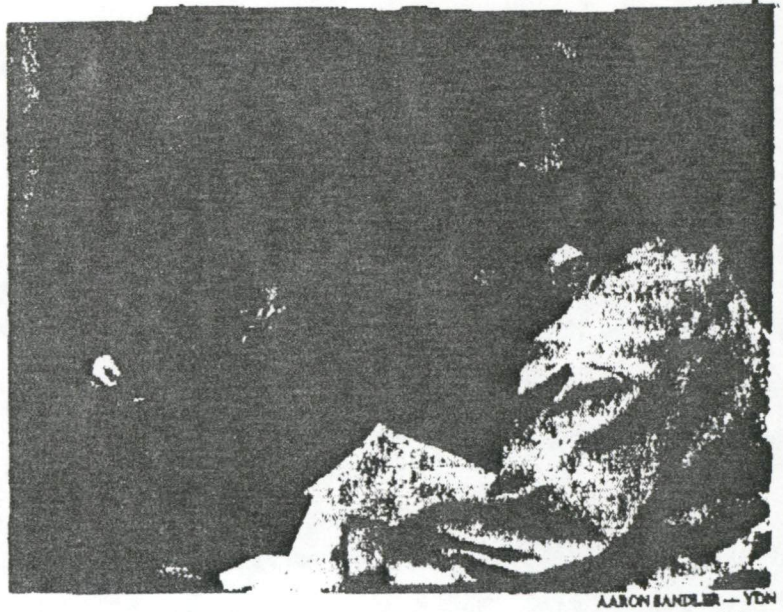
Lockwood said the idea for SMArT came from her experiences in high school. "I did research at a local college, published a paper, and I learned a lot from the experience," she said.

She spent most of her summer working closely with the New Haven school board and with Dwight Hall to get SMArT rolling, she added.

Jack Hasagawa, coordinator of Dwight Hall helped her to design SMArT this summer. "I know that unless someone does something about getting children interested in math and science, American society will go down the tubes," he said.

Kasagawa pointed to recent demographic surveys which indicate that American children get good science grades until the fifth grade, when a "bottleneck" occurs. "At the upper levels of eduation,

See SMArT, Page 4



AARON SANDLER — YDN

Marian Harris '93 and Rowan Lockwood '93, co-coordinators of the Science and Math Achiever Teaming program plan how to get middle school students interested in science.

Students, Scientists Work With City Youth

SMArT, from Page 1

there is a devaluation of math and science in our schools," he said.

The program will begin in January, when the second semester at Troup begins. For the first week, the SMArT student-volunteers will present a "smorgasboard of science" to offer the kids the broadest possible picture of what they can do.

The students themselves, with a little guidance from their SMArT mentors, will then choose the sort of project they would like to do.

"This program is, and has to be, of SMArT, concurred. "The kids' attention span will determine how much work they do," she said. "The projects will, for the beginning, only last a semester. It will give the kids a feeling of getting something done," Harris said.

The Troup school already has pretty good science facilities, Lockwood said, because it is a math-science magnet school for the sixth grade, and because NASA gives it resources for its Young Astronaut program.

SMArT is be partially funded by the Howard Hughes grant, which is

P.O. Box 2285 Yale Station
New Haven
CT 06520

February 26, 1991

The Hon. D. Allan Bromley,
Assistant to the President for Science and Technology,
Old Executive Office Building,
17th. St. & Pennsylvania Ave. N.W.,
Rm. 358,
Washington D.C. 20506

Dear Dr. Bromley,

Earlier this week, I met with the publisher of 'Fortune' magazine, Mr. James B. Hayes, to discuss a new industry/college volunteer pilot program we have started in the New Haven Troop school, which is funded by the Hughes grant. It is called SMArT, for the Science and Math Achiever Teaming program.

This weekend, I will also be attending, as a 1988/89 Westinghouse alumnus, the Westinghouse Science Talent Search Reunion in Washington D.C. on the occasion of the 50th STS Awards, where I am also hoping for an opportunity to make a presentation on SMArT.

Given your Office's interest in science and mathematics education and the efforts this Administration is making to encourage volunteerism through the Points of Light program, I thought that you may be interested in this program. I am enclosing an article my father and I have written on it and submitted to 'Fortune', along with materials on the New Haven/Yale pilot program.

The program was jointly devised by my father and me. I drew on the latent interest I thought college science students would have in increasing their hands-on involvement in science. My father, who works in international business development and innovation for a company in Rockford IL., drew on the franchising techniques of the Junior Achievement organization that he felt strongly had to be applied to math and science if an effective national effort was to be mounted.

... 2

I am very grateful for his interest to Mr. Hayes, who was, I think, enthused by both ideas; the first that college students could supply the numbers of volunteers that are needed but are lacking in industry, and the second that SMArT could be 'seeded' rapidly and effectively throughout the nation, using incentivization, formularization, and franchising business techniques. I am also grateful to Dean Kagan, Dean Judith Hackman and Jack Hasagawa at Yale, who have been very supportive of the program.

If you are interested in following up on this, my telephone number at Yale is 203/436-0801. However, it may be easier to contact me through my father, Mr. John Lockwood, at my home address, 1124 Post Drive, Rockford, Il 61108, (tel. 815/397-0584), or at his business telephone, 815/226-7913. During my stay in Washington this weekend, March 2 and 3, I will be staying at the Washington Hilton 202/483-3000.

Thank you for your interest in the program and for your time.

Yours sincerely,

Rowan Lockwood

Rowan Lockwood (Ms.)

P.S. We have changed the front page of the attached article from the copy we faxed earlier. I regret any inconvenience.

FRANCHISING SCIENCE AND MATH ACHIEVER TEAMS - A SMArT GAMEPLAN, MR. PRESIDENT.

Telephone: Bus. (815) 226-7913
Home (815) 397-0584

The State of the Union addresses of the past two years have been long on educational goals but short on specifics. Of particular interest to business is just how our students are supposed to lead in the big world league of math and science by the year 2000? Clearly Mr. Bush wants to coach a team effort, with business a prime player, but where's the drawcard for the kids? Where's the game plan?

Commentators place long odds on a win whatever the gameplan. To them, simply increasing science education spending will not stem the decline in numbers and skills of teachers and students alike. The problems are universal, the solutions piecemeal. To meet Mr. Bush's goal, a national classroom program must reconcile too many institutional interests in government and the educational establishment in too short a time. Always pitching short, the experts leisurely walk the players.

Outside the classroom, however, at the local level, science education is more fun than a pickup game at recess. All over the U.S., unsung but effective, ever more players - industry volunteers as mentors, college students as tutors - are inventing ever more plays to help out - science clubs and fairs, enrichment and application programs, internships, field trips. The rush of industry support could fill a grandstand. Outside the classroom, it is clear that opportunity and achievement, those uniquely American values that once built the little red schoolhouse and made Johnny run, still endure.

But to win in ten years, the U.S. needs a drawcard, a gameplan and a players league at the national level. One drawcard with that potential is the opportunity for kids to try out in science offered by the Science and Math Achiever Teaming (SMArT) program being introduced at Yale for New Haven schools, funded by a Hughes grant. Its gameplan is to build early achievement in science: its 'league' will be franchised community volunteer teams with their own organization and awards.

SMArT aims to motivate middle and high school pupils in science and math through early achievement in original, long-term, research projects, supported by volunteer teams from industry and academia. Team techniques, as developed, will comprise a rulebook for franchising new teams. Teams will be sponsored by industries and colleges cooperating with the pupils' schools, and, importantly, will be open to all comers.

Offering opportunity to all in science is important. Early effort counts more than perceived ability. Science programs have to look hard at their mission through kids' eyes or risk attracting only those already drawn to science. SMArT wants the many with potential in science to try out, not just the few committed to it. Science is one discipline, (languages another), where a hard grind sharpening the tools of learning usually precedes any fun in using them. Its future in the U.S., now the baby boom is over, depends on motivating the many.

Learning by doing is also key to math and science. If achievement is to spark motivation in those subjects, then it must be meaningful, and result from long-term, original research projects that require more effort for longer than, say, the average science fair project, and correspondingly reward participants with a greater sense of discovery.

Finally, achievement, to thrive in science as in life, must start with taking control and end with recognition. All SMArT projects will be chosen and controlled by the junior team members and will be eligible for local incentive awards and entry in national competition.

The SMArT guidelines reflect these concepts:

- Projects will be devised and managed by the school pupils and must involve original or creative work in results or methodology.
- Projects will be not less than one school year in duration and require a pupil/parent written commitment to timely completion.
- Industry volunteers will commit to provide project guidance, research resources and logistics support for the students involved.
- College volunteers will commit to provide hands-on help to, and pursue sources and technical resources for, the school pupils.
- Cooperating industries will provide schools liaison, project resource, logistics support, and local incentive awards.
- Cooperating colleges will provide project source access, staff advisory services and incentives complementing the industry awards.
- A national center will provide organizing help, project resource, program research and a state and national awards structure.

The core SMArT concept is its three-way, volunteer-based teaming of schools, industry and colleges. This expands the resources needed for an effective program and creates important complementary benefits. Colleges can directly address their declines in enrollments and graduations in math and science while their students take advantage of volunteer service, job opportunities, hands-on research and teaching experience well beyond the lectureroom and lab. Industries and universities can cooperate more in recruiting, innovation and contract R & D, while contributing significantly to competitiveness. Industry volunteers will find working with youth recharges their on-the-job energies, and, should they flag, the college students can bring their own youthful enthusiasm to bear. Science teachers can have some respite and their pupils can have a foretaste of their college and workplace futures. Even the local science fair - now dreaded alike by students without ideas, parents without time and teachers without help, - can become an opportunity instead of a chore.

In 14,000 schools, a national model for this program already exists. Junior Achievement, the leading business-education partnership in the country, has drawn students to business for over seventy years. The name Junior Achievement came from the original JA concept of business volunteers helping students achieve success by starting their own businesses on their own time. Millions of parents know how effective that wellspring of achievement has been in motivating their children. Equally effective but less well known has been JA's pioneering use of that quintessentially American business tool, franchising, to expand its winning concept across the U.S. In this, JA has not only played to an American business strength but has demonstrated the potential in private bodies 'going national' with innovations in education. The SMArT gameplan draws on the same national strengths, opportunity, achievement, volunteerism in higher education and in business to offer a real chance at a come-from-behind world victory in science and math.

How about a tryout then, Mr. President, Coach, Sir? Call on the heavy hitters on your science team from industry and academia. How about a tryout for SMArT as America's farm team in the big league of world science and math education?

****

ROMAN LOCKWOOD, (Ms.),

Home address: 1124 Post Drive, Rockford, Illinois 61108, U.S.A.
Home tel.: (815) 397 0584. Birthdate: 7 June 1971

EDUCATION

1989-91 **Attending Yale University, New Haven, Connecticut, U.S.A.**

My first year courses primarily consisted of the inter-disciplinary Directed Studies Program (Western civilization philosophy, history and literature), but also included Evolutionary Biology and Chemistry. My second year studies have included Mineralogy, Geology, and Anthropology courses, directed towards a double major in Geology and Anthropology, along with History and French.

1986-89 **Charter Class Member, Illinois Mathematics and Science Academy (IMSA),**
1500 W. Sullivan Rd., Aurora, IL 60506-1039, U.S.A.

IMSA is a three-year, residential, state-supported high school with competitive admission for all Illinois sophomore-level students.

1985-86 **Completed Grade 9, Rockford East H.S., Rockford, IL.**

ACADEMIC ACHIEVEMENTS

1989-91 - Publication of paper, "Evidences of Bipedalism in (Larger) Pterosaurs Derived from a Biomechanical Methodology" in BASE journal, Vol. 8 No. 1, (Spring, 1990)

- Admitted to the Yale Directed Studies Program, (1989)

1986-89 - Winner, the Illinois State Academy of Science Frank H. Reed Award, best Westinghouse report, (May, 1989)

- Winner, 48th. Annual Science Talent Search for the Westinghouse Science Scholarships, (January 1989).

- Presented abstract at the annual meeting of the Society of Vertebrate Paleontology at Drumheller, Alberta, Canada, (Oct. 1988).

- Interned in the Dept. of Paleobiology, the National Museum of Natural History, Washington D.C. (Aug. 1988).

- Presented INTECH 88 paper to the DOE location research team for the U.S. Super Collider facility, (May 1988).

- Won First Prize, the INTECH 88 Science Competition for Chicago High Tech Corridor Area Schools and the American Nuclear Society (Chicago Section) Award for an energy-related project, (May 1988).

- Admitted to the Charter Class of the Illinois Mathematics and Science Academy, (1986).

- Rockford East High School Academic Honor Roll (1985-86).

ATHLETICS & EXTRACURRICULAR PARTICIPATION

1990-91 - Won Dartmouth Diving Meet 1M & 3M Events (Feb. 1991)

1989-90 - Varsity Letter, Yale Swimming & Diving Team.
- Won Harvard-Yale Diving Meet 1M Event (Dec. 1989)

1988-89 - 17th. place, Illinois High School Association (IHSA) State Diving Meet, (Nov. 1988).
- Won IHSA W. Chicago Sectional Diving Meet, (Nov. 1988).
- Captain, IMSA Diving Team.
- Section Leader (Flutes), IMSA Concert Band.
- Cast Member, IMSA Drama Club 1989 production.

1987-88 - 5th. place, Scholastic Women's 1M Diving Competition, Prairie State Games, (July 1988).
- 18th. place, IHSA State Diving Meet, (Nov. 1987).
- 2nd. place, IHSA Waubonsie Valley Sectional Diving Meet, (Nov. 1987).
- Certification in Advanced Lifesaving and CPR.

1986-87 - 5th. place, IHSA Waubonsie Valley Sectional Diving Meet, (Nov. 1986).

1985-86 - Elected Student PE Leader for Sophomore year.
- NASTAR Silver medal in skiing, (April 1986).

COMMUNITY WORK SERVICE

1990-91 - Conceived and initiated the New Haven/Yale Science and Math Achiever Teaming (SMArT) pilot program at Troop public school in New Haven. SMArT is a volunteer program designed to encourage students in math and science and funded by Yale from the Hughes Foundation.

1988 - Volunteer lifeguard at Rockford College pool, Rockford, IL, for summer swims for children and the handicapped.

1986-88 - IMSA work-service, including Foreign Language Department assistant, lifeguarding and other duties.

PERSONAL STATEMENT

At Yale, I am pursuing a double major in Geology and Geophysics and in Anthropology. However, I would like to supplement these courses by undertaking interdisciplinary work involving paleoanthropology and paleontology.

PUBLICATIONS & PRESENTATIONS

"Evidences of Bipedalism in (Larger) Pterosaurs", (with Dr. Virginia Naples, Northern Illinois University), presented at the 48th. annual meeting of the Society of Vertebrate Paleontology at Drumheller, Alberta, Canada, October 1988; abstract published in the Journal of Vertebrate Paleontology, Supplement to No. 3, Vol. 8, Sept. 23, 1988.

THE WHITE HOUSE

WASHINGTON

February 15, 1991

TO: ADMINISTRATION OFFICIALS

FROM: OFFICE OF PUBLIC AFFAIRS
195 OEOB, 202/456-2483

For your use and distribution.

PRESIDENTIAL WIRE.....February 15, 1991

On Science and Math Education

President Bush's remarks to the
American Association for the Advancement of Science

"Technology may be the key to the future, but people are the key to technology. The national education goals that we established with the nation's governors explicitly recognizes this connection. One of our most ambitious goals is for American students to be first in the world in science and math achievement by the year 2000.

"Our budget includes substantial funding increases for math and science education. But those math and science goals will never be achieved if they are seen simply as goals for government alone. All sectors of society must recognize the importance of scientific literacy and strive to achieve it."

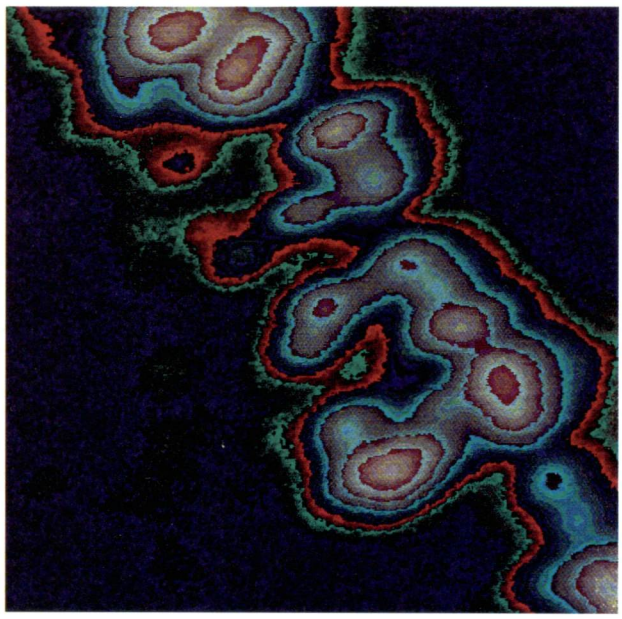
"Last fall, we had 200 of the best mathematics and science teachers in the country here to the White House. And more than a few of those teachers pointed out that kids are natural-born scientists. They delight in the sheer pleasure of learning new things, making something work, understanding the world."

"Sharing science's sense of adventure through education and outreach has never been more important that now."

Washington, DC
February 15, 1991

For more information please contact the White House Office of Public Affairs at 202/456-2483.

NIST



UNITED STATES
DEPARTMENT OF COMMERCE

NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY

Covers. These micrographs were produced using a new type of optical surface imaging—scanning scattering microscopy—that can be used to monitor and measure changes in surface structure and microtopography with nanometer height sensitivity. For example, it can measure and image the surface roughness of polished semiconductor wafers and detect individual surface defects on these wafers.

Below. Recognizing the critical role of quality to business, Congress created the Malcolm Baldrige National Quality Award in 1987. Named after former Secretary of Commerce Malcolm Baldrige, the award honors American companies that achieve the highest level of total quality management. Presented annually, the award is intended to help motivate U.S. companies—both large and small—to improve their total quality management, including the quality of their products and services. NIST manages the award program with the private sector.

NIST at a Glance

The National Institute of Standards and Technology (NIST) was established by Congress "to assist industry in the development of technology . . . needed to improve product quality, to modernize manufacturing processes, to ensure product reliability, . . . and to facilitate rapid commercialization . . . of products based on new scientific discoveries."

A principal agency of the Commerce Department's Technology Administration, NIST has as its goals: to aid U.S. industry through research and services, to contribute to public health and safety, and to support the U.S. scientific and engineering research communities.

NIST conducts basic and applied research in the physical sciences and engineering, developing measurement techniques, test methods, standards, and related services. The Institute does generic and precompetitive research and development work on new advanced technologies.

Sites	Gaithersburg, Md. (headquarters) Boulder, Colo.
Budget	$350 million (est. all sources, 1990)
Staff	3,000 scientists, engineers, technicians, and support personnel, plus some 1,000 visiting scientists each year
Main Research Areas	Chemical science and technology Physics Materials science and engineering Electronics and electrical engineering Manufacturing engineering Computer systems Building technology Fire safety Computing and applied mathematics

Steuben Glass

A National Resource

The competition is intense: Make products that are better, less expensive, and more reliable—and get them to market first—or lose out in the world marketplace.

At the National Institute of Standards and Technology, we provide U.S. industry with many of the tools it needs to compete in world markets. NIST technical services and research programs are helping companies become more efficient, more productive. The Institute's staff are working with hundreds of firms of all sizes to build quality and innovation into their operations. And we are stepping up our efforts to help ensure that U.S. industry can take commercial advantage of emerging technologies.

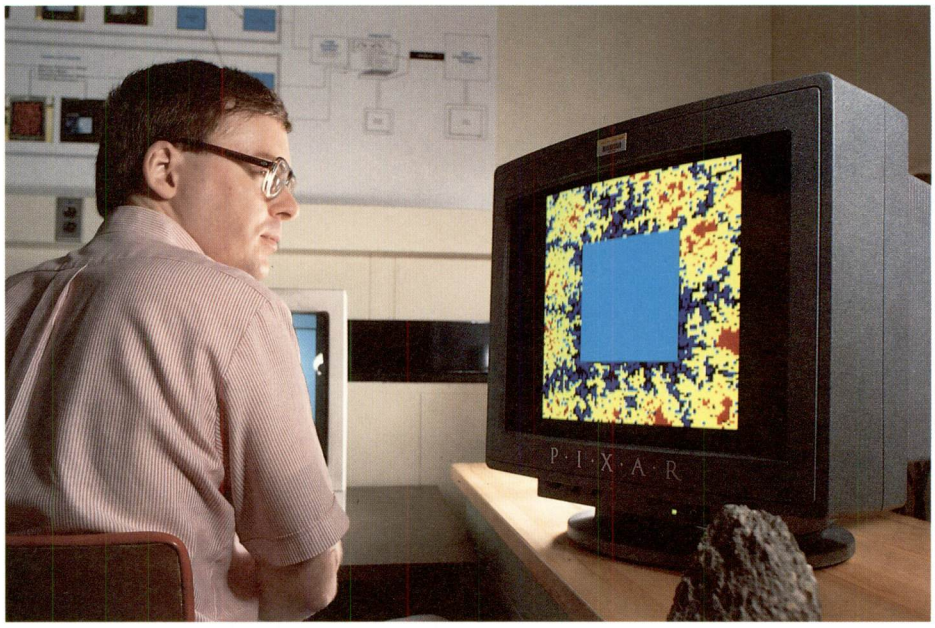
Strategic partnerships—sharing costs and risks—are essential in today's tough marketplace. We know cooperation pays. Since its founding in 1901 as the National Bureau of Standards, the Institute has teamed with thousands of organizations. NIST-pioneered innovations are incorporated in nearly every line of products in our economy.

NIST is a national resource. I invite and urge you to use our research and services.

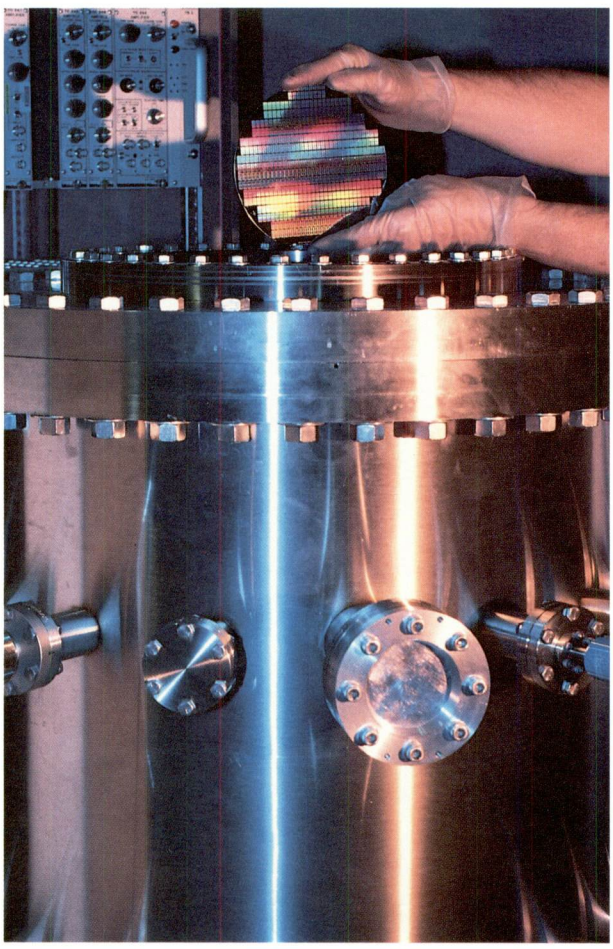
John W. Lyons
Director

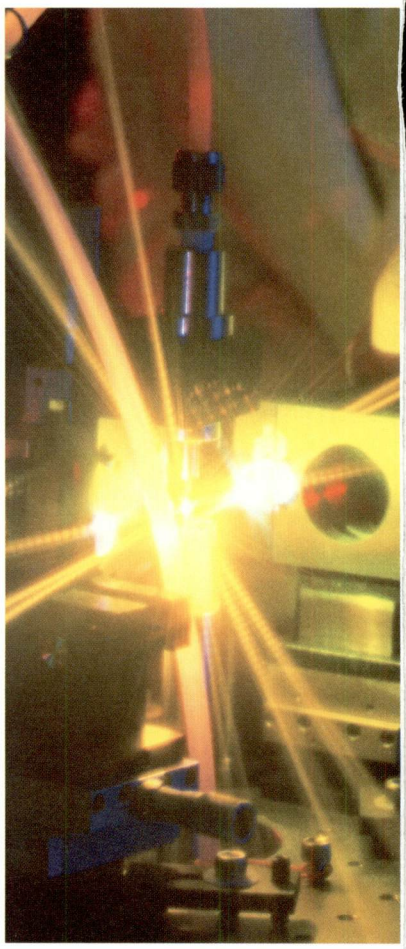
NIST, Gaithersburg, Md. The Institute encourages the use of its research and testing facilities by industry, government, and academia for cooperative and proprietary research. Among the facilities at the Gaithersburg site are: a 20-megawatt research reactor with a cold neutron source, a synchrotron ultraviolet radiation facility, a metals processing laboratory, an automated manufacturing research facility, a fire research facility, and an open systems interconnection (OSI) security laboratory.

NIST researchers are developing new techniques to help improve building materials. One such technique is a computer model that can simulate how the microstructure of concrete develops during the setting process. Models like this ultimately will be used to predict characteristics of concrete, such as performance, strength, and durability.



NIST has constructed the first U.S. facility devoted to cold neutron research, which will give U.S. industry prime access to one of the key tools of modern materials science. The 15 experimental stations being installed at the facility will be available for use by outside organizations. For example, the neutron depth profiling (NDP) instrument (near right) is believed to be the most powerful dedicated NDP instrument in the world. Using NDP, researchers are able to make accurate measurements of impurities and dopants that greatly affect the properties and performance of new materials used in semiconductors and other high-technology products.





Donald Becker

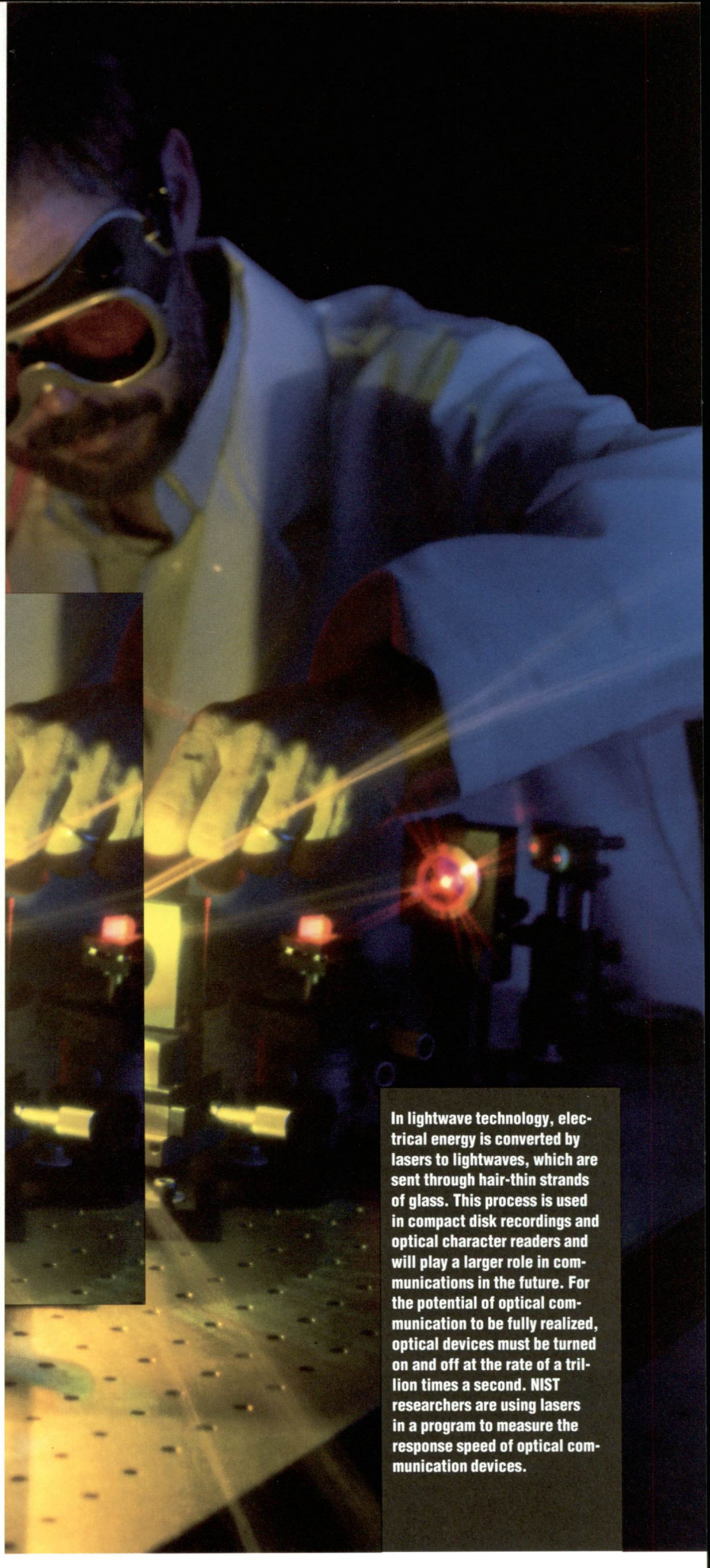
NIST: A World-Class Partner

NIST contributes to the advance of technology through world-class science and engineering research. Measurements, testing procedures, quality assurance methods, and innovations developed at NIST have helped build the technical infrastructure upon which much of the U.S. economy rests.

Virtually all U.S. industries have benefited—from machine tool to food processing to semiconductor manufacturing, and from aerospace to construction to biotechnology. Studies have opened new lines of research, led to new scientific instruments and manufacturing methods, and helped open new markets. Examples range from neon signs to closed captioning on television, from atomic clocks to radio direction finders for planes.

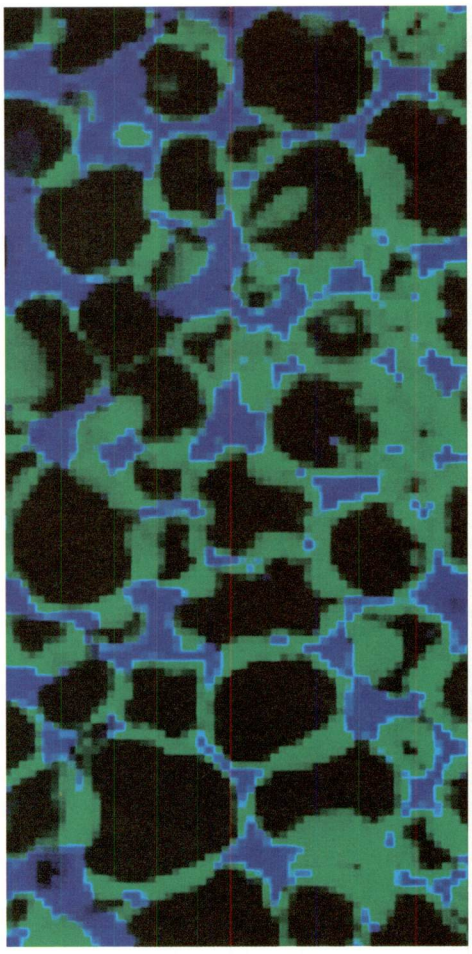
NIST accomplishments are often "the story behind the story," leading to improvements in measurement capability and, ultimately, efficiency, reliability, and quality.

Building on its technical expertise, NIST provides valued, neutral leadership in national and international standards arenas. Staff members chair about 10 percent of the 1,300 voluntary industry standards committees on which they serve. They help achieve consensus among often fragmented business interests, furthering the competitive position of U.S. industry in world commerce.

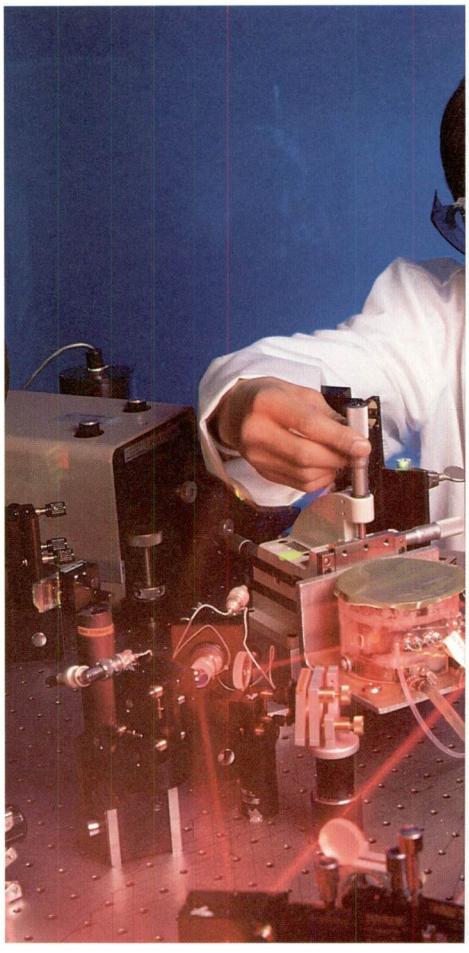


In lightwave technology, electrical energy is converted by lasers to lightwaves, which are sent through hair-thin strands of glass. This process is used in compact disk recordings and optical character readers and will play a larger role in communications in the future. For the potential of optical communication to be fully realized, optical devices must be turned on and off at the rate of a trillion times a second. NIST researchers are using lasers in a program to measure the response speed of optical communication devices.

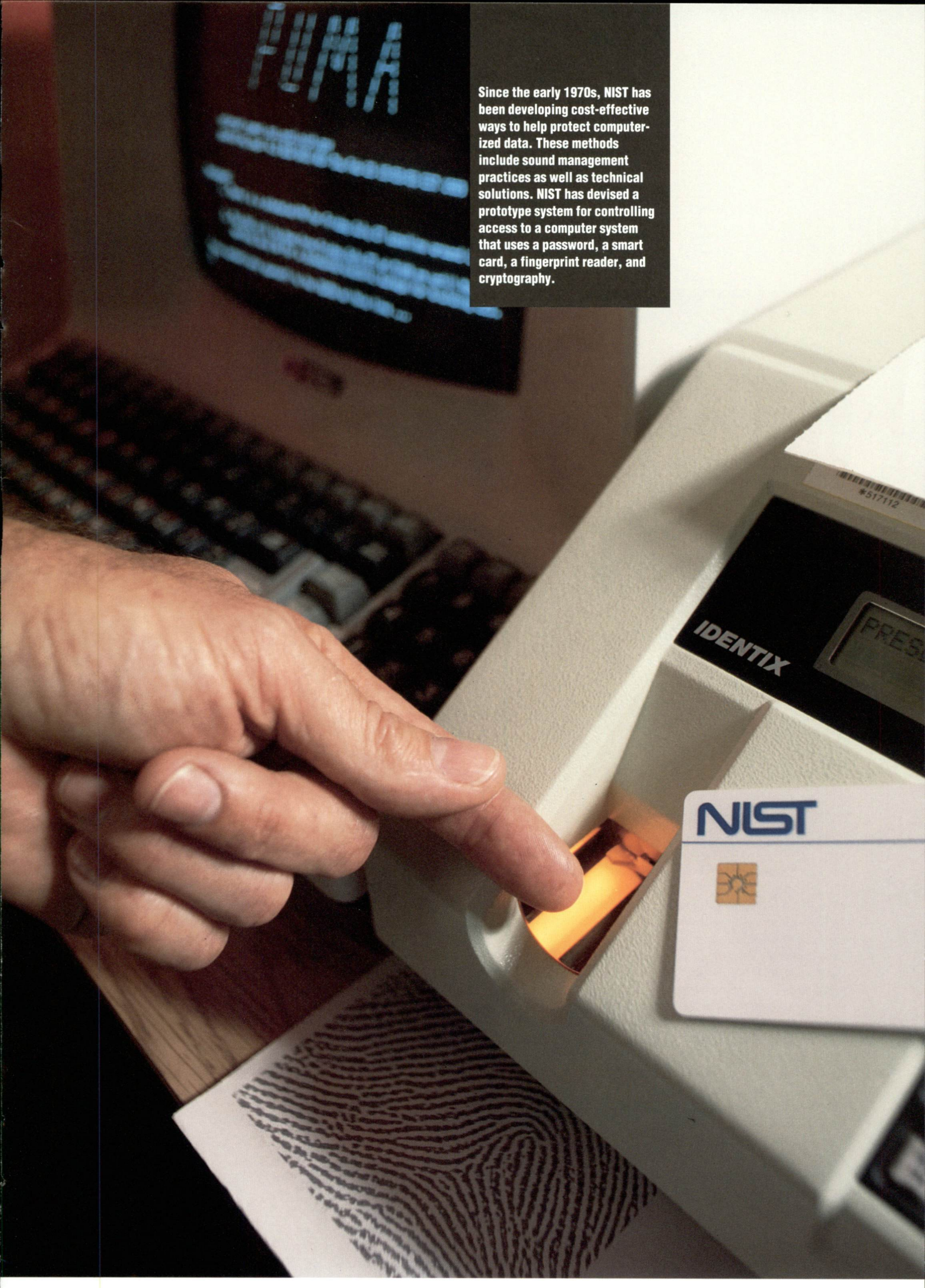
NIST researchers played a leading role in the development of the microanalysis technique—compositional mapping—that uses digital computer technology coupled with electron beam instruments to "map" the distribution of chemical elements on sample surfaces. Micrometer-scale analyses are important in characterizing new, high-technology materials such as aluminum-lithium alloys, high-temperature superconductors, and semiconductors. In the ceramic material at right magnesium is black, vanadium blue, and cobalt green.



In a leading-edge experiment, NIST researchers laser-cooled a mercury ion, confined in a radio frequency "trap," to its fundamental limit. The work is important for spectroscopy, a study of the nature of matter through various radiation it emits. The result may be a highly sensitive spectrum analyzer as well as the basis for a new standard of timekeeping.



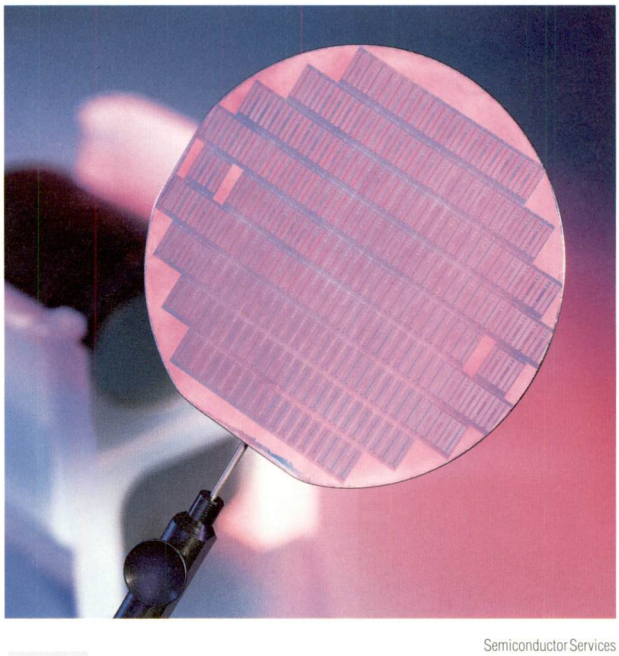
Geoffrey Wheeler



Since the early 1970s, NIST has been developing cost-effective ways to help protect computerized data. These methods include sound management practices as well as technical solutions. NIST has devised a prototype system for controlling access to a computer system that uses a password, a smart card, a fingerprint reader, and cryptography.

Above left. Chlorofluorocarbons (CFCs)—a family of chemicals used widely for refrigerants, foam in building insulation, furniture, and car seats—are breaking down the ozone layer, which protects the Earth from harmful levels of ultraviolet radiation from the Sun. NIST scientists are measuring the chemical and physical properties of alternative refrigerants to help industry find effective replacements for CFCs. For example, a new database called REFPROP, issued by NIST through its standard reference data program, gives refrigeration engineers, chemical and equipment manufacturers, and others a new research tool for evaluating the performance of refrigerants and refrigerant mixtures.

Right. NIST provides the semiconductor industry with the measurement methods and technology necessary for the manufacture of reliable, high-quality chips. In one case, at the request of industry, NIST researchers developed the technical basis for three test methods for evaluating electromigration, a serious failure mechanism in semiconductor integrated circuits.



Semiconductor Services

NIST Research: A Strong Foundation

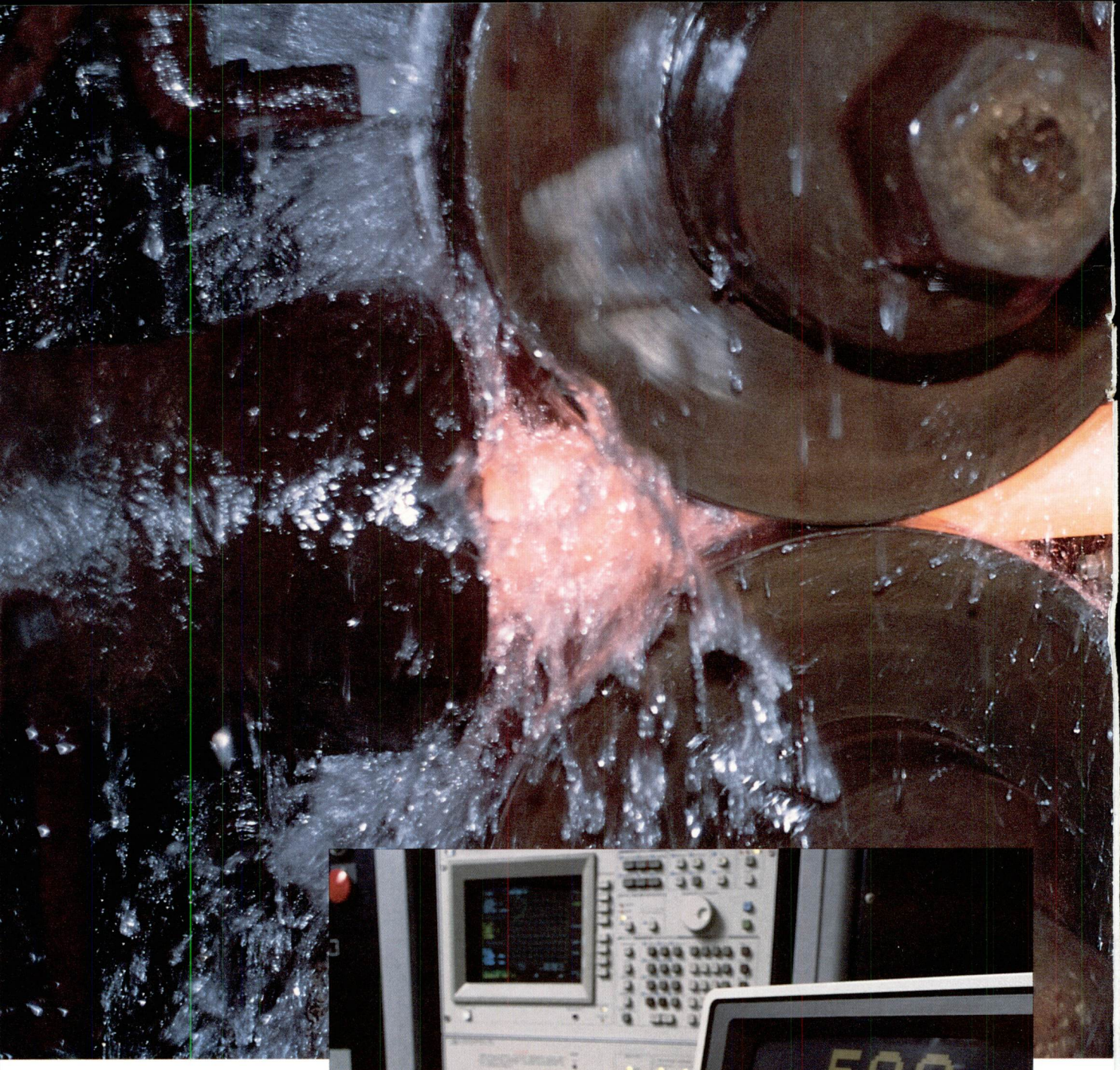
The research of NIST scientists and engineers places them at the frontiers of advanced technology. Advanced semiconductor devices. Optoelectronics. Superconductors. Advanced materials—ceramics, composites, polymers, new alloys, and thin films. High-density data storage. Advanced computing systems. Digital imaging technology. Biotechnology and bioprocessing.

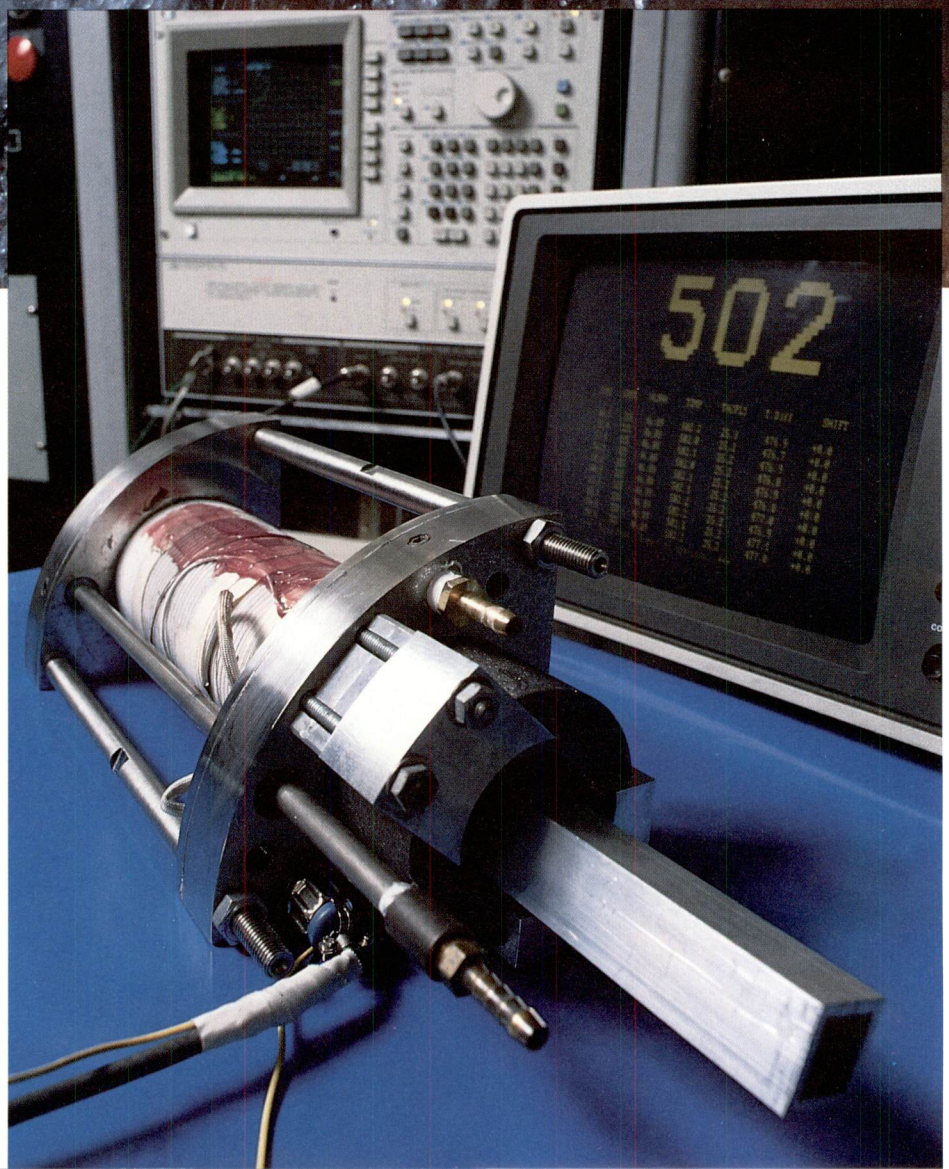
NIST specialists are developing techniques and instruments that will ultimately determine whether technological promise becomes commercial reality. For example, they are working to ensure that U.S. firms will be well prepared to vie in the world market for biotechnology products—predicted to total $40 billion by the year 2000. NIST is helping to lay the foundation for commercial-scale production of bioengineered compounds.

Much of NIST's R&D effort lies at the increasingly fuzzy boundary between basic and applied research, where commercial spinoffs can follow on the heels of discovery. The continuing miniaturization of electronic devices and the building of new materials atom by atom are two such areas.

Today, NIST studies of "laser-trapped" atoms or of the changing behavior of molecules as they grow a few atoms at a time are enhancing scientific understanding. Tomorrow, this knowledge could be embodied in new products.

Working with industry and the Navy, NIST researchers designed and assembled a state-of-the-art flexible manufacturing system for the Navy shipyard at Mare Island, Calif. This workstation (inset) is capable of operating, largely unattended, 24 hours a day, producing parts on demand for nuclear submarines. Many of the advanced techniques used in the workstation were developed in NIST's Automated Manufacturing Research Facility (AMRF). The AMRF is an experimental facility designed to study the application of advanced robotic and computer-control techniques to small-batch manufacturing. Pictured here is the cleaning and deburring workstation.





Researchers from NIST and the Aluminum Association have developed a process control sensor (right) that rapidly measures the internal temperatures of extruded aluminum as it is produced. The sensor, which has performed successfully at plant trials, should help aluminum manufacturers optimize the quality and production of extruded aluminum. The sensor is being modified for use in other types of aluminum production, and can be adapted to the production of other metals, including steel (above).

NIST has organized a consortium of industry and government researchers with the goal of developing a prototype automated analytical chemistry laboratory. When completed, the modular system will perform the three major steps of a chemical analysis: sample preparation (dissolving by microwaves, as shown in the photo to the left), separation, and detection. Though automation has permeated numerous U.S. industries, the analytical laboratory has lacked the tools to incorporate automation. The consortium aims to change this by producing a generic laboratory that can be adapted readily by members for their individual needs. Each day more than 250 million chemical analyses, at an annual cost of $50 billion, are made in this country in fields such as medicine, the environment, and food products.

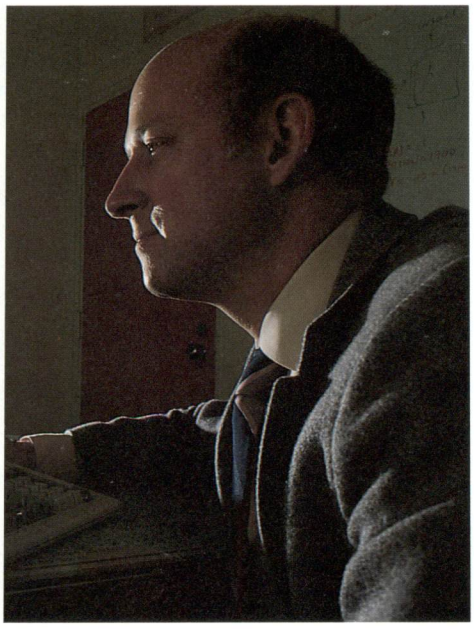
Thousands of biological tissue samples and environmental specimens are being preserved in the NIST Biomonitoring Specimen Bank for future analysis. The bank is especially valuable for determining pollutants present in the environment at a given place and time.

Diamond-tool turning and grinding machines are the acme of precision manufacturing tools, capable of machining high-precision optical finishes without additional polishing (such as on this copper mirror for a laser system). NIST researchers and their industrial partners are working on improved methods of monitoring and controlling diamond turning machines to improve the precision and production of highly efficient optics such as mirrors for laser welders.

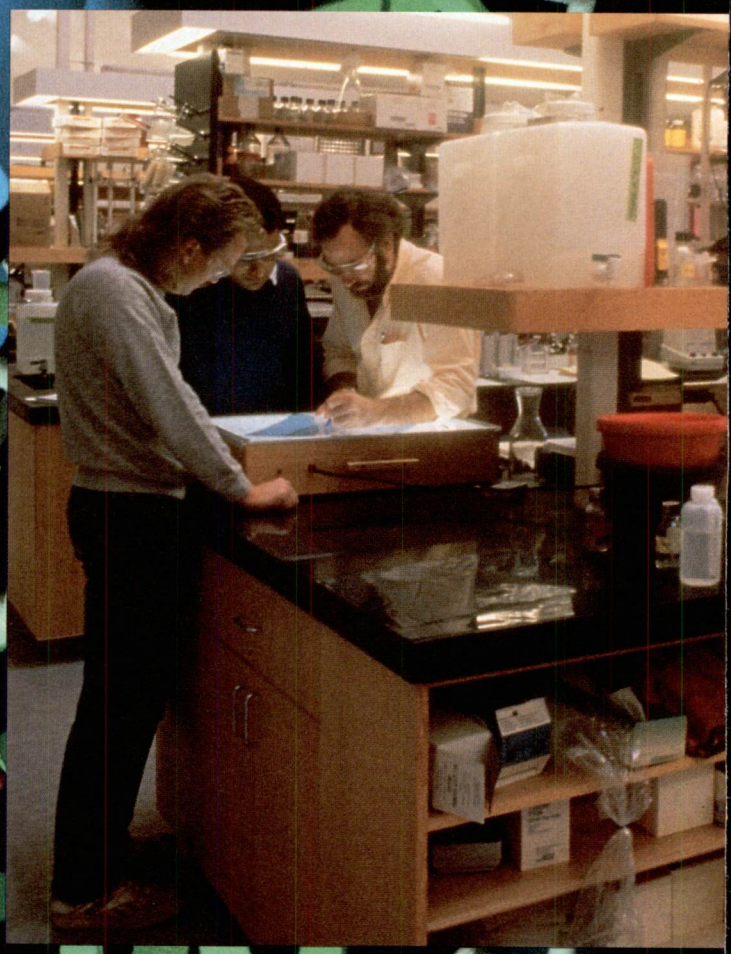
Bessmarie Young

NIST researchers have joined with industry to develop the measurement methods and scientific basis for process monitoring sensors, control models, and other tools manufacturers need to increase the speed and reliability with which polymer composite materials are processed. As part of this effort, model materials with special fiber surface treatments are prepared (left) to study the effect of process changes on composite performance.

Below. A laser and radiochromic sensors form the basis of a NIST-designed system that could be used to monitor, in real time, a number of widely used industrial radiation processes, such as polymer curing, sterilization of medical devices, or semiconductor hardening tests.



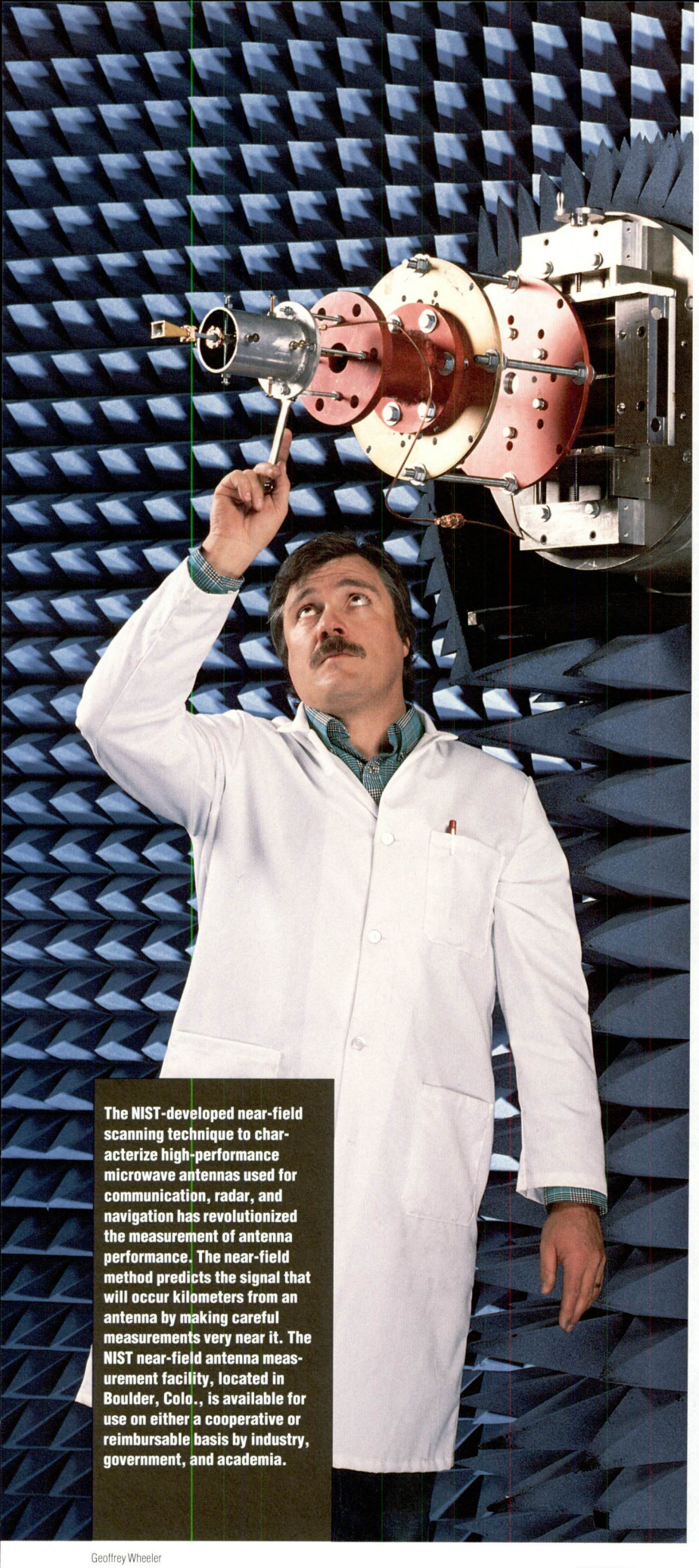
Left. Computer models developed by NIST researchers make it possible to duplicate real fires without having to burn a room or building. One such model, called HAZARD I, makes it possible to predict the spread of smoke, toxic gases, and heat from a fire in a room to other parts of a building. These models give engineers, architects, building owners, and others the knowledge to improve fire safety at reduced costs.



The Center for Advanced Research in Biotechnology (CARB), a joint research venture of the University of Maryland, NIST, and Montgomery County, Md., is a world-class research center for multidisciplinary studies in protein structure, function, and design. Here (inset) researchers from industry, universities, and the federal government are working to narrow the gap between laboratory discoveries and industry needs.

Left. Integrated Services Digital Network—ISDN—is a telecommunications technology used to send and receive voice, data, and pictures simultaneously over digital telephone lines, which are increasingly high-capacity fiber-optic transmission systems. NIST is working with both manufacturers and prospective users of this technology to ensure that ISDN products and services from different manufacturers and vendors are compatible and that they meet users' needs.

Above. More accurate measurements of cholesterol in food are possible using the standard reference material developed by researchers from NIST, the College of American Pathologists, and the U.S. Department of Agriculture. For example, this material was used as the quality control material in a nationwide study of the cholesterol content of eggs. The study showed previously accepted values to be in error, and new, more accurate values were determined.



The NIST-developed near-field scanning technique to characterize high-performance microwave antennas used for communication, radar, and navigation has revolutionized the measurement of antenna performance. The near-field method predicts the signal that will occur kilometers from an antenna by making careful measurements very near it. The NIST near-field antenna measurement facility, located in Boulder, Colo., is available for use on either a cooperative or reimbursable basis by industry, government, and academia.

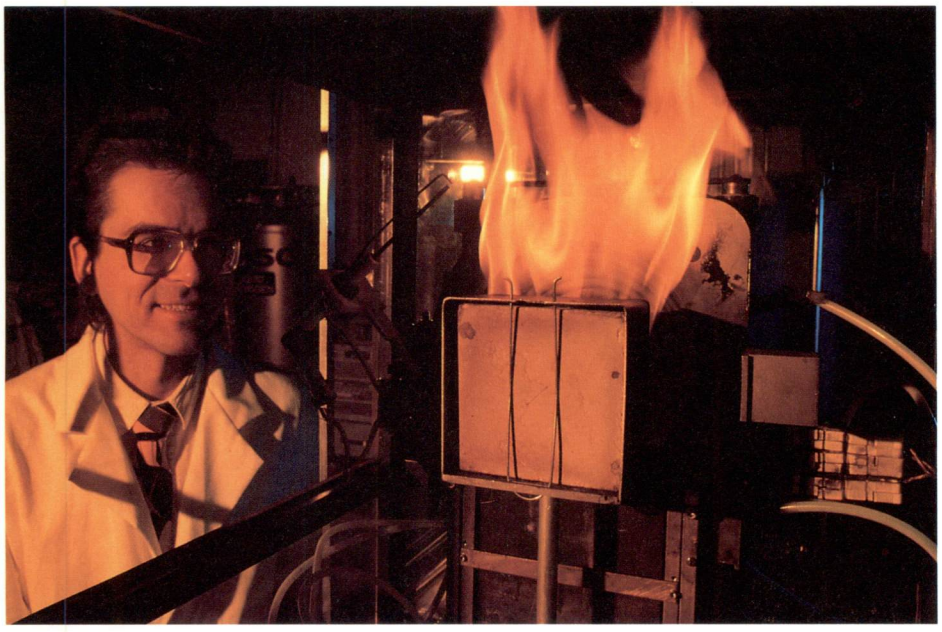
Geoffrey Wheeler

Cooperation, Naturally

Results-oriented cooperation. That has always been NIST's way of doing business. The Institute's focus on industrial problems was the catalyst for some of the nation's first research consortia. Since the 1920s, industrial researchers have been coming to the Institute to use its vast array of research instruments and testing equipment and to work with its technical specialists, many of whom are the recognized leaders in their fields. Now, through cooperative research and development agreements, companies can be assigned the rights to intellectual property resulting from collaborations.

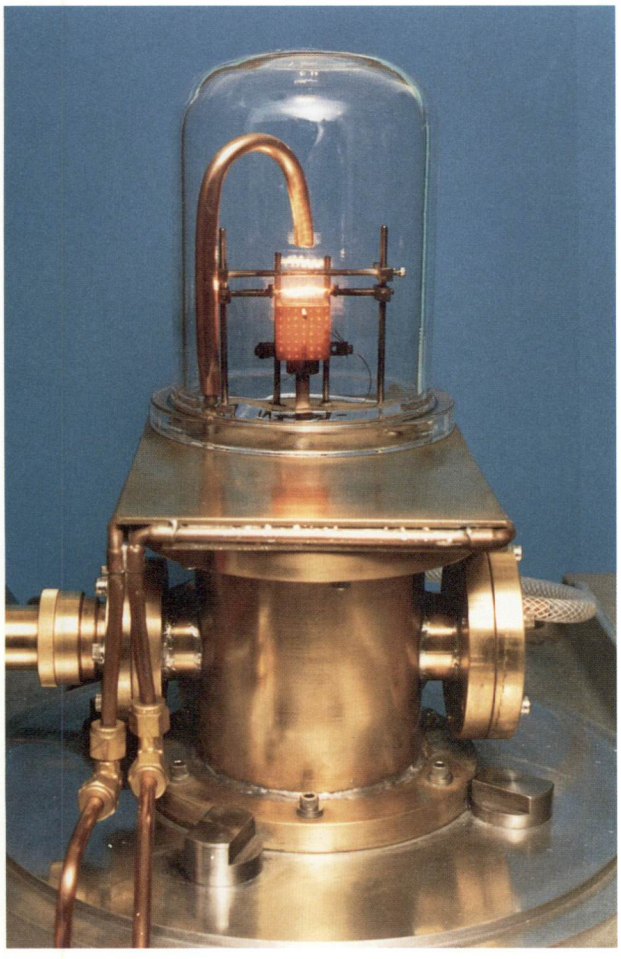
And from the start, firms have depended heavily on NIST technical services. Ninety of the nation's 100 most R&D-intensive firms now use NIST measurement or data services; 27 of the top 50 have placed researchers at the Institute during the last 10 years. In all, NIST staff members are involved in over 1,100 collaborations. Any U.S. firm—large or small—is eligible to collaborate with NIST on projects of mutual interest.

Research results—disseminated through an annual output of 3,000 publications and technical talks and more than 100 major, Institute-hosted conferences and workshops—have concrete applications, either today or tomorrow.



Left. This NIST cone calorimeter provides data critical to predicting the fire hazard of a product using a small sample of material—replacing time-consuming and expensive full-scale tests. The U.S.-based ASTM has adopted a voluntary fire hazard test method based on the instrument. It also is being considered as the basis for a standard test method by the International Organization for Standardization.

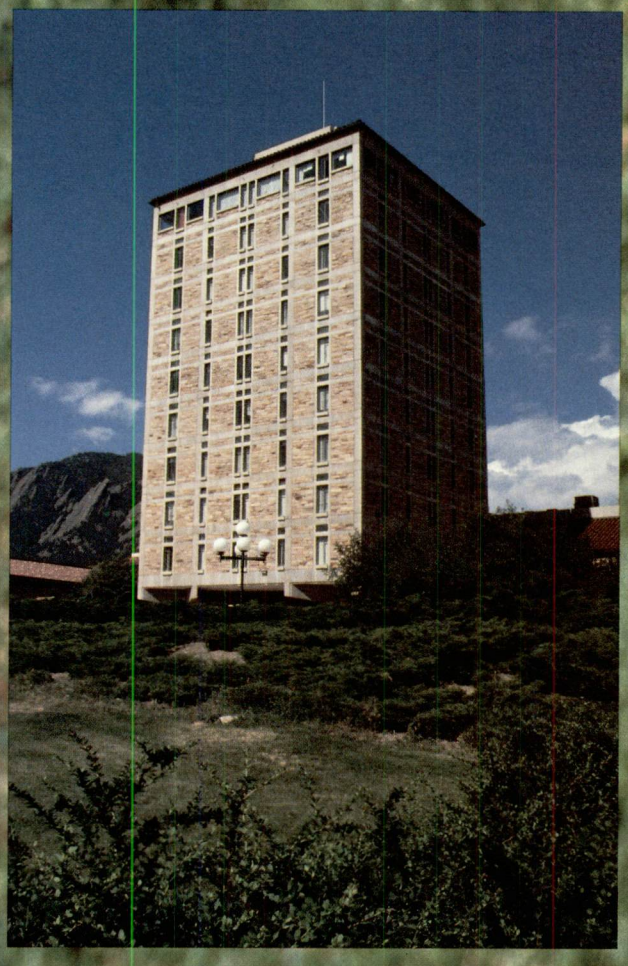
Wide World Photos, Inc.



Left. NIST scientists are developing the measurement information industry needs to produce diamond films with many of the properties of natural diamond. The physical and chemical properties of diamond make it a highly desirable material for aerospace products, electronics, and industrial equipment. The goal of the NIST research is to characterize the production processes, the structure, and other properties of diamond films to help industry produce high-quality, high-performance advanced materials.

Above. Investigating the October 1989 Loma Prieta earthquake in California, NIST researchers concluded that deep, unstable soil deposits played a major role in the damage to buildings and "lifelines"—bridges, highways, and water and gas pipelines. As part of the National Earthquake Hazards Reduction Program, NIST conducts research and provides technical support to the private sector and government agencies working to improve the performance of buildings and other structures subjected to earthquakes.


U. S. DEPARTMENT OF COMMERCE
BOULDER LABORATORIES
325 BROADWAY



For More Information

Chemical science and technology
Harry S. Hertz
A309 Chemistry Bldg., 301/975-3145

Physics
Katharine B. Gebbie
B160 Physics Bldg., 301/975-4201

Materials science and engineering
Lyle H. Schwartz
B309 Materials Bldg., 301/975-5658

Electronics and electrical engineering
Judson C. French
B358 Metrology Bldg., 301/975-2220

Manufacturing engineering
John A. Simpson
B322 Metrology Bldg., 301/975-3400

Computer systems
James H. Burrows
B154 Technology Bldg., 301/975-2822

Building technology
Richard N. Wright
B250 Building Research Bldg., 301/975-5901

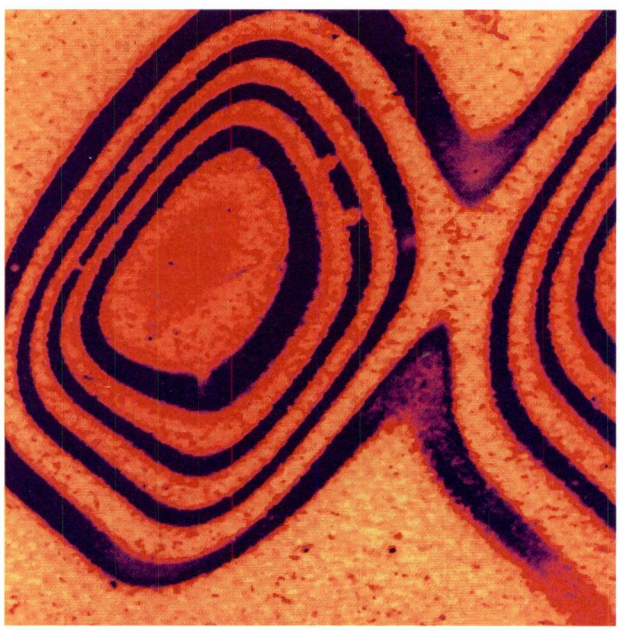
Fire safety
Jack E. Snell
A247 Polymer Bldg., 301/975-6850

Computing and applied mathematics
Francis E. Sullivan
A438 Administration Bldg., 301/975-2732

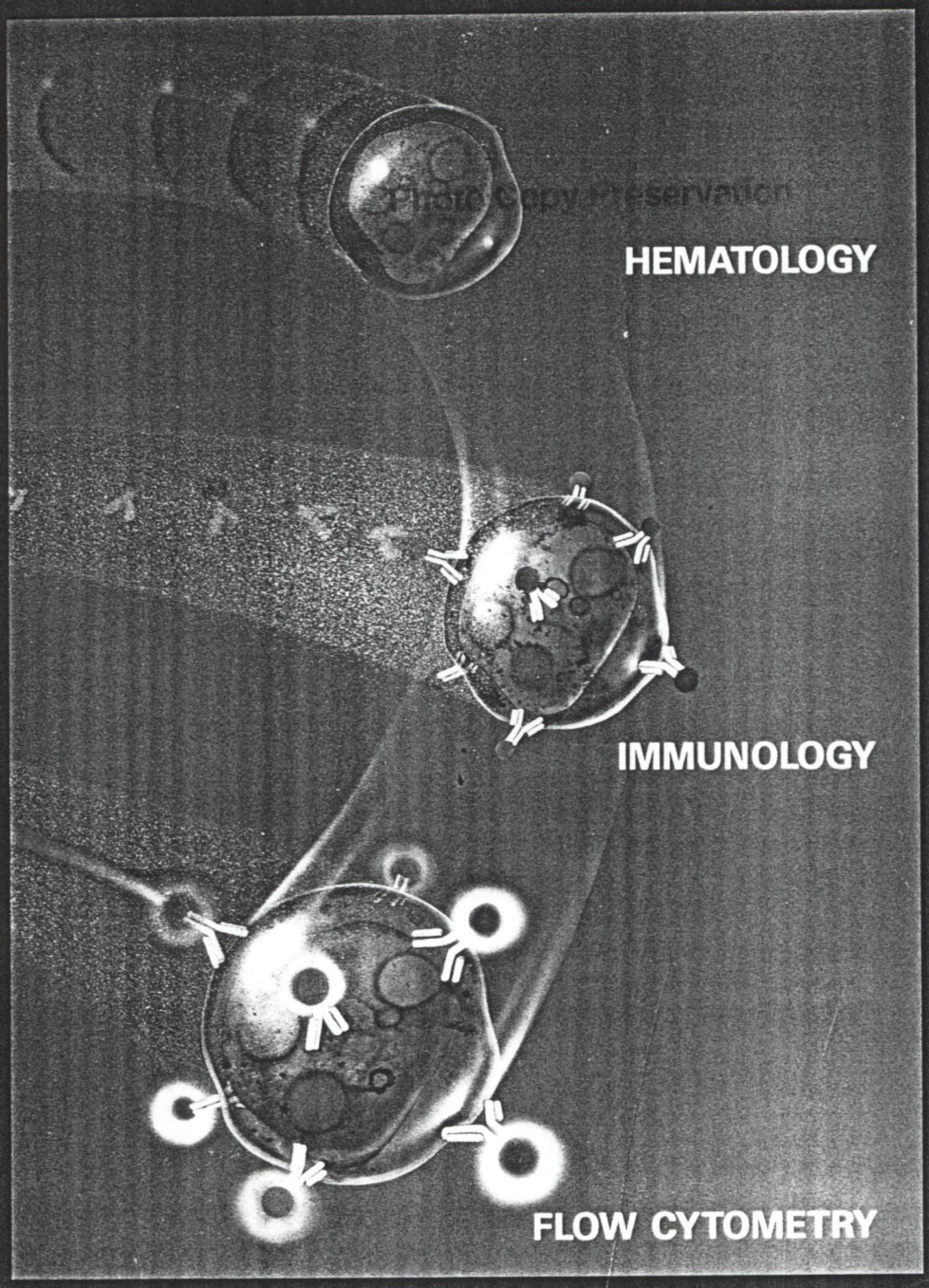
Technology services
Donald R. Johnson
A363 Physics Bldg., 301/975-4500

General inquiries
Peggy M. Saunders
E128 Administration Bldg., 301/975-3058

Note: All addresses at NIST, Gaithersburg, Md. 20899



COULTER



COMPLETE CELL ANALYSIS

Coulter…The Search Continues.

Introduction

Millions of tests are performed every day — all over the world — on COULTER® equipment. In hospital, clinical, research, and industrial laboratories, COULTER instruments provide vital information. Diagnosing disease, controlling the quality of pharmaceuticals and cosmetics, measuring air contamination and moon dust are but a few of the many applications. Doctors, medical technologists, researchers and scientists have relied on COULTER instruments for over thirty years. The Coulter Principle — Wallace H. Coulter's discovery for counting and sizing microscopic particles — is the basis for that trust.

The Principle became a family of companies . . . the Coulter corporations. A leader in technological innovation, Coulter produces products and services for patient care, scientific, research and industrial applications.

Coulter — a worldwide corporation — designs, manufactures, sells and services instruments and supplies for the healthcare and other industries.

Yet the search continues. Coulter scientists constantly seek new ways to apply the Company's knowledge and skill. Areas of particular expertise include hematology, chemistry, immunology, particle counting and flow cytometry.

The following is a glimpse into the future . . . Coulter's commitment to the betterment of mankind.

Introduction

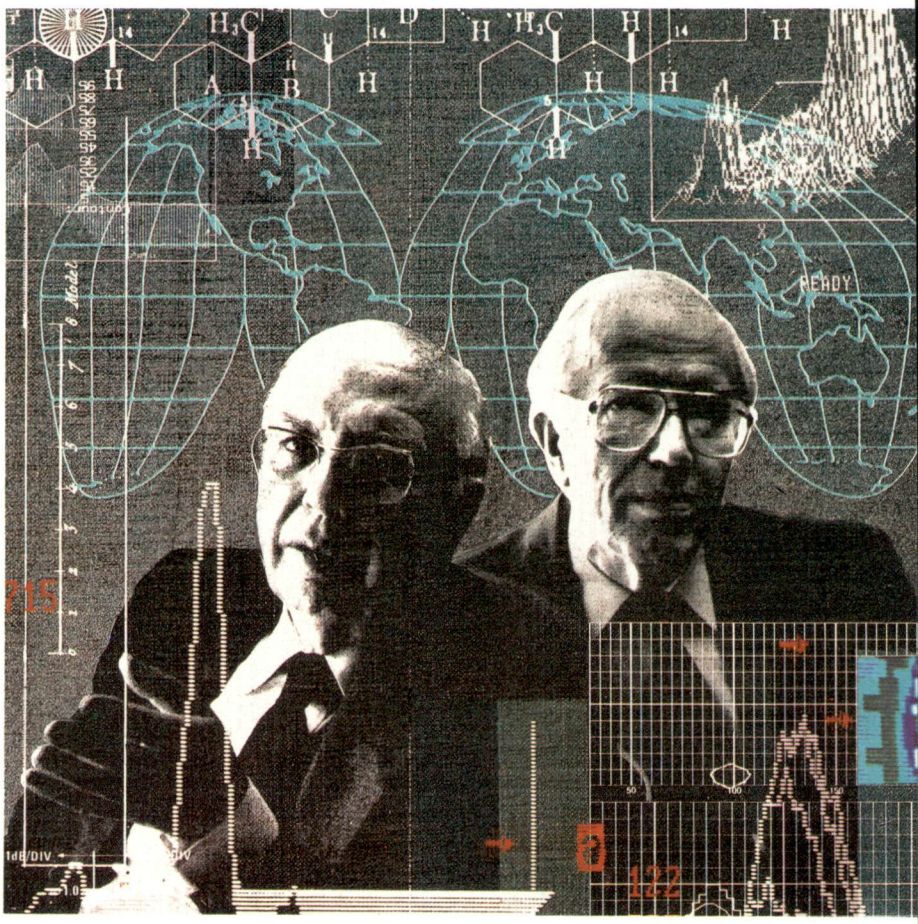
Millions of tests are performed every day — all over the world — on COULTER® equipment. In hospital, clinical, research, and industrial laboratories, COULTER instruments provide vital information. Diagnosing disease, controlling the quality of pharmaceuticals and cosmetics, measuring air contamination and moon dust are but a few of the many applications. Doctors, medical technologists, researchers and scientists have relied on COULTER instruments for over thirty years. The Coulter Principle — Wallace H. Coulter's discovery for counting and sizing microscopic particles — is the basis for that trust.

The Principle became a family of companies . . . the Coulter corporations. A leader in technological innovation, Coulter produces products and services for patient care, scientific, research and industrial applications.

Coulter — a worldwide corporation — designs, manufactures, sells and services instruments and supplies for the healthcare and other industries.

Yet the search continues. Coulter scientists constantly seek new ways to apply the Company's knowledge and skill. Areas of particular expertise include hematology, chemistry, immunology, particle counting and flow cytometry.

The following is a glimpse into the future . . . Coulter's commitment to the betterment of mankind.



Wallace H. Coulter and Joseph R. Coulter, Jr. co-founded the Coulter companies worldwide. As chairman and president (respectively) they continue their leadership roles in the growth and development of the Corporation.

"We will make it easier, faster and more reliable than ever before to diagnose disease. The patient will be the ultimate beneficiary."

Wallace H. Coulter

Genesis... The Search Begins.

The year was 1947. In a private home laboratory, during his free time, Wallace Coulter built electronic devices and experimented with a variety of novel ideas. One, in particular, would lead to the first viable method of counting and three-dimensional sizing of microscopic particles . . . the Coulter Principle.

Wallace Coulter's discovery made it possible, for the first time, to count and size biological cells or industrial particles at a rate of several thousand per second. This achievement earned him two of the highest awards given for scientific excellence. In 1960, he received the John Scott Award, which recognizes an individual whose invention has benefited mankind. Other recipients of this award include: Thomas Edison, Marie Curie, Guglielmo Marconi, Orville Wright and Jonas Salk.

In 1980, the Institute of Electrical and Electronics Engineers, Inc. presented him with the Morris E. Leeds Award for "an outstanding contribution in the field of electrical measurement."

Years of experimenting.

Before the honors, came the experimentation. It was five years before the first commercial instrument was produced . . . and a patent for the principle secured. Today, the Coulter Principle is the *most widely used method in the world* for counting and sizing microscopic particles. Indeed, it is estimated that 95% of all blood cell counters in use today have been made by Coulter or are copies based on the Coulter Principle. Not only was the principle the cornerstone for a company — Coulter Electronics — it also launched an industry . . . automated hematology instrumentation.

"The whole thing started in Chicago, in a corner of my basement. Today, Coulter provides the means to diagnose disease all over the world."

Wallace H. Coulter

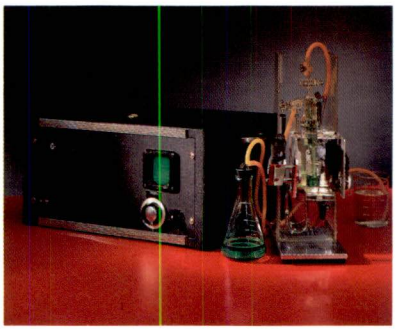
This discovery changed the practice of medicine. Now, in a matter of minutes, patient blood analysis results are available to the physician to indicate or confirm a diagnosis. Treatment can begin immediately.

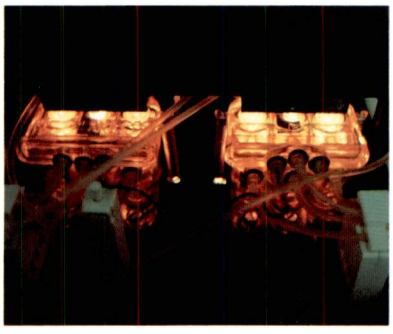
Innovative response.

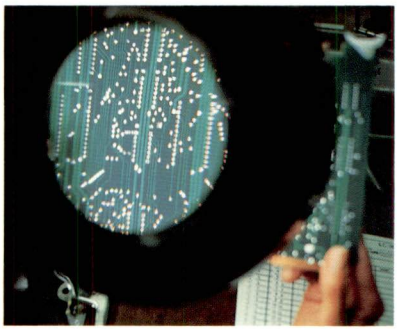
Coulter, as a company, is unique in its diversification; it matches technology to the needs of medicine. As an example, clinicians and researchers have a variety of techniques in cell analysis from which to choose. Coulter understands the urgencies, demands and problems of the laboratory environment. Over the years, with countless new ideas and discoveries, Coulter has demonstrated its ability to meet the strictest requirements.

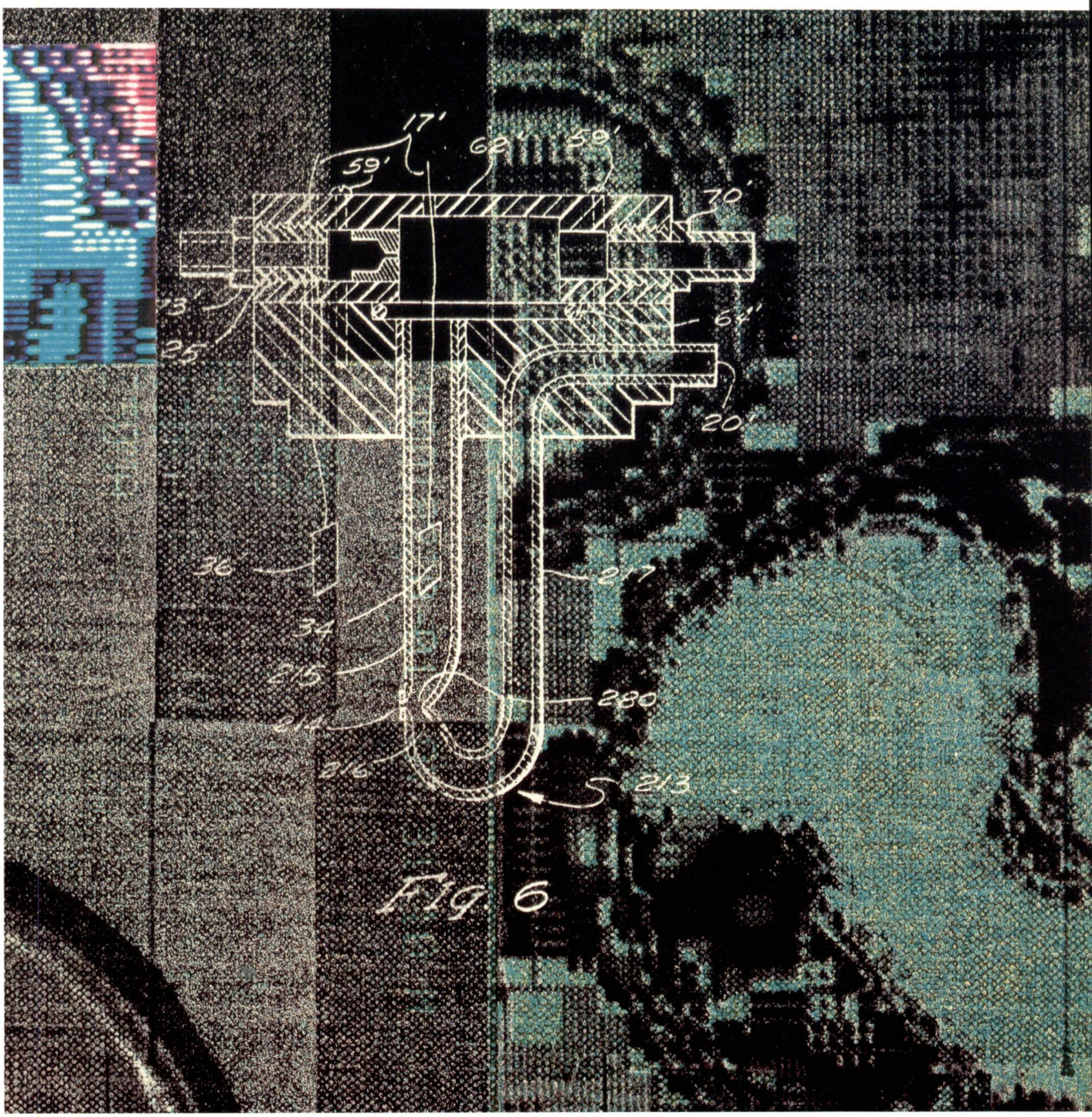
Daily, COULTER instruments significantly impact the detection, treatment and prevention of disease in such areas as: early detection of leukemia by rapid, accurate white blood cell differentiation; diabetes control, through faster and more accurate glucose analysis; T/B cell analysis and tumor marker studies in cancer research and treatment.

From a single moment of discovery in humble surroundings, an innovative corporation has risen to take its place among the world's leaders in healthcare.








17'
68'
59'
59'
70'
64'
20'
36
217
34
215
214
216
213
280
FIG. 6


EMERGENCY ROOM

Coulter People... Searching with a Sense of Future.

The search continues worldwide. It covers a spectrum of disciplines that affect the diagnostic process. Computer experts, administrative personnel and service engineers all work to support Coulter scientists as they seek answers to complex medical diagnostic problems.

People with pride.

It's Coulter people — all over the world — working with common goals, who have kept the Company at the leading edge of technology. Each person contributes to product success *and* to the continued success of the Company. Each new product is the result of a team effort. These efforts are reinforced by the commitment of management to further strengthen the Company's leadership role in its chosen areas of healthcare and science.

Over 5,000 Coulter employees express their confidence through personal loyalty and commitment. More than half boast of 10 or more years of service.

Customers who contribute.

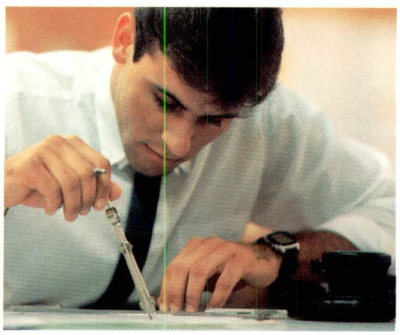
Coulter customers are the most important (and largest) group of Coulter people. For many, the association started in the classroom. There, they learned to count cells on a COULTER counter. When they moved on to hospital, research and industrial laboratories, again, there were COULTER counters. And the association continues: with Coulter operator training programs in Coulter classrooms, with manuals and audio-visual programs, and with workshops to help operators share work experiences. Also, with seminars where experts share research findings with colleagues; with newsletters and other communiques to help all Coulter people share new information on clinical procedures and applications.

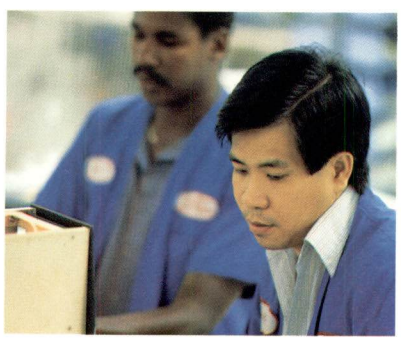
Quality people with ideas.

It's Coulter employees, communicating with customers — teaching, learning, sharing experiences — that make COULTER products special. Indeed, Coulter's success has come from its ability to translate customer needs into viable products.

Throughout the world, Coulter people design, manufacture and distribute diagnostic systems for over 80 percent of the world's clinical laboratories. Coulter's total system approach provides its customers with quality products and services.

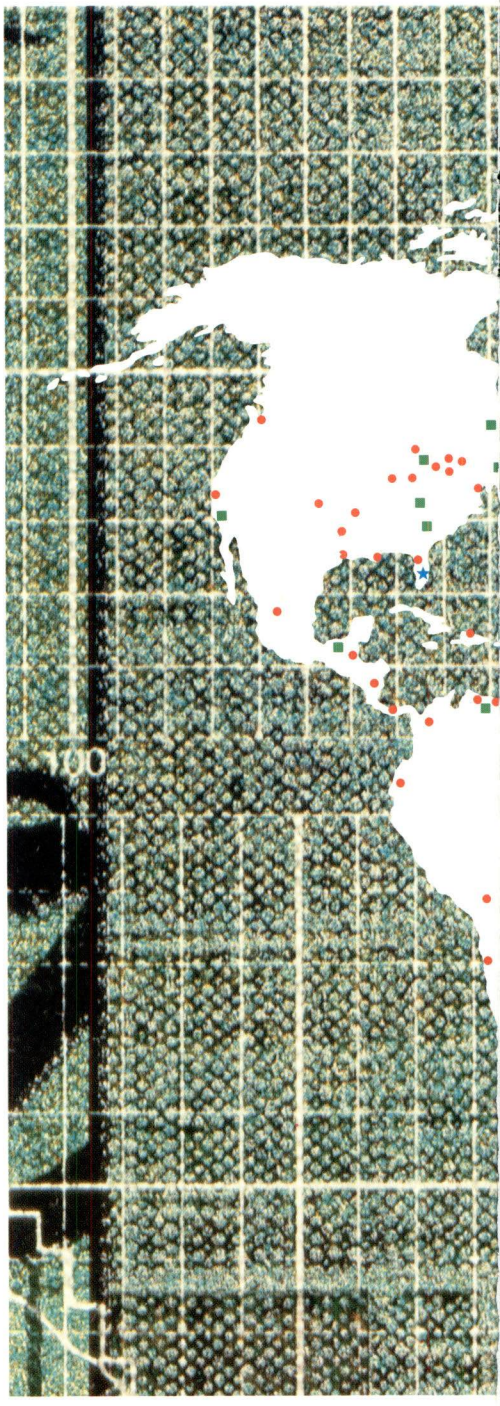
> *"The real secret to our success is teamwork. When you walk into a room... you can feel it."*
>
> Joseph R. Coulter, Jr.






TC=
AN=
30
PRISM
2P64
0.0
5.0
10.0

A Worldwide Search...



The search, begun in Chicago, spread around the world. Wallace and Joseph Coulter found the best scientific, engineering, manufacturing, sales and service people available. As a result, the Coulter Corporation has been international for almost as long as it's been a company. Coulter Electronics, Inc. and Coulter Sales Corporation were incorporated in 1958. Coulter Electronics, Ltd. was founded in England a year later. In 1962, fifteen companies were established within five continents, including Coultronics in France. In addition, COULTER products and services are available through a network of more than 80 distributor organizations around the globe.

Shared efforts . . . quality work.

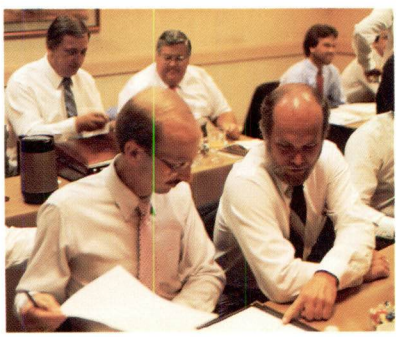
Part of the Company's strength has been its internationality — its ability to share the fruits of independent research among all locations. For example, the original design for one chemistry analyzer came from R&D efforts in England; while another, sold in 72 countries, was designed in France.

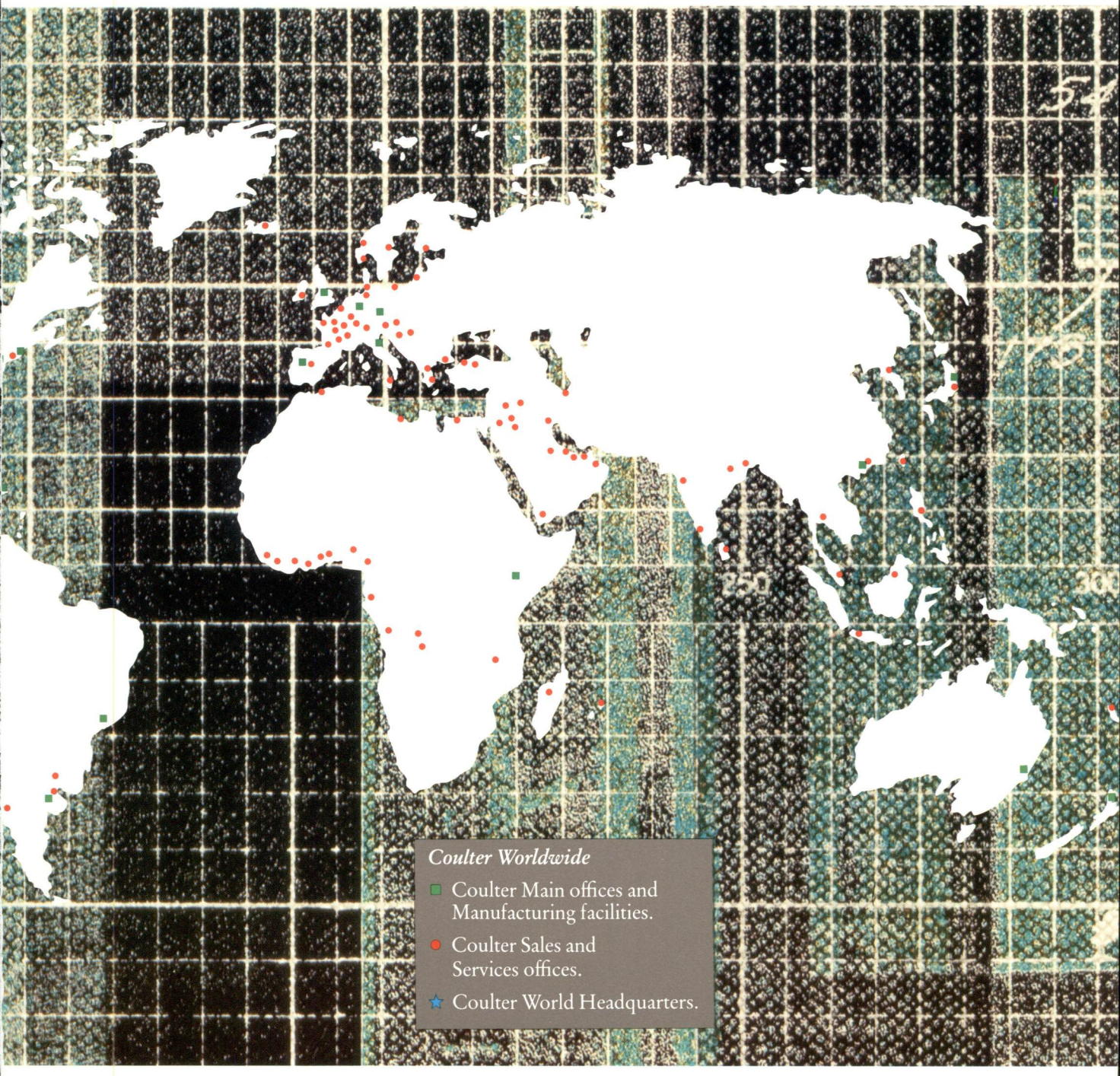
Quality products . . . worldwide.

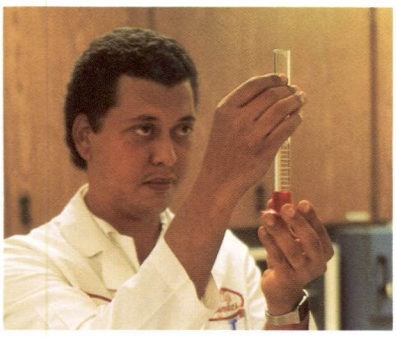
All COULTER instrument manufacturing facilities produce systems which meet the highest performance specifications . . . instruments that set industry standards. Specially developed COULTER reagents help to keep these instruments at their peak performance levels. To insure reagent quality and integrity, manufacturing sites have been established around the globe.

Each day, laboratorians in all parts of the world rely on COULTER reagent and instrument systems to produce the diagnostic information clinicians depend on to make urgent medical decisions.

> *"The phrase 'Quality Counts' has been associated with this company for a long time... with good reason."*
>
> Joseph R. Coulter, Jr.




Coulter Worldwide
Coulter Main offices and Manufacturing facilities.
Coulter Sales and Services offices.
Coulter World Headquarters.



The Search for Answers Through Biotechnology.

In an age of cost containment, speed and accuracy in medical diagnosis is often the key to a successful treatment regime. Coulter's technological leadership is a significant factor in reducing costs while improving patient treatment. Indeed, in this area, COULTER instruments have consistently led the way for the entire industry.

The routine clinical laboratory, where once only basic tests were performed, now produces sophisticated tests, formerly reserved for research laboratories. Coulter has made a significant contribution to this transition.

In clinical hematology.

Automated COULTER systems produce hundreds of complete blood analyses every day. It would require several technologists, working full time to keep up with the output of just one of today's COULTER counters. In hospitals, medical centers, and reference laboratories, COULTER systems detect blood cell abnormalities which help physicians diagnose disease or monitor follow-up therapy.

In physicians' offices, COULTER systems produce diagnostic information so rapidly, the doctor has a patient's results before the examination ends.

In clinical chemistry.

COULTER systems analyze patients' blood, providing doctors with rapid diagnostic or therapeutic drug monitoring information. Hundreds of assays per hour, for a variety of tests, are performed automatically, accurately, reliably and cost effectively.

In clinical cellular immunology.

Clinicians need powerful tools to meet the challenges of diseases such as AIDS, leukemia and lymphoma. COULTER flow cytometry systems combine advanced laser and computer technologies to examine thousands of cells per second. Data on cell structure, size and DNA content is vital in the detection and treatment of cellular disease.

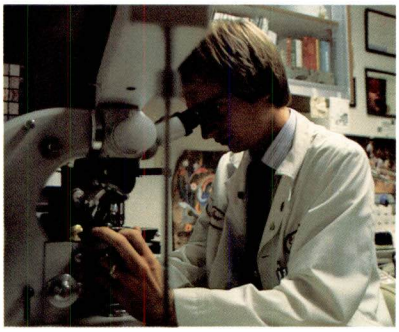
The Coulter tradition of combining disciplines to solve medical problems is clearly seen in this clinical area. COULTER monoclonal antibodies and flow cytometry systems are used together to quickly and accurately produce complete, concise patient immunology profiles.

Also, by combining advanced laser technology with two proprietary technologies — the Coulter Principle, and high frequency conductivity analysis — cell population studies are significantly enhanced.

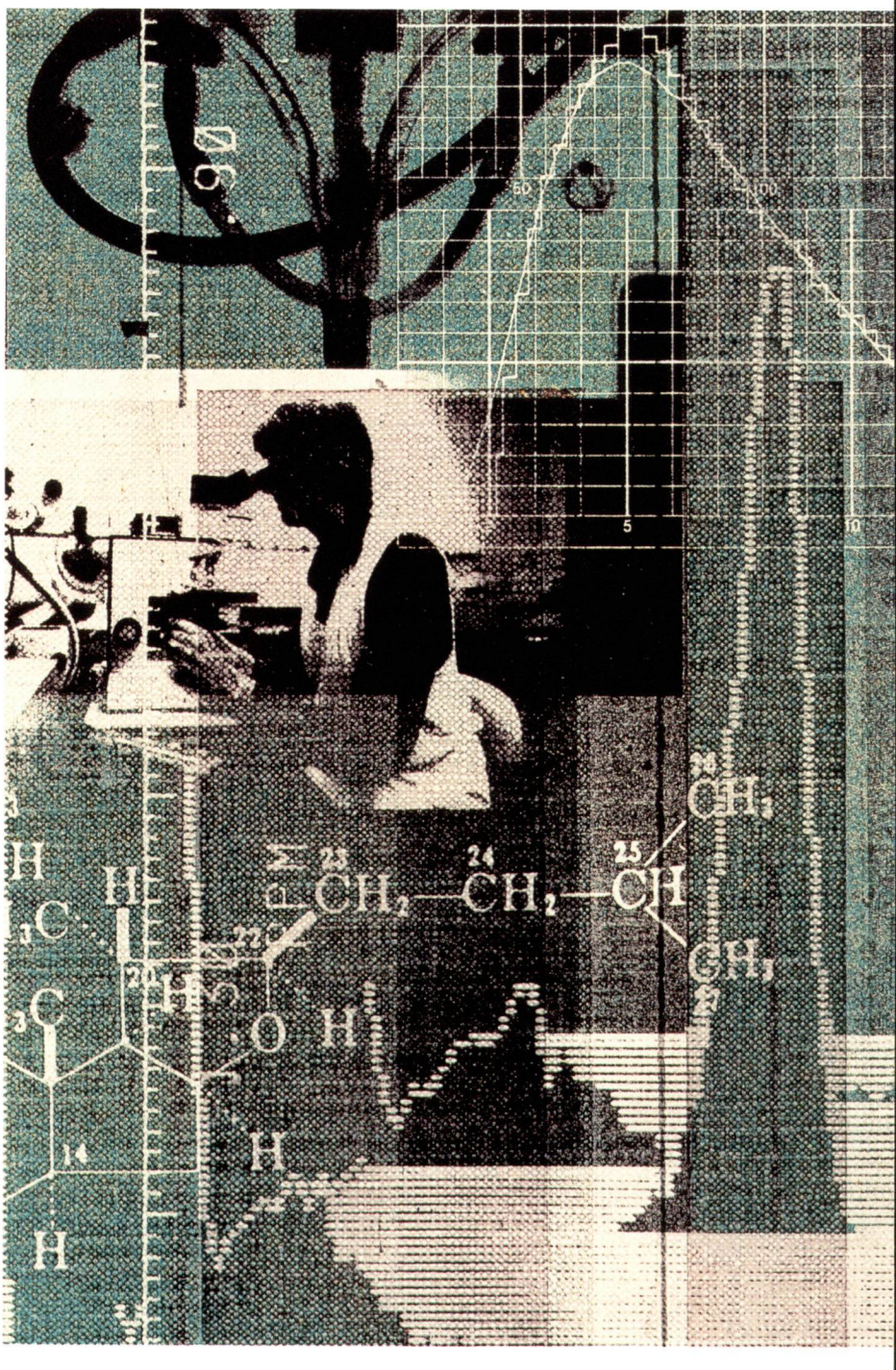
In research laboratories.

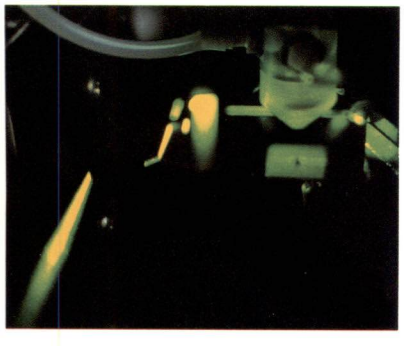
Coulter has proven its ability to find solutions for difficult medical diagnostic problems. And it will continue to assist research scientists in exploring new frontiers — in cancer detection and therapy, chromosome analysis for genetic studies, and cellular immunology.

> *"Our strength lies in the breadth of our technical talents...in our ability to solve problems."*
>
> Wallace H. Coulter



Coulter has invested over a decade in laser technology research. The result: Researchers can now sort and analyze cells in minutes instead of months. Similar investments in hematology and immunology research are opening new areas for investigation. Studies of cell kinetics in both normal and tumor populations are now economically feasible. Other projects investigate characterization of specific cellular enzymes, cell surface markers, hematopoiesis, and tissue transplant rejection.





The Search Beyond Medicine...

The result of Coulter technology is found in diverse fields throughout the world. Particle size measurement and characterization are vital to the production of safe, consistent consumer products and to the development of new products and technologies.

In quality control.
Industrial applications include quality control of food, clothing, paints, perfumes, chemicals, electronic components, biologicals and pharmaceuticals.

Copiers . . . controlling consistency of the toner.

Chocolate . . . making it smooth and creamy.

Paint . . . improving quality of the pigment.

Cosmetics . . . assuring that face powder clings.

Photographic film . . . allowing more precise light-sensitive emulsions.

Beverages . . . producing quality filtration in beer and wine.

Aerospace . . . analyzing moon dust; identifying contaminants in hydraulic fluids.

Pharmaceuticals . . . assuring the correct consistency of tablets.

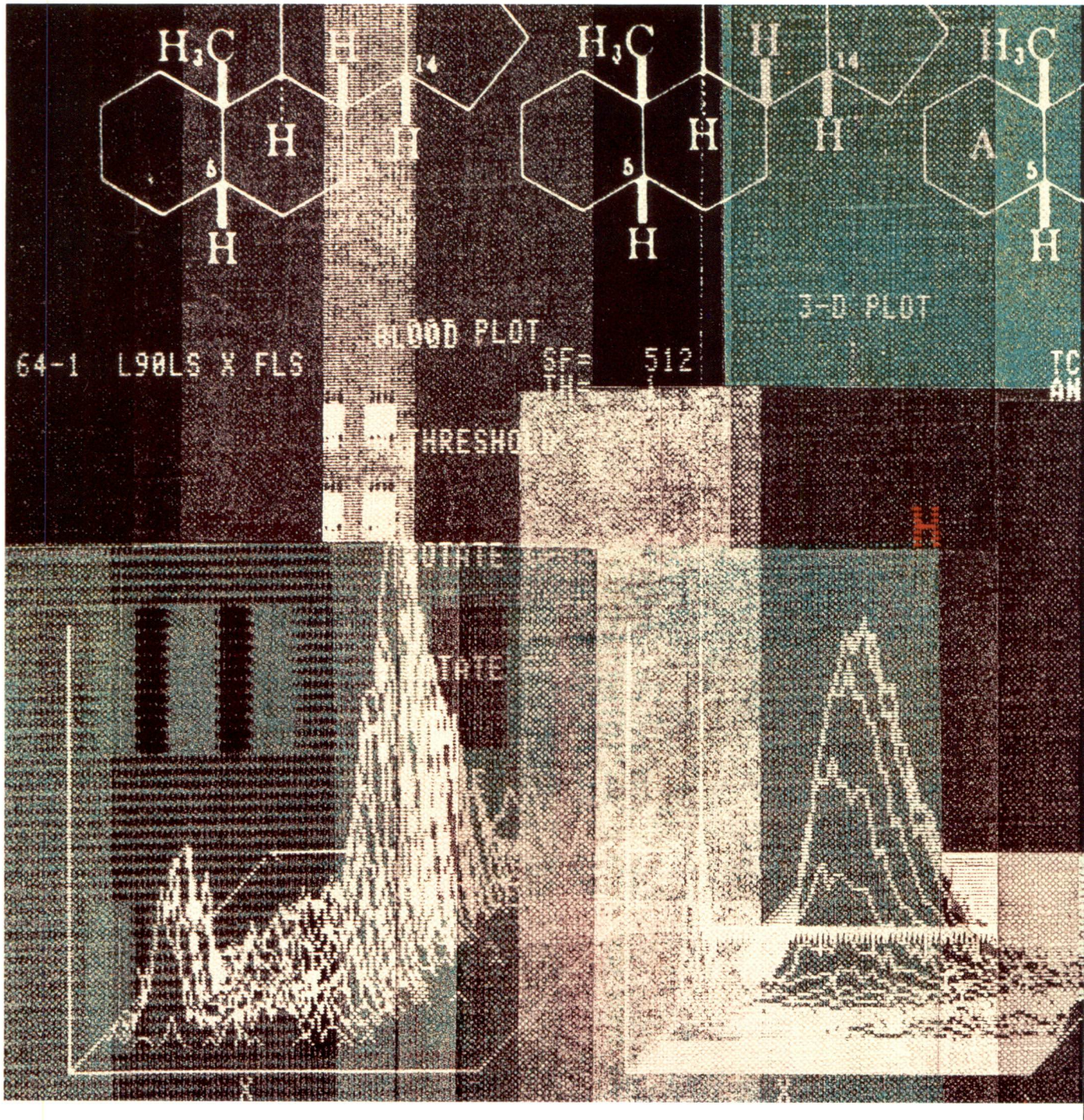
In process control.
The success or failure of many manufacturing operations often depends on the consistency of raw material particle size. Costly production errors and wasted labor are prevented by timely reporting of vital data from COULTER analyzers such as: the size of cocoa bean grindings to produce sweet or bitter chocolate; mica size for shiny lipstick; polystyrene particles to make paint adhere; latex particle carrier systems for monoclonal antibodies.

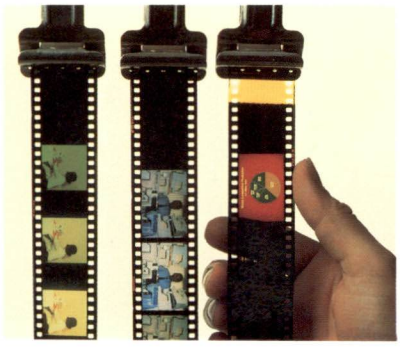
"Industries all over the world rely on Coulter for help in making better products."

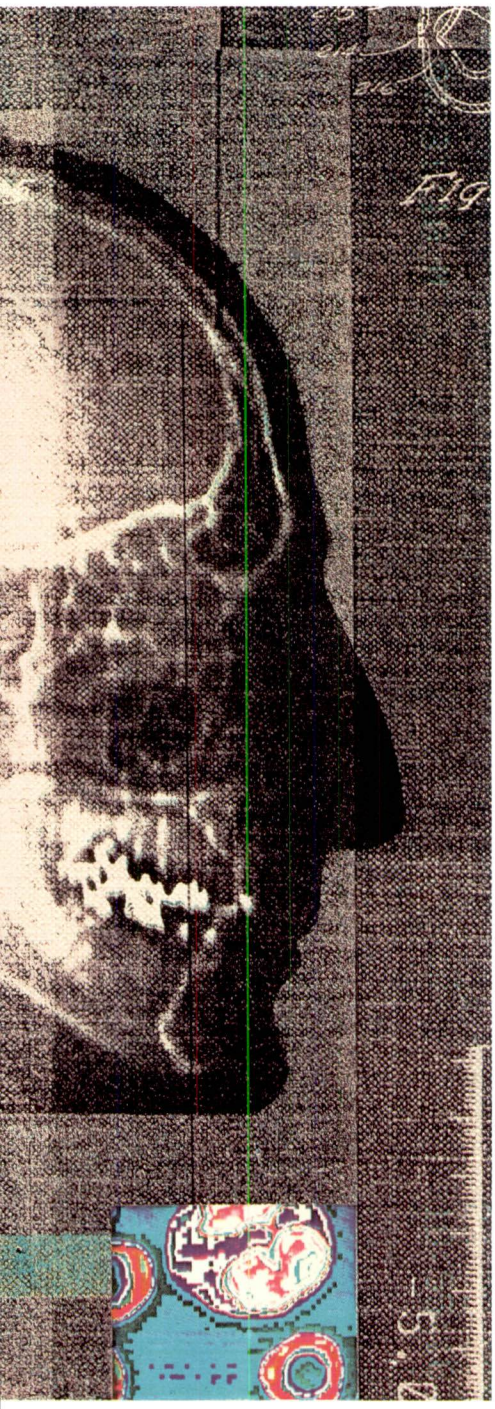
Joseph R. Coulter, Jr.

In research and development.
For almost 30 years, investigators have relied on COULTER instruments for precise accurate measurements to help expand scientific knowledge.

On the frontiers of research, from analyzing moon dust to analyzing phytoplankton, (unicellular sea plants, a basic link in the marine food chain), Coulter will continue its commitment to excellence and to the development of the technologies of the future.


H3C
H
H
H3C
H
H
H3C
H
H
3-D PLOT
BLOOD PLOT
64-1 L90LS X FLS
SF=
512





Searching to Better Serve...

"Our customer service begins the moment that someone orders one of our products."

Wallace H. Coulter

Whether in the research, quality control or medical laboratory, all Coulter customers share in the "proactive" approach to service. The goal is to provide complete and continuing customer support.

Educating and training every customer is fundamental to Coulter's success. Virtually every teaching hospital, medical school and research laboratory has benefited from Coulter education.

Coulter's quality control systems are integral components of customer support. Laboratories using these systems reach a higher level of performance. In addition, Coulter factory-trained and certified technical representatives are available whenever needed.

Coulter Education Centers reach out to every customer. Language specific, hands-on training — conducted by professional instructors — assures efficient operation of the most sophisticated systems. Symposia, seminars and special publications are also available to Coulter customers.

Epilogue

Coulter continues its commitment to excellence by bringing the best instruments, diagnostics and services to the healthcare industry and to other industries . . . utilizing the same technologies. Future growth will come from Coulter's continued interaction with clinicians and researchers, who challenge the established disciplines.

Seeking solutions will keep the Coulter Corporation at the leading edge of technology . . . in position to improve existing products and to provide the discoveries of tomorrow.

This is Coulter's commitment. The search continues . . .

Designed by Gary Singer Communications

Epilogue

Coulter continues its commitment to excellence by bringing the best instruments, diagnostics and services to the healthcare industry and to other industries . . . utilizing the same technologies. Future growth will come from Coulter's continued interaction with clinicians and researchers, who challenge the established disciplines.

Seeking solutions will keep the Coulter Corporation at the leading edge of technology . . . in position to improve existing products and to provide the discoveries of tomorrow.

This is Coulter's commitment.
The search continues . . .

Designed by Gary Singer Communications

"We will continue our dedication to the advancement of medical science. We will fulfill our responsibility to the community."

Wallace H. Coulter

Coulter Corporation
Hialeah, Florida, USA

Coulter Electronics, Inc.
Hialeah, Florida, USA

Coulter Leasing Corporation
Hialeah, Florida, USA

Coulter Electronics of New England, Inc.
Amherst, Massachusetts, USA

Coulter Electronica, S.A.
Buenos Aires, Argentina

Coulter Electronics Pty. Ltd.
New South Wales, Australia

Coulter Electronics Ind. & Com., Ltda.
Rio de Janeiro, Brazil

Coulter Electronics of Canada, Ltd.
Burlington, Canada

Coulter Electronics Ltd.
Luton, England

Coultronics France, S.A.
Margency, France

Coulter Electronics GmbH
Krefeld, West Germany

Coulter Electronics (HK) Ltd.
Hong Kong

Coulter Scientific SPA
Milan, Italy

Japan Scientific Instruments Co., Ltd.
Tokyo, Japan

Coulter Scientific Japan Ltd.
Tokyo, Japan

Coulter Electronics (Kenya) Ltd.
Nairobi, Kenya

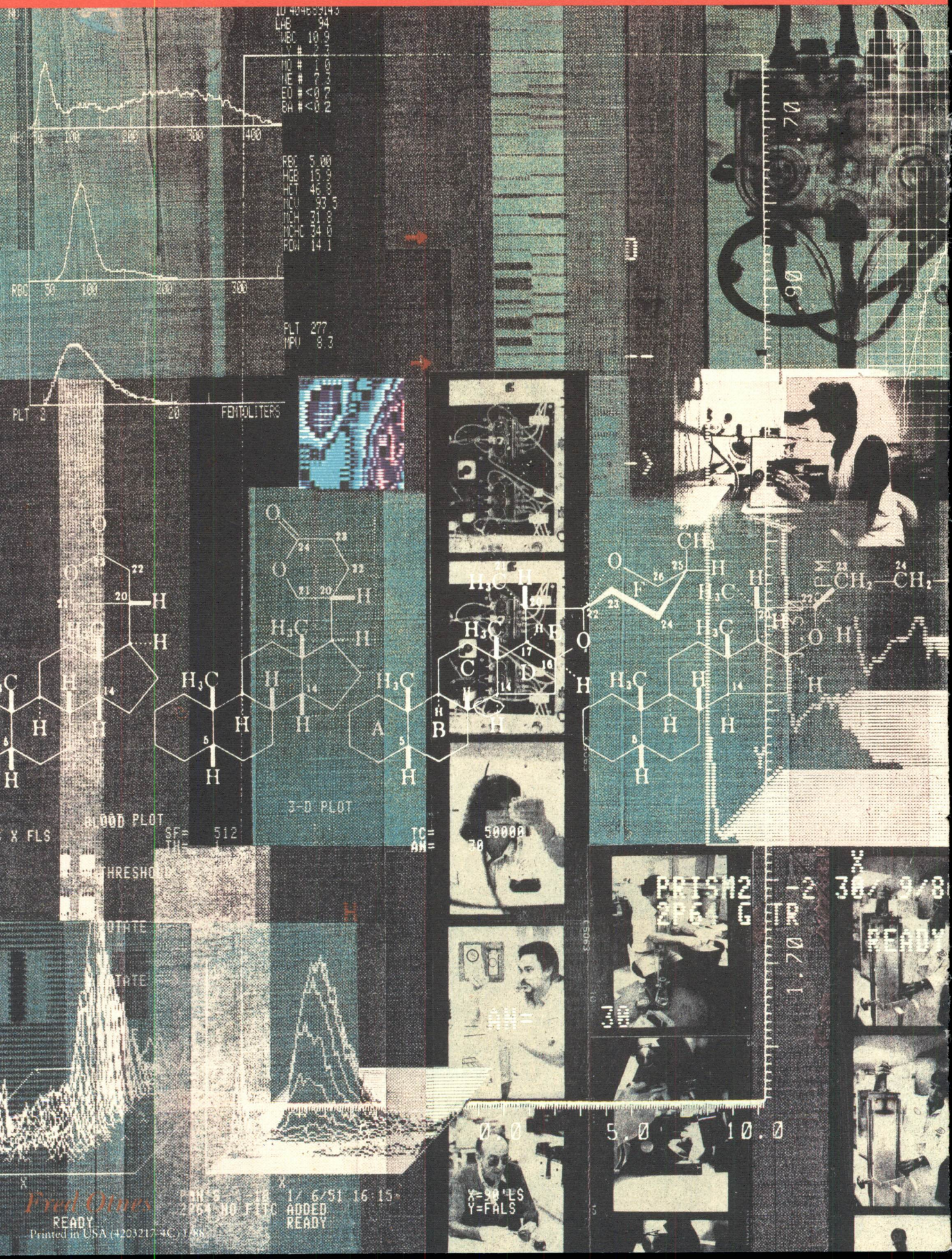
Coulter de Mexico S.A. DE C.V.
Mexico City, Mexico

Coulter Electronics Sales of P.R., Inc.
San Juan, Puerto Rico

Coulter Cientifica S.A.
Madrid, Spain

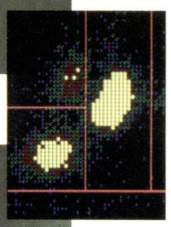
Coulter Electronics, S.A.
Caracas, Venezuela

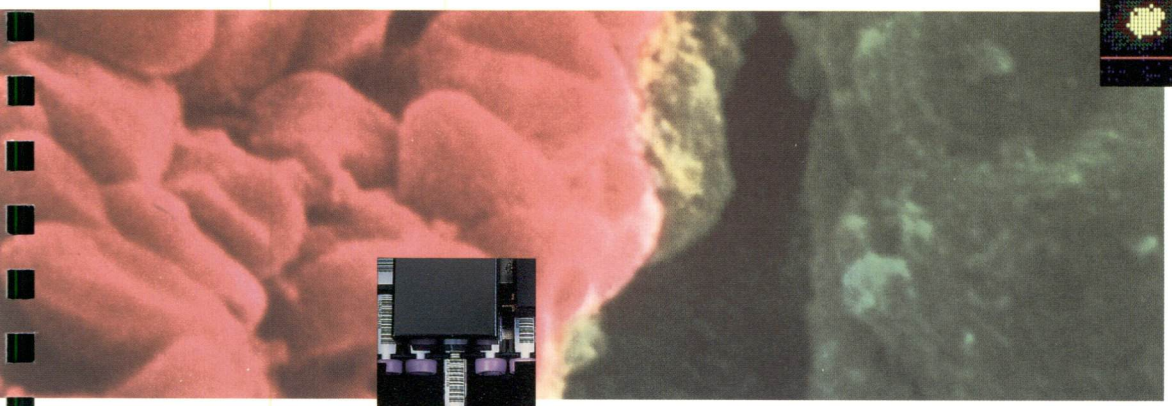
COULTER
WORLD HEADQUARTERS
600 West 20th Street, Hialeah, Florida 33010-2428 USA
305-885-0131



Printed in USA (4203217-4C) 1/88

COULTER® STKS Hematology System





COULTER

HEMATOLOGY

Scanning electron micrograph of densely packed red blood cells in a capillary, the smallest vessel, made up exclusively of endothelial cells. Magnification 600X.

The COULTER STKS Hematology System. Simply Superior in Every Way.

Whether you're looking for proven-in-use, walk-away technology or superior cellular classification, the COULTER STKS is the only hematology system proven worldwide to be the best at both. Its rapid, global acceptance by over 1,000 hematology laboratories in its first year, proves that COULTER hematology instruments continue to outperform any and all alternatives.

Singular, superior features in a fully-automated system:

- The only system with FAIL-SAFE:
  - Positive Sample I.D.
  - Positive Cassette Position I.D.
  - Aspiration Integrity Verification.
- The only instrument with proven auto-sampling robotics.
- The only instrument performing multi-technology white cell classification on near-native cells, measured directly in a single channel.
- The only instrument to study over 8,000 white cells for every differential examination.
- The only instrument with independent, triple apertures for WBC, RBC and platelet enumeration.
- The only instrument with no routine maintenance.
- The only instrument to offer 6 workload scheduling options.
- The only system that automatically separates normal and abnormal reports using the Auto-Reporter 3.
- The most advanced computer power applied to hematology.
- 0 to 24-hour sample stability.
- Backed by an Interlaboratory Quality Assurance Program of over 8,500 participants.
- The industry's #1-rated service organization.

Coulter Milestones in the Technologic Integration for a Complete Cell Analysis™ Concept.

1953 COULTER COUNTER® Model A.

1968 COULTER Model S Series.

1970 Conductivity Patent.

1978 COULTER S-PLUS Series Instruments with whole blood automated platelet counts.

1978 Immunology R&D begins.

1980 COULTER S-PLUS II with automated Lymph % and # and aperture burn circuit. Mab products introduced.

1983 COULTER S-PLUS IV with Histogram Differential: Automated Mononuclears, Lymphocytes & Granulocytes. Advanced Data Management: Automated Operation & QC.

1984 Automated Closed-Vial Sampling.

1985 Clinical Flow Cytometer.

1986 COULTER STKR with Automated Differential Interpretive Report.

1987 Complete Cell Analysis Concept – Integrated Hematologic, Immunologic and Flow Cytometric Analysis. Incorporation of differential capability onto T-Series Instruments.

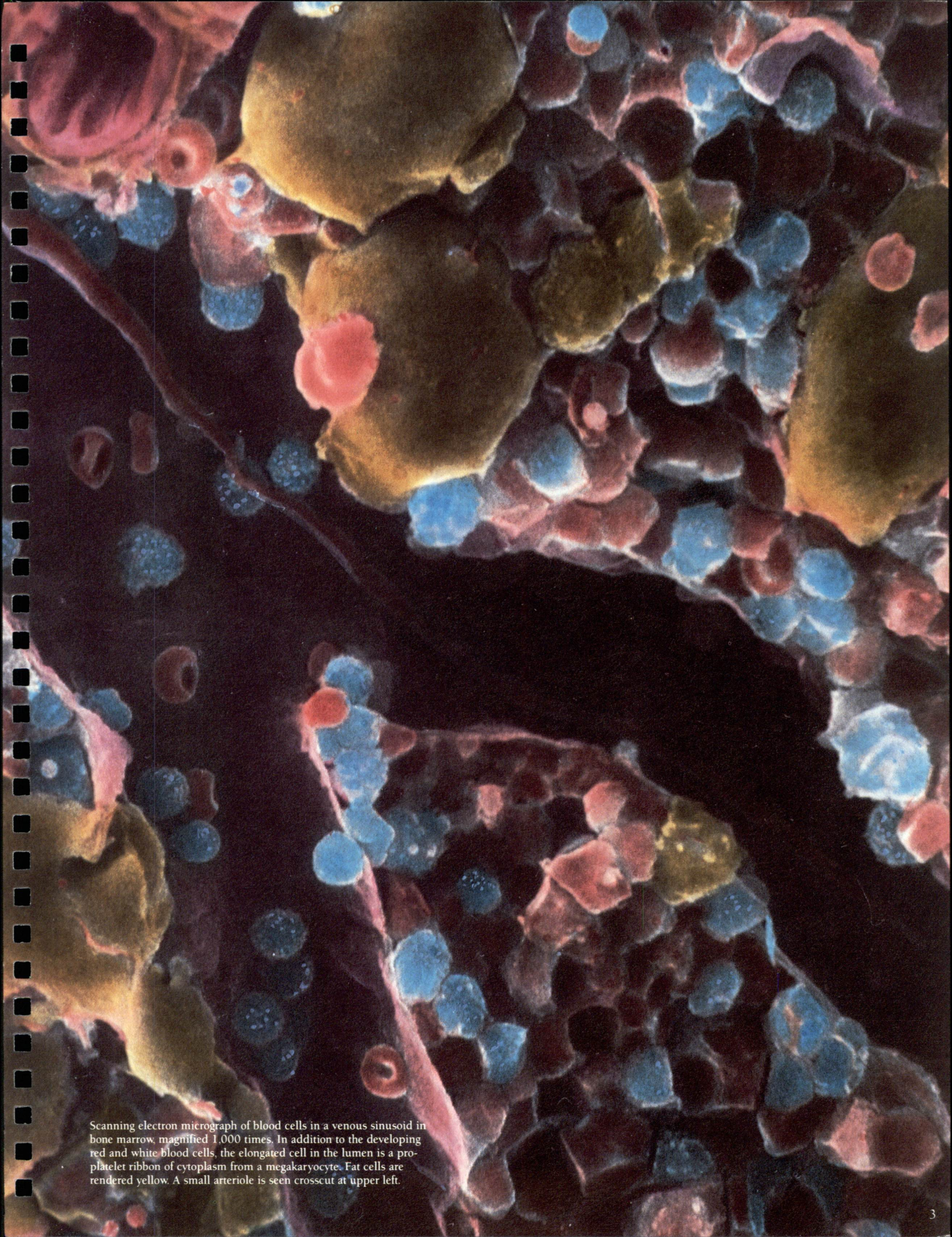
1987 VCS Technology to study volume, conductivity, light scatter and opacity of white blood cells in their near-native state.

1988 COULTER Q-Prep Immunology Workstation for standardizing sample prep in immunophenotyping.

1989 Introduction of the COULTER STKS System to provide a complete hemogram and differential in a fully-automated, walkaway, high-volume analyzer. Introduction of the COULTER DNA-Prep System for standardizing sample prep in DNA content analysis.

1990 COULTER™ CYTO-TROL™ Control Cells, the first in vitro diagnostic control for flow cytometry.

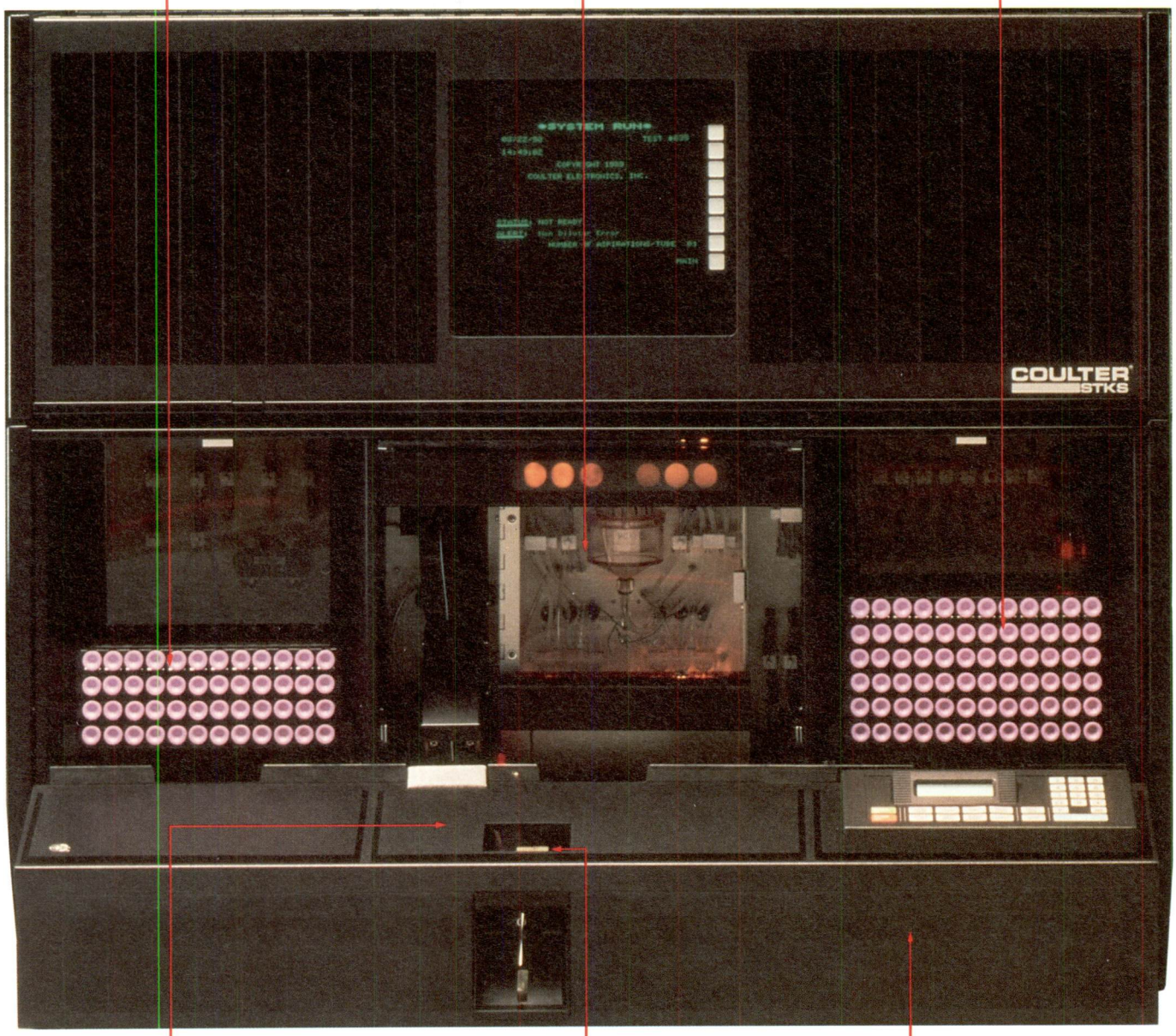
1991 COULTER MAXM System.



Scanning electron micrograph of blood cells in a venous sinusoid in bone marrow, magnified 1,000 times. In addition to the developing red and white blood cells, the elongated cell in the lumen is a pro-platelet ribbon of cytoplasm from a megakaryocyte. Fat cells are rendered yellow. A small arteriole is seen crosscut at upper left.

Singular, Superior Features on the STKS System.

- Unloading Bay – complete, identified and audited samples are positively linked to cassette position.
- Triple Apertures for maximum throughput and counting accuracy.
- Loading Bay – accommodates 144 samples.



- FAIL-SAFE features:
  - Sample tube and cassette position bar codes read at time of aspiration.
  - Dual Blood Detectors ensure aspiration integrity.
- Self-Cleaning Blood Sampling Valve requires no maintenance.
- Proven Auto-Sampling Robotics assures continuous sample processing and technologist protection from aerosols.
- Laser Bench.
- Hydrodynamically focused VCS Flow Cell for volume, conductivity, light scatter and opacity measurements. Autopurge and Autoclear ensure flow cell integrity.

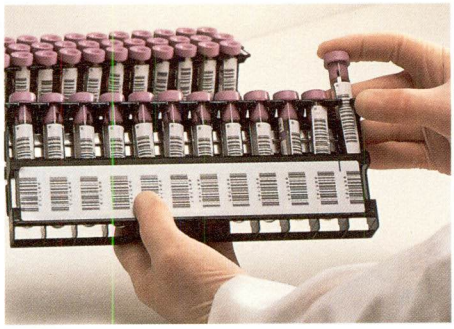
High Resolution Scatterplot – Comprehensive sample information presents a variety of displays to view discrete white cell populations. Each display represents a different view of the 3-dimensional plot as it is rotated on its axis.

Graphic Printer with color or black and white customized report capabilities.

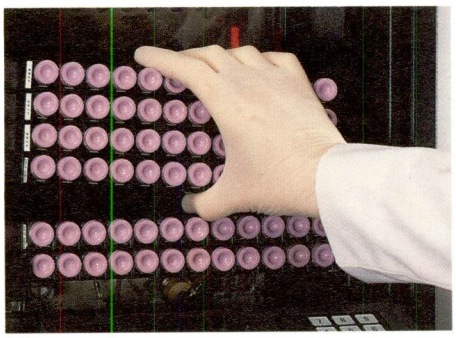
Data Management System – Versatile, friendly PC offers help screens and overlapping "window" menu screens for easy operation and training; color displays for all screens; plenty of storage capacity; and open-ended, add-on potential.

High-Productivity Sample Processing.

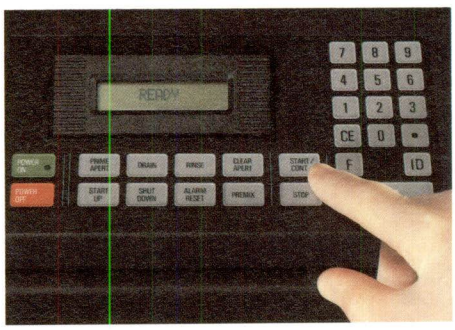
1. Identify samples and tickets through bar coding.



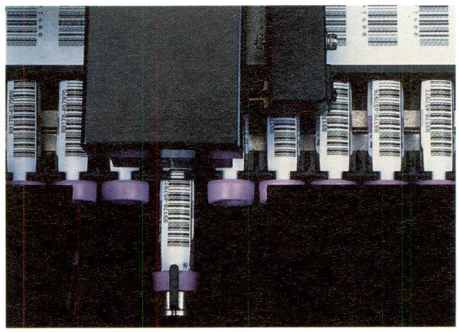
2. Load samples randomly into 12-unit cassettes.



3. Stack in STKS loading bay.

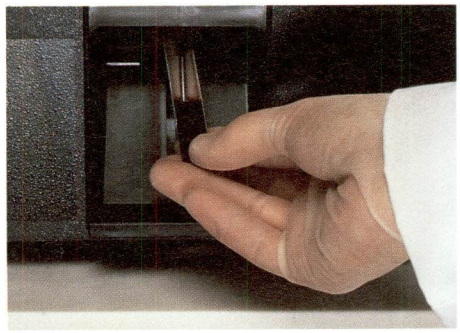


4. Press Start. The STKS begins to produce results in less than one minute. In one hour, find 109 samples fully analyzed, including differentials.



5. Positive sample I.D. Bar code is read on sample tube and linked to bar-coded cassette position at exact time of aspiration to eliminate error.

6. Retrieve finished reports automatically separated into normals and abnormals from the optional Auto-Reporter 3.



7. Stats in secondary mode for micro-sample volumes. Stats may also be analyzed in closed-vial sampling mode using single cassettes. You can interrupt auto-processing at any time for stats without losing data.

User-Defined, Sample Processing and Workflow.

Walkaway sample processing – safe and simple.

The STKS features Coulter's proven-in-use sampling robotics that ensure thorough sample mixing and unattended sample processing. The STKS loading bay accommodates 144 tubes in a 12 x 12 cassette configuration. Once processing begins, all instrument functions are computer-monitored, including bar code reading and matching to sample reports, sample integrity checks, and automatic extended counting for cytopenic samples. Results are even separated into normals and abnormals in the Auto-Reporter 3. You can easily retrieve abnormals for follow-up.

The system is extremely easy to run, and requires only 4 reagents, plus COULTER CLENZ® Cleaning Agent. Even system calibration is automated by the computer, and a service call is not required.

Flexibility in Workflow Management.

The STKS offers you 6 different options for workflow handling:

1. Real-time autoscheduling
   - using bar code labels.
   - using cassette position.
2. Pre-assigned worklist with demographics
   - done manually.
   - done by the host LIS.
3. Post-assigned worklist.
4. Post-assignment with demographics via Data Base.

Other features that make the STKS totally walkaway:

- Positive sample I.D.
- Proven auto-sampling – over 3,000 installations.
- Dual aspiration detectors, placed before and after the blood sampling valve, ensure sample integrity.
- Continuous computer monitoring of instrument performance.

Flexibility in Reporting.

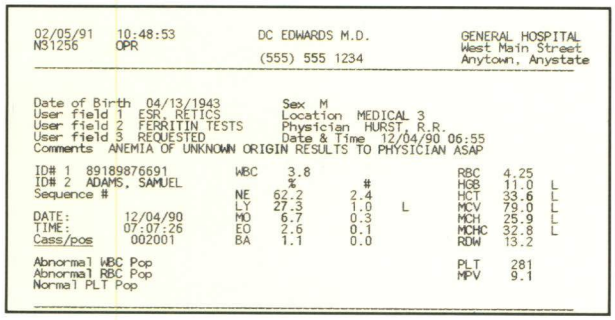
The latest software enhancements on the STKS System provide flexible reporting options to meet a variety of laboratory needs.

- Ability to edit reports and comment on patient files.
- User-Definable Patient Report provides a chartable report from the graphic printer or the traditional ticket printout.
- Color-coded workload recording with graphic plotting.
- Worklist Integrity Checks capture manual transcription errors.
- Expandable, User-Definable Patient Demographics.
- Sophisticated QC – simple to use, easy to understand.
- Over eight sample identifiers for additional security:
    1. Positive bar code sample I.D.
    2. Patient name.
    3. Automatic sequence #.
    4. Positive bar code cassette position.
    5. Date and time of collection.
    6. Date and time of processing.
    7. Date of birth.
    8. Additional patient demographics.

You'll get an excellent report.

The Coulter Hematology Cell Classification provides the most specific, sensitive cell classification report available. It includes white cell, red cell and platelet abnormalities and also quantifies (+,++,+++) anisocytosis, microcytosis, macrocytosis, hypochromia and poikilocytosis. This improved cell classification saves labor – by reducing the number of manual differentials – and helps the operator focus on areas of concern on the peripheral blood smear to increase their efficiency in confirmation of abnormalities. Definitive flags and high and low action limits are laboratory adjustable.

Chartable Report.



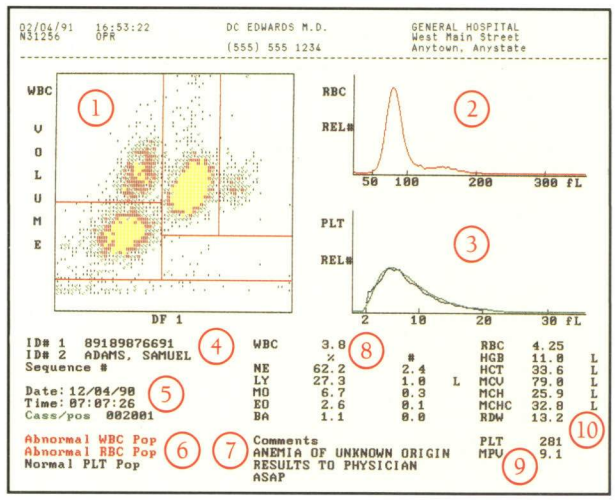
```
02/05/91   10:48:53          DC EDWARDS M.D.          GENERAL HOSPITAL
N31256     OPR                                       West Main Street
                              (555) 555 1234           Anytown, Anystate

Date of Birth  04/13/1943        Sex  M
User field 1  ESR, RETICS        Location  MEDICAL 3
User field 2  FERRITIN TESTS     Physician  HURST, R.R.
User field 3  REQUESTED          Date & Time  12/04/90 06:55
Comments  ANEMIA OF UNKNOWN ORIGIN RESULTS TO PHYSICIAN ASAP

ID# 1  89189876691          WBC    3.8                    RBC   4.25
ID# 2  ADAMS, SAMUEL                %                     HGB   11.0   L
Sequence #                  NE    62.2      2.4           HCT   33.6   L
                            LY    27.3      1.0    L      MCV   79.0   L
DATE:        12/04/90       MO     6.7      0.3           MCH   25.9   L
TIME:        07:07:26       EO     2.6      0.1           MCHC  32.8   L
Cass/pos      002001        BA     1.1      0.0           RDW   13.2

Abnormal WBC Pop                                         PLT   281
Abnormal RBC Pop                                         MPV   9.1
Normal PLT Pop
```

Laboratory Report.

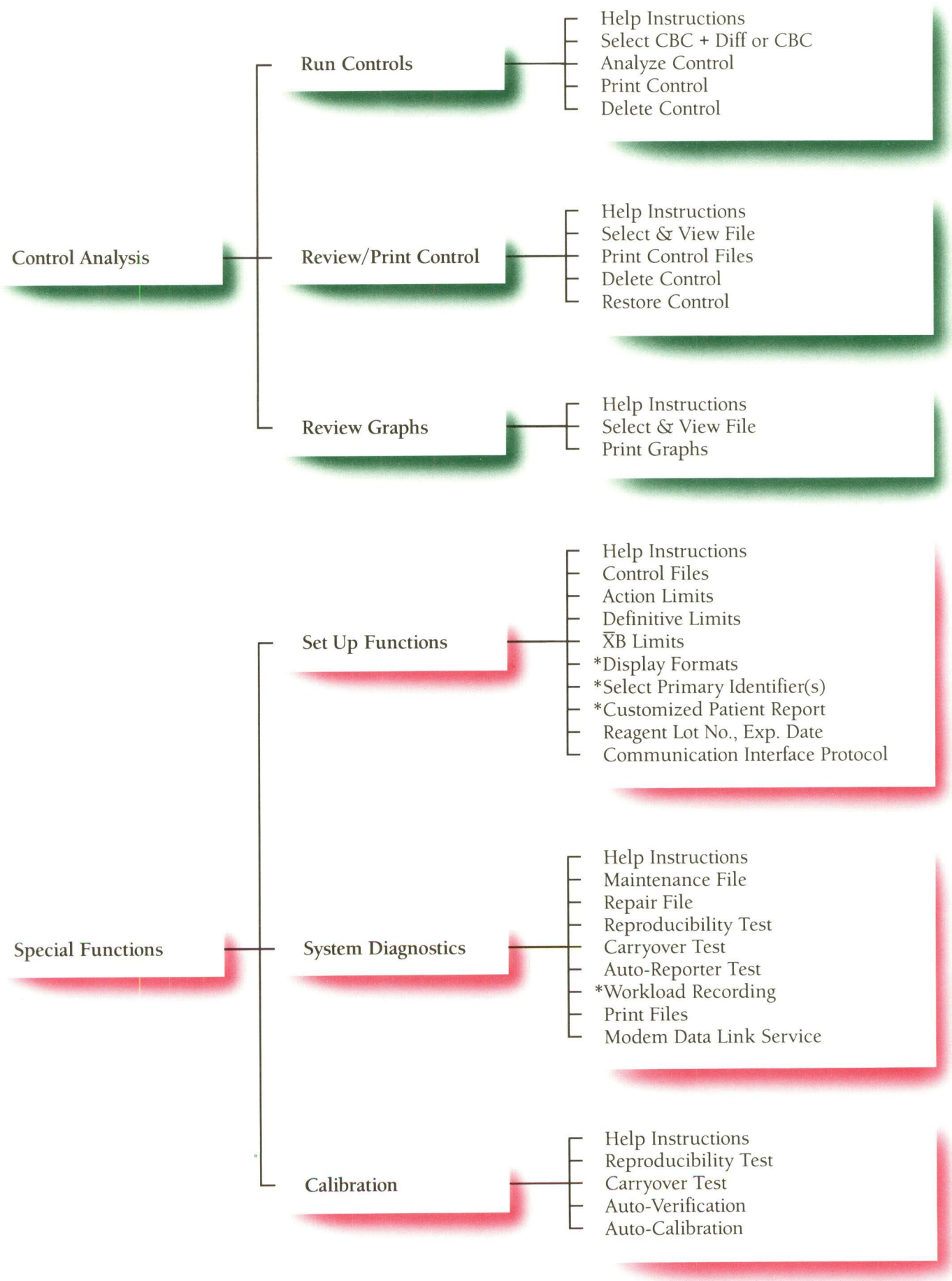


1. WBC scatterplot.
2. RBC histogram.
3. Platelet histogram.
4. Sample I.D. and demographics.
5. Date and time of sample analysis.
6. Sample status.
7. Comment field.
8. Differential results in # & %.
9. RBC and plt results.
10. High and low action flags.

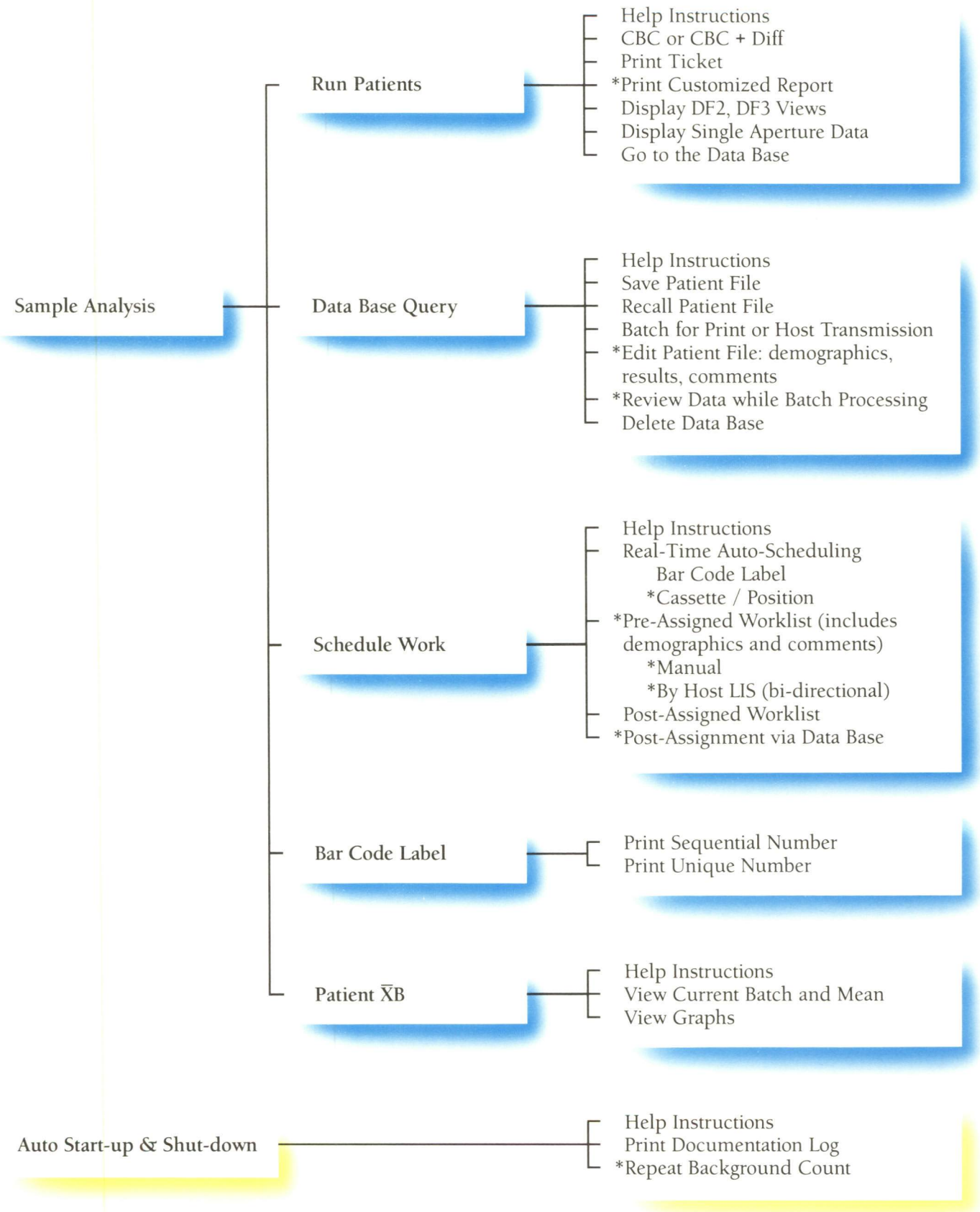
Suspect and Definitive flag information is operator selectable.

Coulter Classification Chart

	WBCs	RBCs	Platelets
Instrument-Defined Suspect Classifications: (Lab Report Only)	Immature Grans/Bands Variant Lymphs Blasts Review Slide	Nucleated RBCs Dimorphic RBC Population Micro RBCs/RBC Fragments RBC Agglutination	Platelet Clumps Giant Platelets
User-Defined Abnormalities: Definitive Flags (Lab Report Only)	Leukopenia Leukocytosis Neutropenia Neutrophilia Lymphopenia Lymphocytosis Monocytosis Eosinophilia Basophilia	Anisocytosis (Quantitative +, ++, +++) Microcytosis (Quantitative +, ++, +++) Macrocytosis (Quantitative +, ++, +++) Hypochromia (Quantitative +, ++, +++) Poikilocytosis (Quantitative +, ++, +++) Anemia Erythrocytosis Pancytopenia	Thrombocytopenia Thrombocytosis Large Platelets Small Platelets
User-Defined High and Low Action Limits (Chartable Report Only)	All WBC Parameters	All RBC Parameters	All Platelet Parameters


Control Analysis
Run Controls
Help Instructions
Select CBC + Diff or CBC
Analyze Control
Print Control
Delete Control
Review/Print Control
Help Instructions
Select & View File
Print Control Files
Delete Control
Restore Control
Review Graphs
Help Instructions
Select & View File
Print Graphs
Special Functions
Set Up Functions
Help Instructions
Control Files
Action Limits
Definitive Limits
X̄B Limits
*Display Formats
*Select Primary Identifier(s)
*Customized Patient Report
Reagent Lot No., Exp. Date
Communication Interface Protocol
System Diagnostics
Help Instructions
Maintenance File
Repair File
Reproducibility Test
Carryover Test
Auto-Reporter Test
*Workload Recording
Print Files
Modem Data Link Service
Calibration
Help Instructions
Reproducibility Test
Carryover Test
Auto-Verification
Auto-Calibration

User-Friendly Interface.



* Available with optional DMS Enhancement Software Package

Lightning-Fast Data Acquisition and Storage.

The superior Data Management System of the STKS gives you the most advanced computing power applied to hematology.

VGA Graphics Support

Powerful 16 MHz 386 Microprocessor

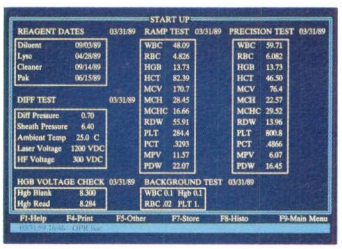
- 32-bit computer platform
- 4 MB on-board RAM
- Multiple Math Coprocessors

High performance disk subsystem

- 40 MB hard disk drive
- 3.5″ 1.44 MB Floppy Drive

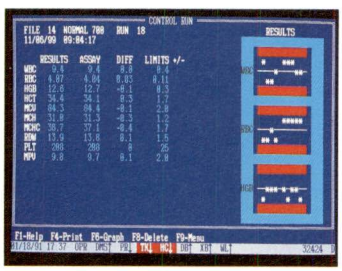
Full alphanumeric keyboard

- Single button start-up initiates a full system check, while you walk away.



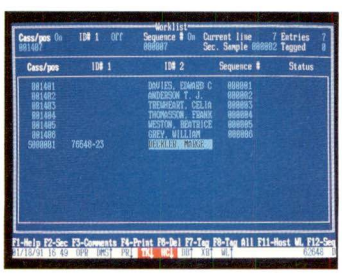
1. Start-Up

- Comprehensive quality control program for accurate results.
- Provides 15 controls files of 100 lines each
  - Trend Analysis Windows for Controls (Shown).
  - Levey-Jennings Graphs.
  - $\overline{X}$B Analysis.



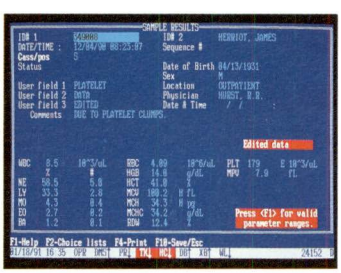
2. Controls

- Worklist generation provides flexibility in workflow.

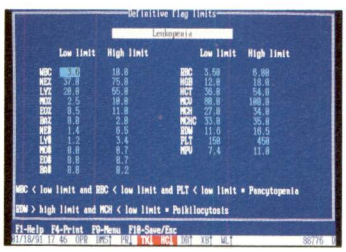


3. Sample Analysis

- Data Base Query provides immediate access to 1,000 patient results, including all displays.
- Patient results and demographics can be edited.
- Data Base sorting and batch processing improve laboratory efficiency.

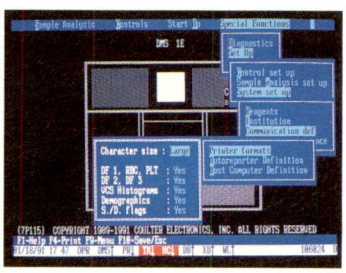


4. Data Base



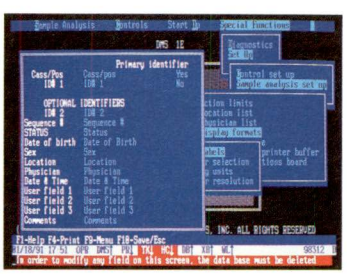
5. User-Defined Flags

- Set user-defined flags.
- Access workload report.



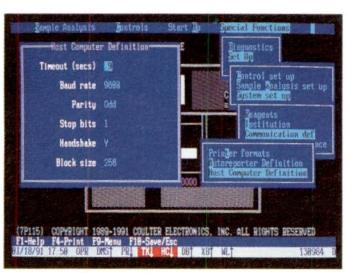
6. Format Customized Report

- Selectable graphic printer format provides backup report to ticket printer or to host LIS.
- Format a chartable report as a primary report.
- Format a report just for laboratory use.



7. Positive Sample I.D. and Security

- Customize primary and secondary identifiers to match your workflow.
- Choose a primary identifier and select from a wide range of optional secondary identifiers.
- STKS matches sample against tube bar code and/or cassette position number.



8. Interface

- Easy interface to link uni- or bi-directionally to host LIS.
- ASTM protocol helps protect many labs against major software rewrites for host computer interface.

Intuitively-Designed Data Management Software.

STKS software is easy-to-use.

- Powerful DMS allows easy software upgrade capabilities.
- User-friendly software with help screens reduces training time.
- Pull-down and pop-up menus eliminate confusion of where you are in the software.
- User-friendly color graphics and simple data formats make information easy-to-interpret.
- Alpha entry of patient name with alphanumeric keyboard provided.

It's power with a purpose.

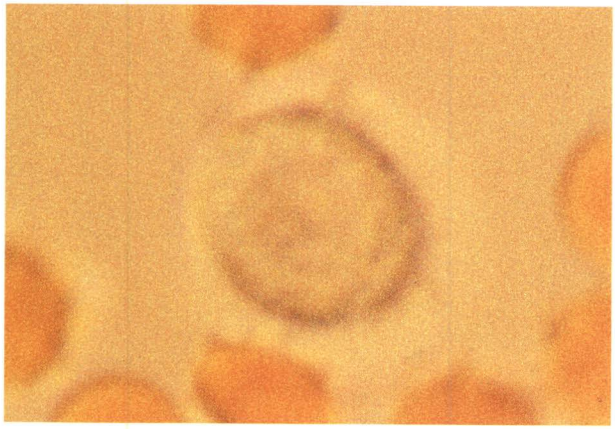
- STKS software allows you to sort by name, I.D. number, date/time, flag status, plus batch printing and batch transmission to the host.
- Automated Quality Control package provides easy printout of all QC information for regulatory compliance.
- Improve laboratory productivity via multiple tasking. You can review patient or control data while batch processing.
- Workload Recording, a graphic management tool, assists with resource allocation and cost management.
- Hard copy printouts of all start-up, patient and commercial control files, and calibration files simplify record-keeping for regulatory compliance.

VCS Technology for Automated Differentials 24 Hours a Day.

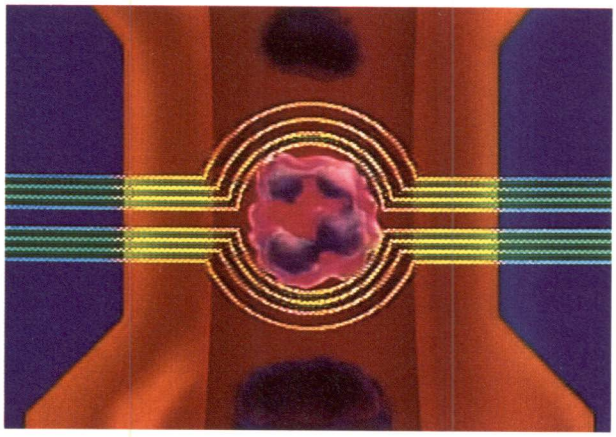
VCS Technology to determine the white cell differential, studies over 8,000 cells in their near-native state for each differential report. All measurements are taken in a single flow cell in which each cell is hydrodynamically focused to ensure it correctly intersects the optical path.

Three different measurements are taken simultaneously by independent technologies. This 3-dimensional study of cell volume, conductivity, and light scatter characteristics also allows for the determination of cellular opacity. Over 16 million data points can be plotted for analysis within the 3-dimensional matrix on each sample — to provide the most complete white cell profile possible.

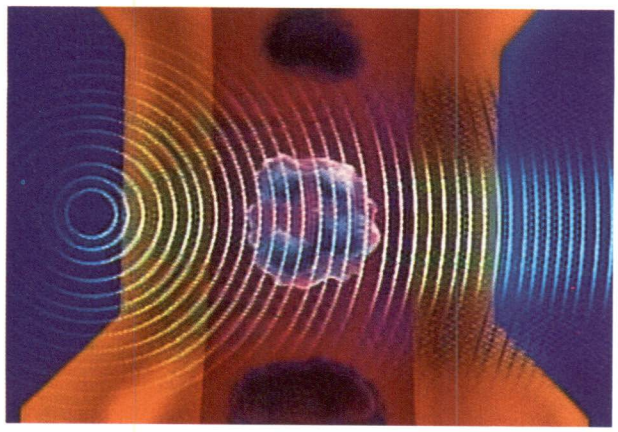
Near-Native State White Cell Analysis.



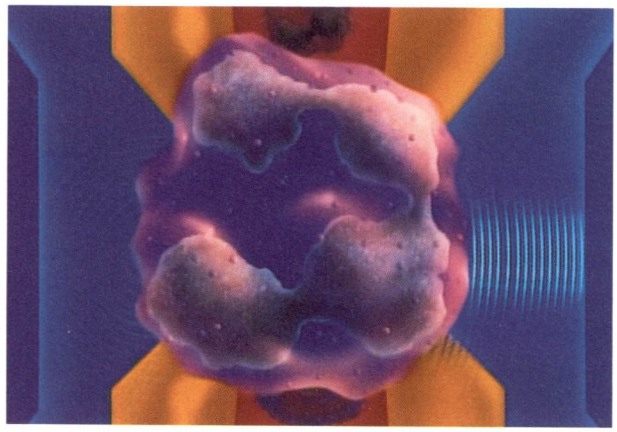
1. WBCs are analyzed in their near-native state – without shrinking or staining – so they retain their substance, depth and complexity.



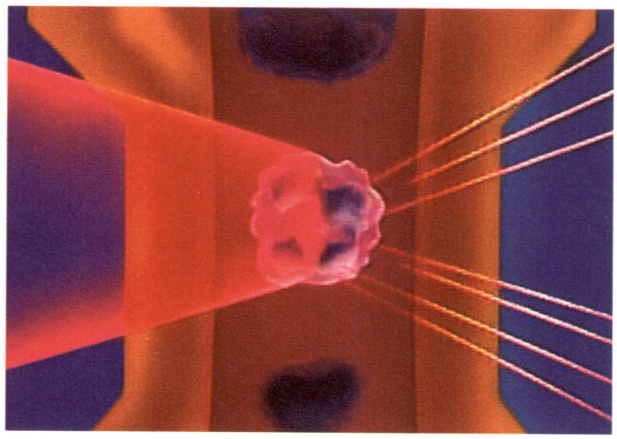
2. Cell volume is determined using the Coulter Principle of Impedance.



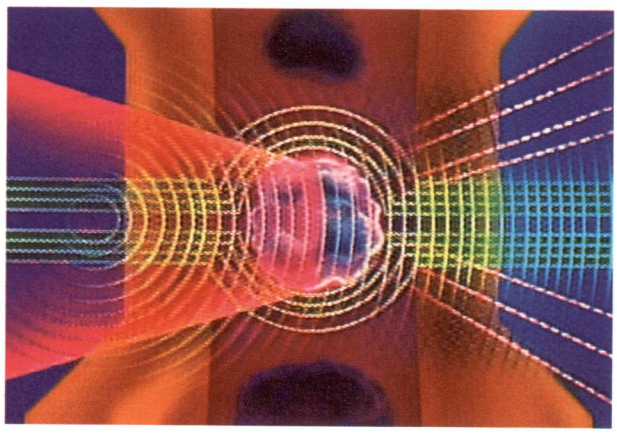
3. Cell conductivity is determined using a high-frequency electromagnetic probe, which provides information on the cell's internal constituents.



4. Only COULTER VCS Technology determines cellular opacity, a value derived by eliminating volume from the conductivity measurement. This allows an even more accurate measurement of cellular content.



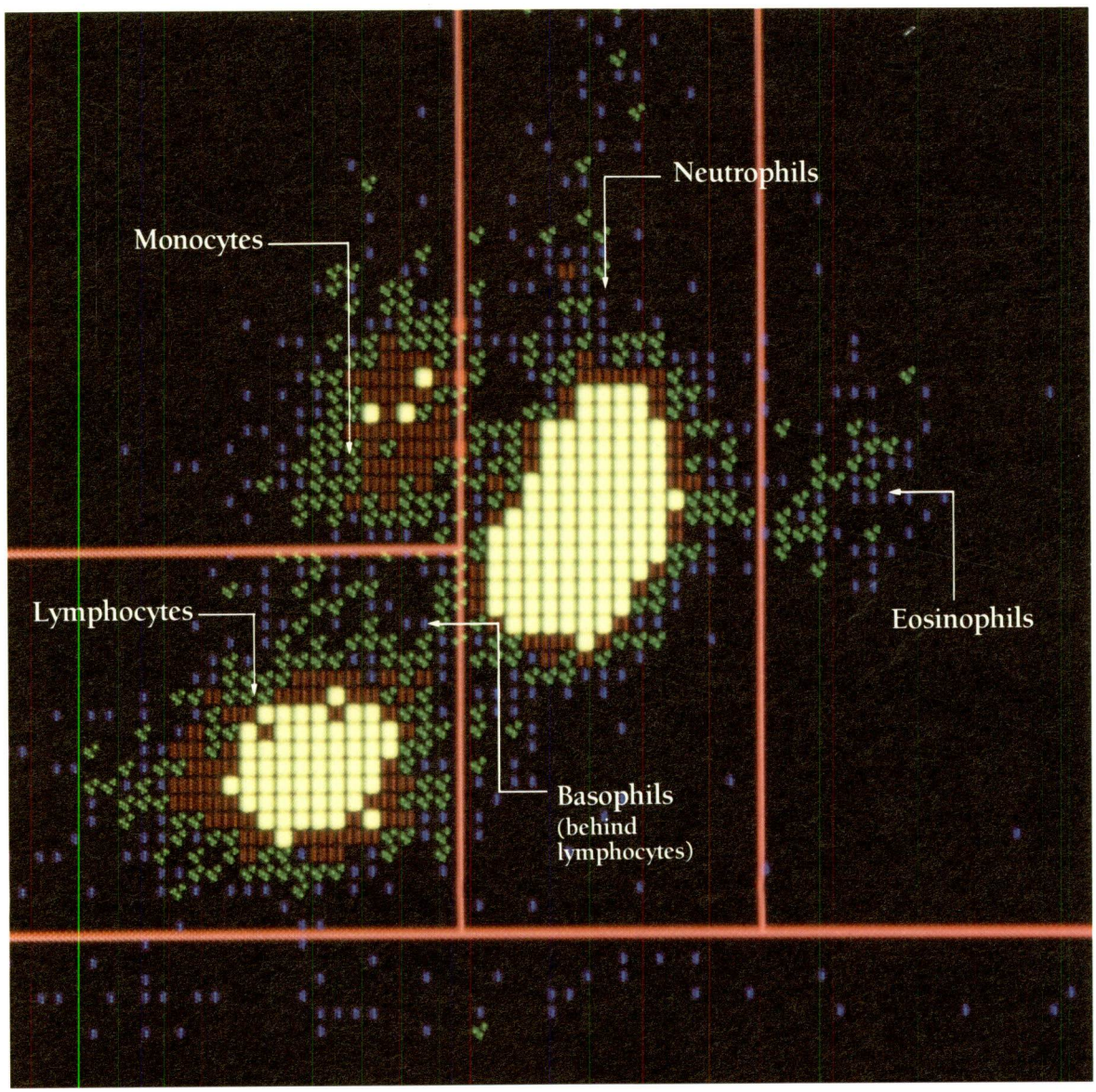
5. Laser light, using forward angle scatter, determines cell surface characteristics, morphology and granularity.



6. Taken together, these measurements provide the most comprehensive study of white cell characteristics for accurate classification.

Superior-Resolution Scatterplots Allow Visualization of 5 Distinct Normal Populations.

By plotting each cell according to its volume, conductivity and light scatter characteristics, each cell can be placed in a 3-dimensional grid. This clustering of cells, based on like characteristics, clearly separates normal cell populations. The data is presented as a 3-dimensional scatterplot which can be displayed on the instrument computer terminal from three different views.

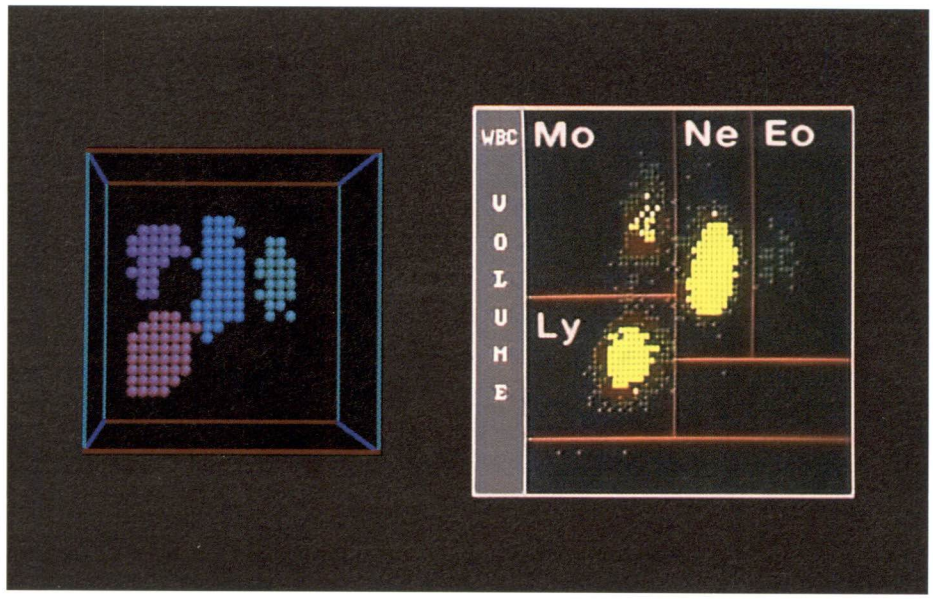


Population density on the scatterplot is color-coded as follows:

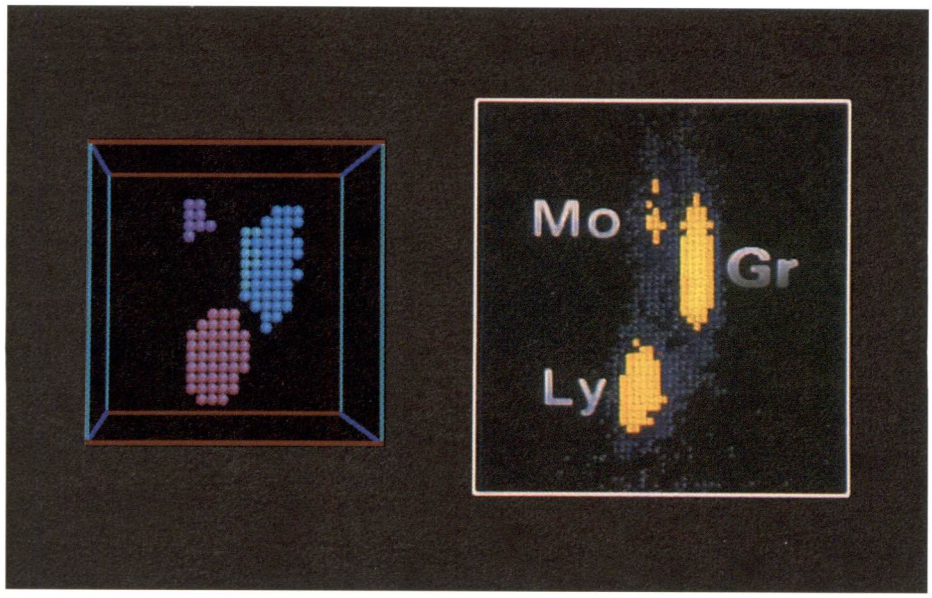
Highest density	yellow – 11 or more cells.
	red – 5 to 10 cells.
	green – 2 to 4 cells.
Lowest density	blue – 1 cell.

By color coding density, rather than cell types, abnormal shifts in population concentration can be identified easily.

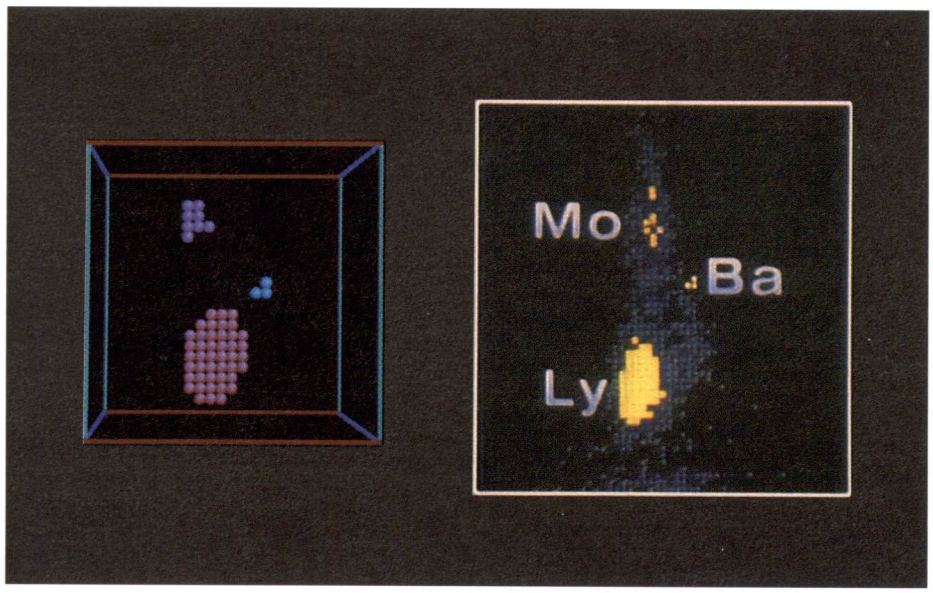
The DF1 display shows lymphocytes, monocytes, neutrophils and eosinophils. Basophils are behind the lymphocytes.



The DF2 display shows lymphocytes, monocytes and granulocytes.



The DF3 display allows visualization of the basophil population which is hidden from view behind the neutrophils, in the DF2 position.



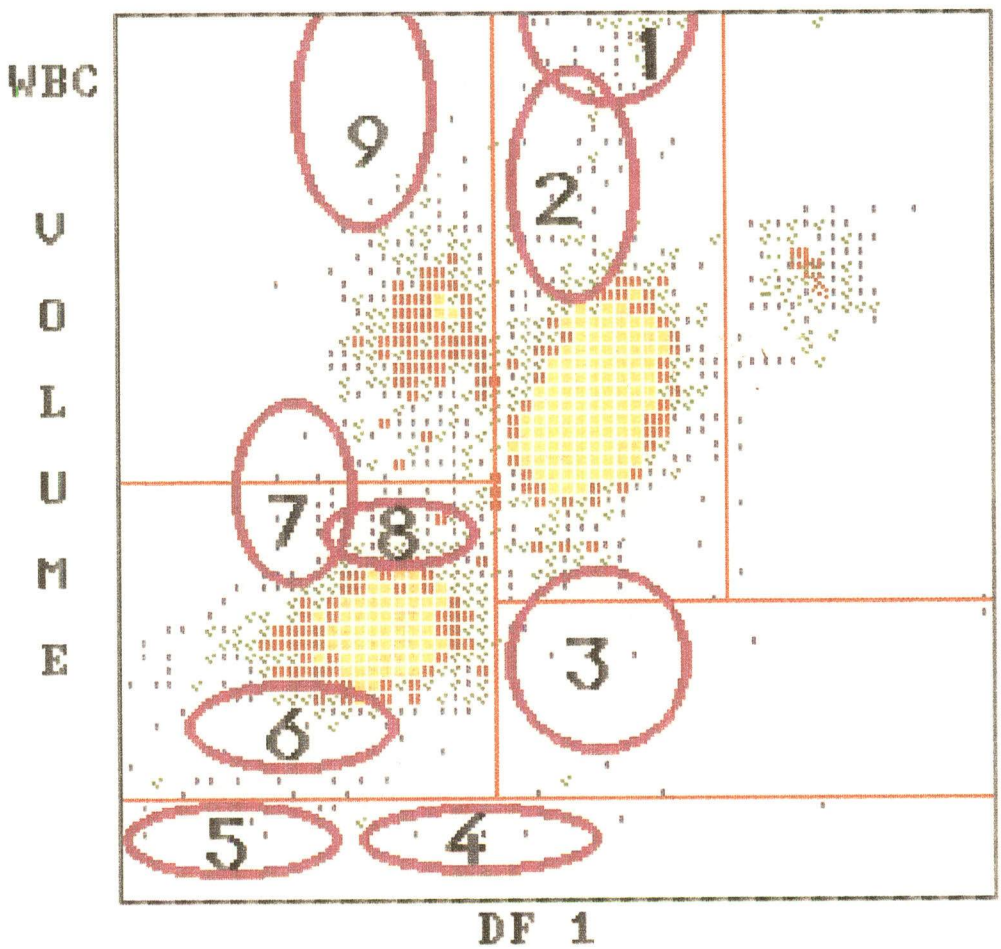
High-Resolution Identification of Abnormalities and Subpopulations.

Familiarity with a normal scatterplot pattern allows technologists to identify the presence of abnormalities and subpopulations quickly and easily. In addition to comprehensive white cell flagging criteria, the scatterplot presents a visual pattern through which abnormalities and subpopulations can be detected.

Classification of abnormal cell types is made easy because abnormal cell types fall in their respective gating areas which are individualized for each analysis. For example:

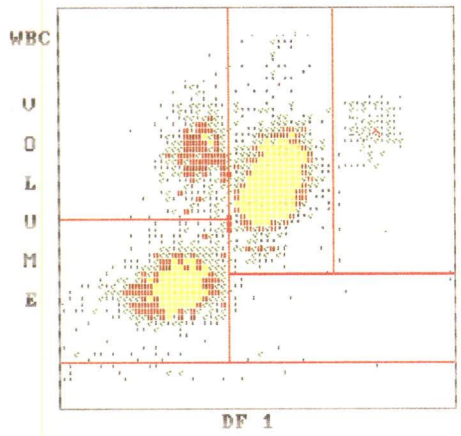
- Blast cells primarily lymphoid appear in LYMPHOCYTE gated region.
- Blast cells primarily monocytic appear in MONOCYTE gated region.
- Blast cells primarily myeloid appear in NEUTROPHIL gated region.
- Left shift cells appear in NEUTROPHIL gated region.

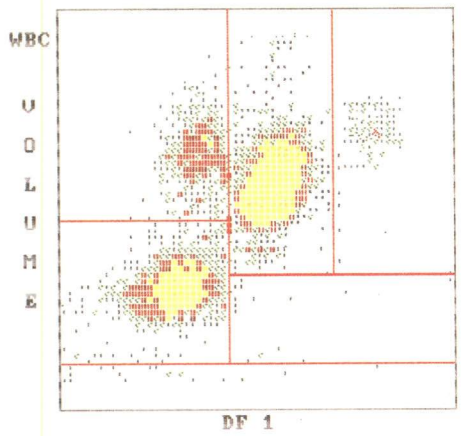
The diagram below is intended as a guide for technologist review and data interpretation.

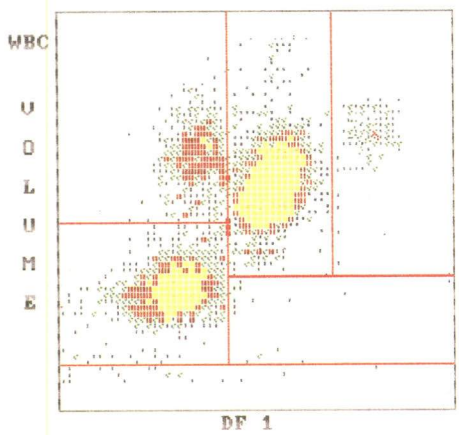


1. Suspect Blasts
2. Suspect Immature Granulocytes
3. Aged and Damaged Neutrophils
4. Giant Platelets
5. Nucleated Red Blood Cells
6. Variant Lymphocytes
7. Suspect Blasts
8. Variant Lymphocytes
9. Suspect Blasts

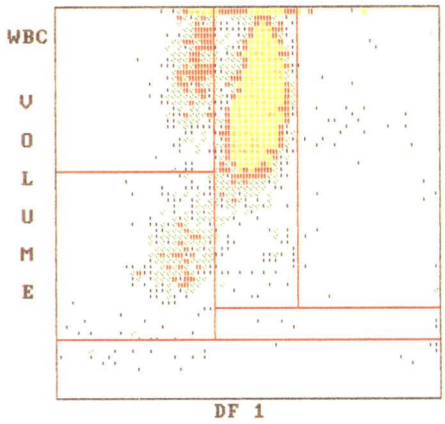
Normal DF1 Examples.



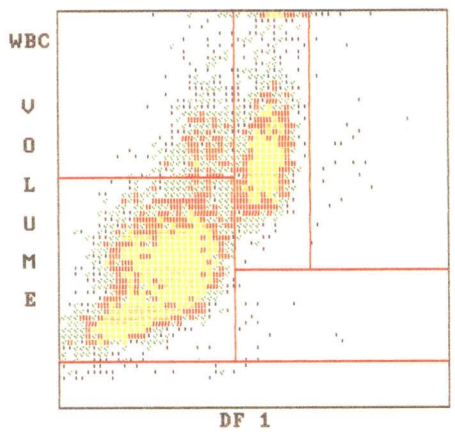




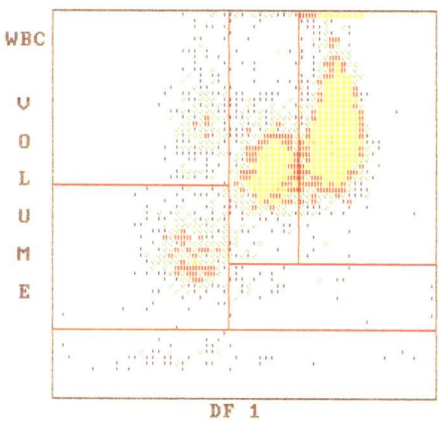
Abnormal DF1 Examples.



Identification of immature granulocytes in neutrophil region.

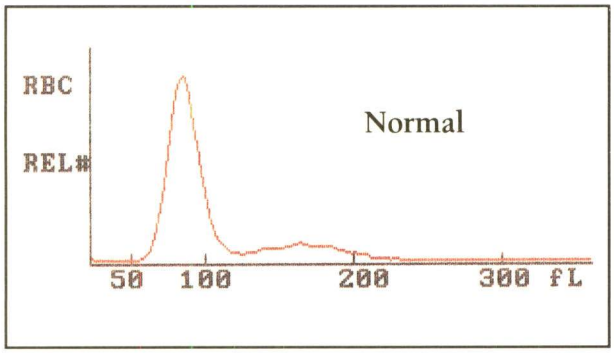


Identification of blast cell population in lymphocyte region.

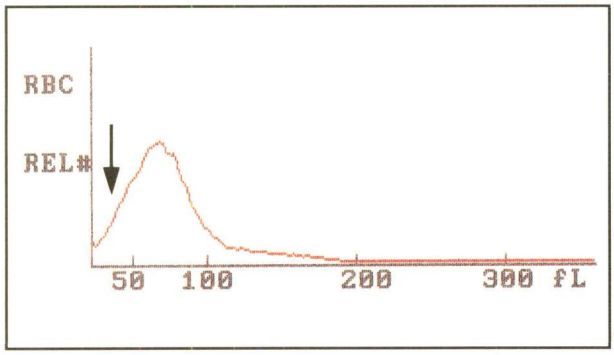


Identification of eosinophilia.

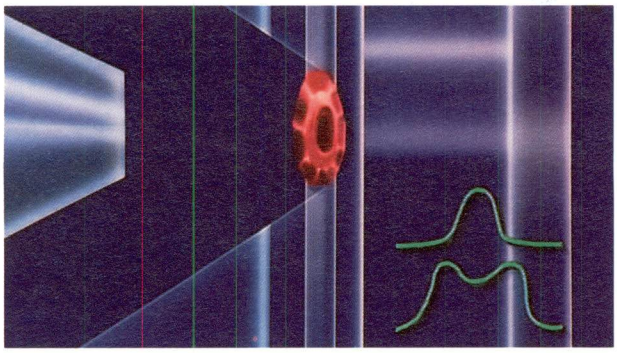
Perfect for Red Cell Measurements.



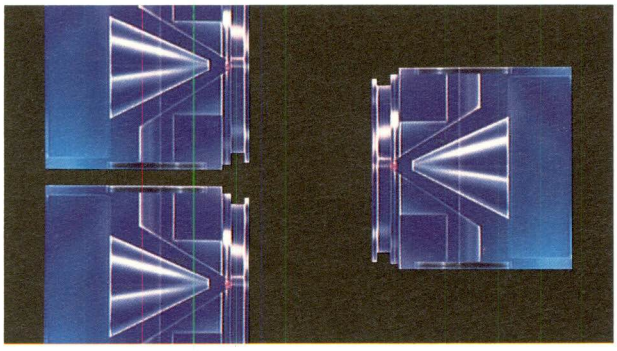
High resolution histograms mean high sensitivity. Optimal resolution is achieved across 256 channels.



Sickle cell disease in crisis: marked RBC fragmentation, elevated RDW and high take-off of the histogram.

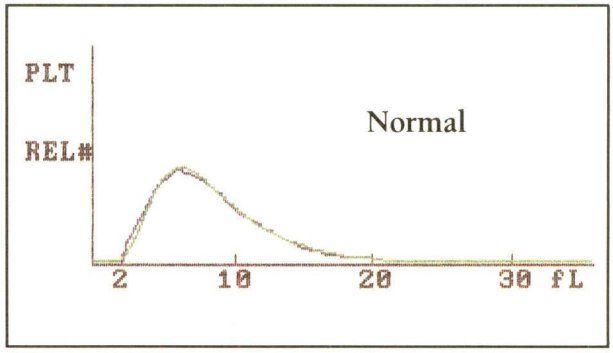


Unique Pulse Editing Technology eliminates abnormal pulses to ensure size measurement integrity.

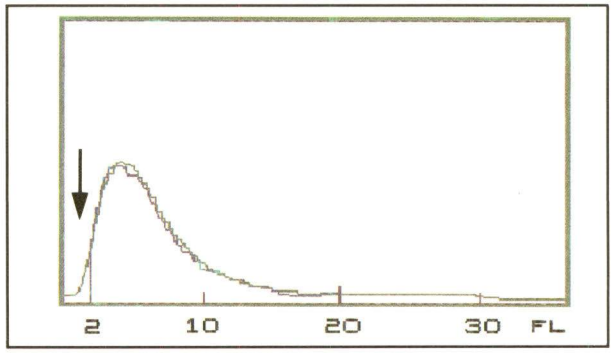


Triplicate counting eliminates random error and ensures precision. Extended analysis periods provide excellent accuracy on cytopenic samples.

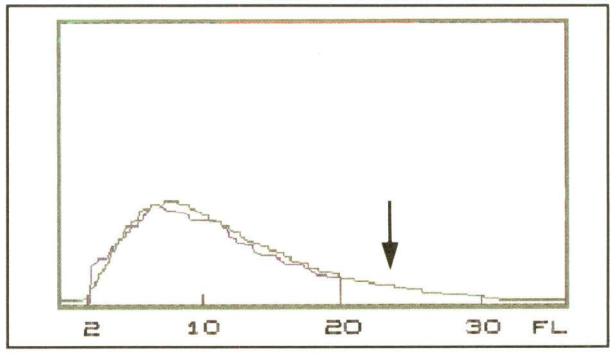
Perfect for Platelet Measurements.



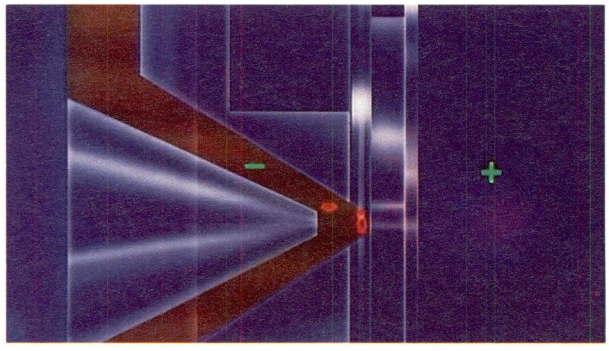
High resolution histograms optimize platelet population resolution across 64 channels for maximum sensitivity.



Unique, patented, log-fitting platelet algorithm ensures accurate counts in presence of schistocytes and microthrombocytes (arrow)...



...the algorithm also eliminates RBC interference and captures macrothrombocytes (arrow).



Unique Sweep Flow Technology prevents red cell recirculation, ensuring platelet count accuracy.

Coulter Aperture Technology for WBC, RBC and Platelet Studies.

The Coulter Principle Remains the Reference Method.

We are often asked why Coulter still uses Aperture Technology instead of another means of measurement. Our answer is simple – because no other technology has been shown to be superior. It works for red cell and platelet measurements as well as for white cells...And it remains the world reference method for counting and sizing blood cells.

Platelet Counting Accuracy Using Coulter's Proprietary Algorithm.

To ensure platelet count accuracy, the STKS System uses Coulter's patented log-fitting platelet algorithm. Platelets are distributed across 64 channels. The algorithm eliminates RBC interference while capturing macrothrombocytes. You can obtain accurate platelet counts on the STKS even in the presence of small platelets and schistocytes.

Triplicate Counting, A Coulter Exclusive.

The STKS provides three simultaneous and independent counts for WBC, RBC and PLT using 3 apertures. These counts are statistically analyzed for agreement – then averaged. Agreement between two of the counts is required for valid averaging. A display is provided for all three counts for each parameter.

System Enhancements Ensure High-Quality Quantitative Results.

Sweep flow technology, proprietary to COULTER instruments, enhances platelet count accuracy by preventing red cell recirculation. Pulse editing ensures red cell volume accuracy by eliminating abnormal pulses from the analysis which can be caused by cells traversing the aperture in an improper orientation.

This Easy-to-Use System Requires Very Few Reagents.

- **COULTER ISOTON® III Diluent.** For accurate cell counting and sizing, ISOTON III stabilizes cell membranes while forming the sheath flow in the flow cell to present white cells to the optical path in perfect alignment.
- **COULTER LYSE S® III diff Lytic Reagent.** Quickly and thoroughly lyses red cells, while providing accurate hemoglobin measurements. Its use minimizes the need for extra reagents where other COULTER instruments are also in service.
- **COULTER SCATTER PAK.** This dual-purpose reagent system within the SCATTER PAK is the key to evaluating white cells in their near-native state. Erythrolyse II lyses red cells and dilutes the sample. StabiLyse preserves the structure, surface characteristics and size of the white cells for the volume, conductivity, opacity and light scatter measurements.
- **COULTER 4C® PLUS Cell Controls.** Extreme sensitivity and tightest range of expected values ensure the highest precision and accuracy. 4C PLUS controls set the industry standard for controlling CBC parameters at clinically-significant low, normal and high levels.
- **COULTER LATRON Control.** Assures the accuracy of the 3-dimensional measurements of volume, conductivity and light scatter for instruments using VCS Technology. It checks for proper gain, capacitance and laser flow alignment.
- **COULTER S-CAL® Calibrator.** Provides single point values – traceable to reference methods – for accurate instrument calibration – without a service call.

It's also a System that Protects Technologists from Biohazards.

- **Closed-Vial Sampling.** In the primary mode, you'll never pop a top. The instrument's sampling needle requires no maintenance and is self-venting.
- **Safe Reagent System.** You'll never be bothered by reagent neutralization. With no formaldehyde and minimal cyanide, you can discard reagents without labor-intensive handling.
- **Cap-pierceable controls and calibrator.** COULTER 4C PLUS cell controls and S-CAL Calibrator can be used in the closed-vial sampling mode to further protect technologists from potential biohazards.


COULTER No. 8546733
20 LITERS
(5.3 gallons)
BALANCED ELECTROLYTE SOLUTION
ISOTON III
DO NOT
STACK OVER
4 HIGH


4C PLUS
COULTER CELL CONTROL
COULTER
For In Vitro Diagnostic Use
HEMATOLOGY REFERENCE CONTROL
PROTECT FROM FREEZING - Store at 2° - 8°C (35° - 46°F)
Active Ingredient: Stabilized Human Blood
COULTER PN 7546771
Manufactured by:
COULTER DIAGNOSTICS


LYSE S III diff
COULTER LYTIC REAGENT
COULTER

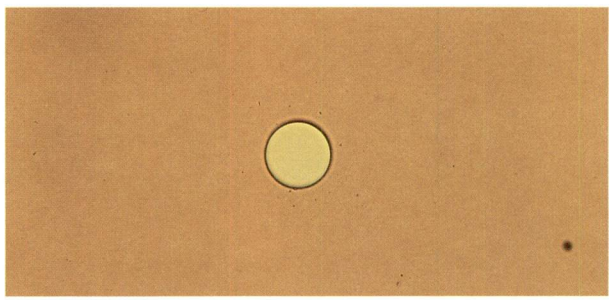

COULTER
LATRON CONTROL
COULTER
LATRON PRIMER


COULTER
PN 7546917
COULTER
SCATTER PAK
COULTER
PN 7546917
COULTER
SCATTER PAK

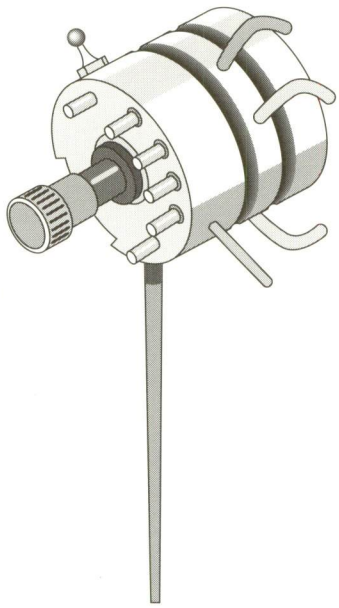

S-CAL KIT
S-CAL KIT
COULTER

Technologic Advancements Eliminate Maintenance Procedures.

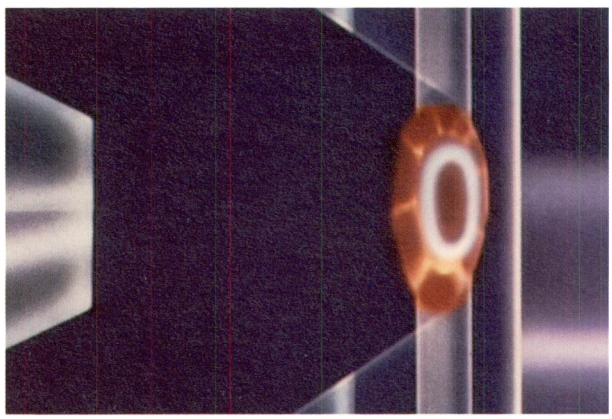
COULTER CLENZ Cleaning Agent maintains the integrity of the system's highly-sensitive flow cell, counting chambers, apertures, blood sampling valve and Hb cuvette.



Shown above are examples of an aperture, before and after cleaning with COULTER CLENZ Cleaning Agent.



A key to our claim of "No Routine Maintenance" is Coulter's patented blood sampling valve which is constantly maintained, automatically.



Coulter's patented burn circuit means the end of protein buildup and the end of routine aperture maintenance.

No Routine Maintenance.

Maintenance	Daily	Weekly	Monthly
BSV Cleaning	NO	NO	NO
Aperture Cleaning	NO	NO	NO
Needle Replacement	NO	NO	NO
Tubing Maintenance	NO	NO	NO
Protein Removal	NO	NO	NO
Calibration	NO	NO	NO
Fan Filters	NO	NO	YES
Syringe Cleaning	Not Applicable	Not Applicable	Not Applicable
Flow Cell Cleaning	NO	NO	NO

No Routine Maintenance.

Labor-saving features give you more time to run patient samples.

You can lower labor and operating costs, as well as instrument downtime. Forget routine replacement of apertures, baths, chambers, needles, tubing or pumps. Here are some of the maintenance-saving features that make this instrument the least labor-intensive analyzer on the market today.

- **Self-Cleaning Blood Sampling Valve.** Never remove it. Constant circulation of ISOTON III diluent between each sample, and COULTER CLENZ Cleaning Agent during shut-down, keeps the sampling valve clean and fully-operational at all times.
- **Patented Burn Circuit.** Automatically removes protein buildup, once and for all. With virtually no maintenance, your apertures will stay clean and protein-free to ensure the accuracy of RBC parameters, including MCV.
- **Non-pinch tubing.** Forget about manual maintenance. Routine tubing replacement is a thing of the past.
- **Autoclear and Autopurge.** Flow cell integrity is constantly maintained by these two computer-controlled functions. The instrument knows when rinsing and purging are required and carries it out automatically, without you.
- **Dual Blood Detection System.** Measures the optical density and timing of the sample, before and after traversing the blood sampling valve, to ensure consistent sample integrity.
- **COULTER CLENZ Cleaning Agent.** Routine use eliminates the need for system bleaching while maintaining all fluidics and optical pathways.

Coulter QC and Support - The Best in the Industry.

Coulter's Interlaboratory Quality Assurance Program (IQAP).

Coulter has always prided itself on the personalized service it gives its customers. This is certainly true of IQAP. Over 8,500 laboratories receive monthly reports comparing their system performance to other labs using the same COULTER instruments and lot numbers of 4C PLUS cell controls.

IQAP helps your lab eliminate some of the time-consuming recording and computation steps needed for a qualified quality assurance program. It's an easy-to-read report on accuracy and precision that helps satisfy the requirements of state and regulatory agencies.

QCC - It's Just for Quality-Conscious Customers.

By choosing COULTER instruments, reagents, controls, calibrators and service, we know you care enough to deserve extra benefits and values that aren't available to others. That's why Coulter has designed its QCC Program - to provide Coulter customers with special advantages. QCC can help relieve continuing education costs and keep your library current with publications.

QCC. It's just our way of saying "thank you" for being a Quality Coulter Customer.

Coulter Quality Includes Customer Service, Support and Training.

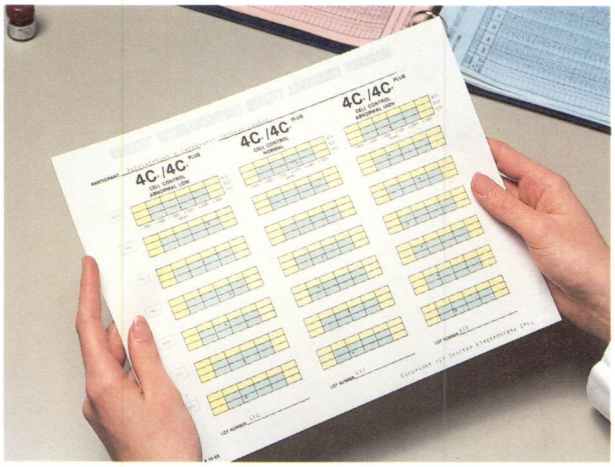
For six consecutive years, the Coulter Service Organization has ranked #1 in the industry.* And we intend to keep it that way. That's why we back your COULTER STKS instrument with our exclusive "95% UP-TIME GUARANTEE."

Coulter offers many service options so you can be sure you get exactly the kind of coverage you need. It's the most extensive array of service options in the industry.

The Coulter Education Center in Miami Lakes, Florida, ensures that when you return to your laboratory you get the most from your new instrument quickly. All customers get language-specific, hands-on training.

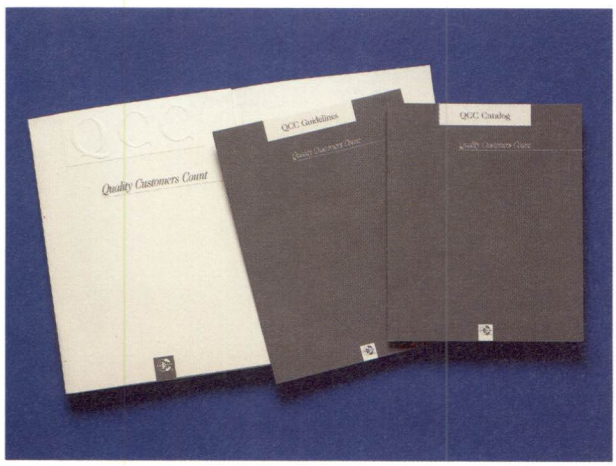
*1990 IMS SERVICETRAK data.

When You Choose COULTER Products, You Choose the Company Behind Them.



To join IQAP, you merely need to use 4C PLUS cell controls on a regular basis. Then you can submit data from any number of COULTER instruments, from any number of labs (main lab, stat, satellite), *and* from any number of shifts. IQAP is an easy and efficient way to monitor the on-going precision and accuracy of all your hematology instruments.

To keep our service rating #1 in the industry, Coulter trains over 600 service representatives per year on all products and all product lines. With over 1,350 technical representatives worldwide, a Coulter Service Representative is always there when you need one.



Use your QCC Value Points for tuition on courses at the Coulter Education Center and Coulter Field Training Centers; in-laboratory training courses or Outreach programs; admission to regional seminars, workshops and symposia; or to obtain technical and educational publications and AV programs from Coulter. With QCC, you're also eligible for service contract enhancements.

The Coulter Education Center in Florida is staffed with 19 instructors who train over 2,400 customers a year. They teach hematology, chemistry and flow cytometry, including applications such as immunophenotyping and DNA analysis.

Coulter Complete Cell Analysis Case Study.

Hematologic Presentation.

A 7-year-old white male was investigated to rule out rheumatic fever. A CBC and differential was requested.

The CBC showed a leukocytosis with a predominance of cells in the lymphoid region. The instrument cell classification reported the suspected presence of blasts and variant lymphocytes, along with a relative neutropenia and absolute lymphocytosis.

The red cell profile showed a moderate microcytic hypochromic anemia.

The platelet count was low (27,000) with an abnormal distribution. (Figure 1)

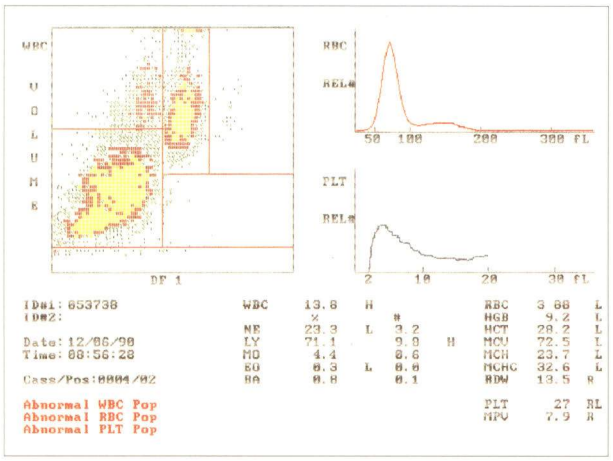


FIGURE 1

The peripheral smear (Figure 2) confirmed the instrument findings of moderate anemia, decreased platelets, relative neutropenia and a homogenous population of dysplastic mononuclear cells. The bone marrow aspirate revealed increased cellularity with 99% of the marrow elements identified as malignant acute leukemia lymphoblasts. Most cells showed FAB-L1 morphology. These lymphoblasts were alpha naphthol butyrate esterase negative; myeloperoxidase negative; acid phosphatase negative; PAS positive.

In this case, the hematologic findings on the peripheral blood smear, along with bone marrow studies and special stains, indicated a probable lymphoproliferative process. Based on these findings, a diagnosis of ALL was made. A further workup was performed for Complete Cell Analysis to determine the cell lineage(s) involved in the proliferative process.

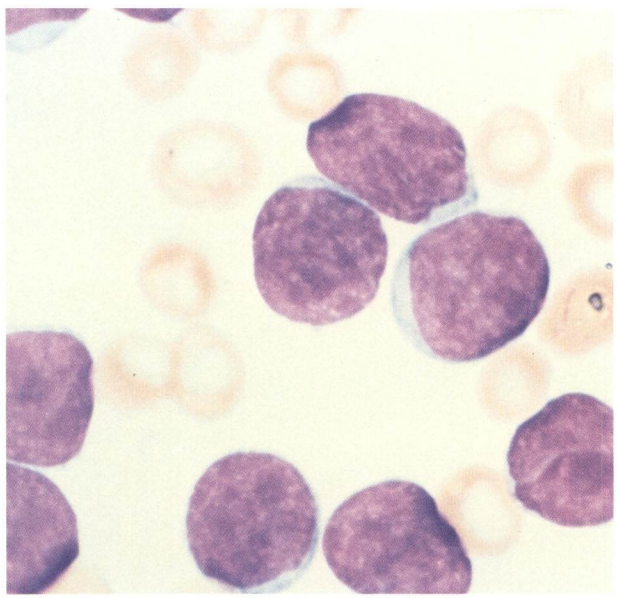


FIGURE 2

Immunologic Findings.

As shown in Table 1, the cells of interest are negative for expression of T cell and Myeloid markers. Greater than 96% of the cells express J5 (CALLA), while 93% are positive for I3, 96% for B4, and 21% for B1. Low percentage markings with all 4 Myeloid markers are consistent with previous results which indicated a lymphoid process. Low markings with T cell antigens T11, T4, T8, T3, T6, versus high markings with B1 (21%), and B4 (96%), indicate B cell line proliferation.

TABLE 1

Description	Antibody	Patient Results % Positive	Patient Results Count cells/μl
Lymphocyte Markers (T&B Cells)			
E Rosette Receptor	T11(CD2)	11	1661
T Helper Cell	T4(CD4)	7	1057
T Supressor Cell	T8(CD8)	7	1057
TL T Lymphocyte	T3(CD3)	10	1510
Total Thymocyte	T6(CD1a)	0	0
B Lymphocyte	B1(CD20)	21	3171
B Lymphocyte	B4(CD19)	96	14496
Myeloid Markers			
Monocytes, Myeloid Cells	Mo1(CD11b)	1	151
Monocytes	Mo2(CD14)	1	151
Myeloid Cells	MY7(CD13)	0	0
Myeloid Cells	MY9(CD33)	1	151
Specialty Markers			
CALLA	J5(CD10)	96	14496
HLA-DR	I3	93	14043

Figure 3 shows a Co-Plot of selected monoclonals tested in this case. Significant positivity is shown for the following antibodies: I3, B1, B4, and J5.

On the basis of these studies, a separate aliquot of cells was processed for DNA content and cell cycle analysis.

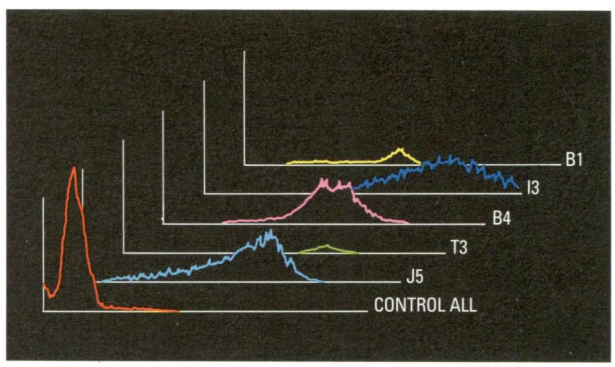


FIGURE 3

DNA Content Analysis.

The patient's sample was analyzed on the COULTER EPICS® Profile II Clinical Flow Cytometer for DNA content using propidium iodide for fluorescent staining. Figure 4 shows a normal DNA content histogram. Figure 5 shows the patient's histogram with an aneuploid peak to the right of the normal G_0/G_1 population (hyperdiploid). In many cancers, aneuploidy is associated with an unfavorable prognosis and a poor response to chemotherapy. A notable exception is ALL where aneuploidy has been associated with improved survival in children.

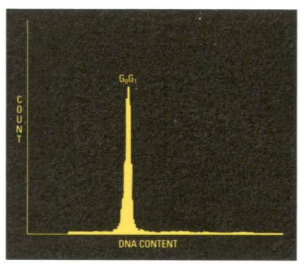


FIGURE 4

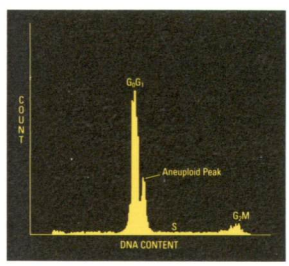
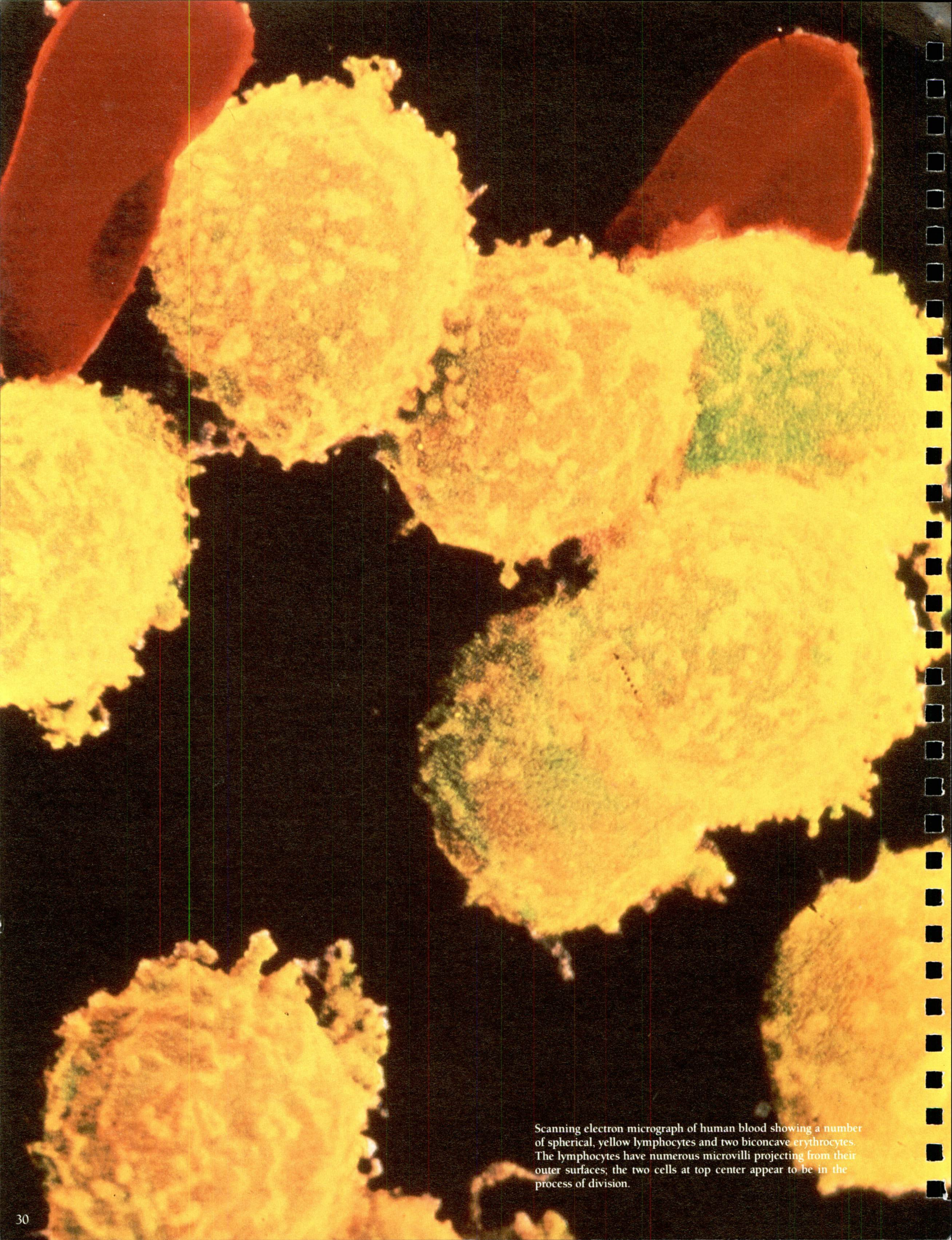


FIGURE 5

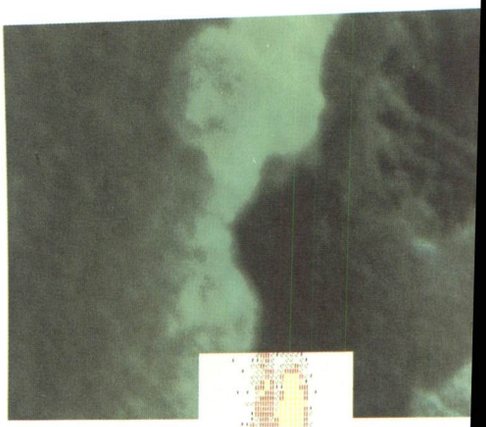


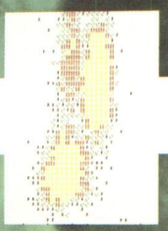
Scanning electron micrograph of human blood showing a number of spherical, yellow lymphocytes and two biconcave erythrocytes. The lymphocytes have numerous microvilli projecting from their outer surfaces; the two cells at top center appear to be in the process of division.

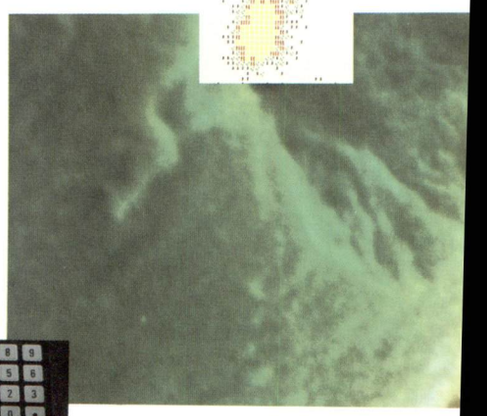
Coulter Worldwide Sales Offices:

Country	Country Code	Phone Number
Australia	61	2-905-0688
Brazil	55	21-342-2358
Canada		416-639-4701
Dubai	971	4-213534
France	33	1-34-27-23-23
Germany	49	2151-818-0
Hong Kong	852	8140481
Italy	39	2-982-951
Japan	81	3-3877-9233
Kenya	254	2-567804
Latin America		305-885-0131
Mexico	52	5-688-74-23
Netherlands	31	2979-88578
New Zealand	64	9-886-621
Portugal	351	1-895828
Puerto Rico		809-752-8420
South Africa	27	11-805-2055
Spain	34	1-6-45-30-11
Turkey	90	4-1402536
United Kingdom	44	0582-491414
United States		305-885-0131 (Ext. 2646)
		1-800-526-6932
Venezuela	58	2-52-66-68

4203326-0B Rev. 4/91
4/91







Coulter Corporation
P.O. Box 2145 • Hialeah, FL 33012-0145

COULTER

COULTER ELECTRONICS, INC.

601 West 20th Street
Hialeah, Florida 33010-2432 USA

Mailing Address:
P.O. Box 2145
Hialeah, Florida 33012-0145 USA

Telephone:
(305) 885-0131

March 8, 1991

Ms. Shirley M. Green
Special Assistant to the President
THE WHITE HOUSE
1600 Pennsylvania Avenue, N.W.
Washington, D. C. 20006

Dear Ms. Green:

We have received copies of correspondence between Dr. Penn Lupovich, Director of Laboratories for Group Health Association, Inc., in Washington, D. C., and The White House in connection with Dr. Lupovich's nomination of Wallace H. Coulter, Chairman of the Board and Founder of The Coulter Corporation, as recipient of the **Medal of Freedom**.

We were very pleased to read Dr. Lupovich's nominating letter and we fully agree that Dr. Coulter is deserving of this great honor. His contribution to the world of medicine, clinical pathology and scientific and industrial research has been outstanding.

Dr. Coulter pioneered the development of automated laboratory instrumentation four decades ago and has guided the many remarkable advances in the development of technological instrumentation we see in the clinical and research laboratory today. Coulter instruments developed from the Coulter Principle, discovered in 1947-48, have played a valuable role in the major medical and scientific advances of recent years.

Dr. Coulter's background reflects the American spirit of invention in this century. Born in 1913, he grew up during the days when electronics was in its infancy, and among his childhood idols were such geniuses as Edison, Marconi, Bell and other seekers into the unknown and untried of their day.

His father was a railroad telegrapher/dispatcher and his mother a schoolteacher. During his early childhood he moved with his family to various parts of the country, always encouraged by books and always free to give vent to his insatiable curiosity. From the beginning, radio and electronics fascinated him. As a youth, he studied both with the intention of making radio and electronics his career.

Dr. Coulter discovered the Coulter Principle while experimenting in his basement laboratory/workroom in Chicago during the late 1940's. He was trying to find a way to count minute particles, such as blood cells, electronically. At that time laboratory technologists were conducting blood tests manually, using a microscope -- a time-consuming, often inaccurate method.

Cont'd.....Page 2

4232099-3B Rev. A 5-88

Ms. Shirley M. Green
THE WHITE HOUSE

The Principle led to construction of an instrument that would count blood cells hundreds of times faster and much more accurately than the manual method, and a small industry was spawned in Coulter's Chicago basement. The first COULTER COUNTER ® analyzers were designed and built one-by-one by Wallace and his brother Joseph during their free time after work, with the help of one full-time employee.

Details on the man and his Company can be found in the attached booklet and biography.

In recognition of his ground breaking discovery, in 1960 Wallace Coulter was named recipient of the coveted **John Scott Award for Scientific Achievement**. This was a special honor, because it linked him with such past recipients as his early role models Thomas Edison and Guglielmo Marconi, not to mention the renowned Madam Curie, Orville Wright and other scientific luminaries.

That same year his unique invention, the COULTER COUNTER ® automated blood cell and particle analyzer was tapped by the Department of Commerce for the distinction of being the **first** American-made product to be shown behind the Iron Curtain at the 19th International Fair in Plodiv, Bulgaria. Shortly after that it made its European debut at an exhibition in Germany.

World wide interest grew quickly, and Wallace and his Principle reached international importance.

Today, the Company started by Wallace and Joseph Coulter is wholly owned by the Coulter family, and the same "spirit of family" that existed with their employees during the early years in the Chicago basement facility continues today in Coulter companies around the world.

Dr. Coulter continues to play an active role in research and development working with a select group of world class engineers and scientists to expand the Company's product lines to meet the needs of the future.

In addition to the John Scott Award, he has been recipient of numerous honors and awards over the years. He holds several honorary degrees. His Principle has been cited as the basis for the **first** viable modern flow analyzer.

Dr. Coulter actively sought ways to make his discovery useful in service to others. Some examples of this are:

In the early 1960's a COULTER COUNTER blood cell analyzer was given to the Hospital Ship HOPE in the name of the employees of Coulter Electronics. The People to People Foundation still use the instrument in its efforts to provide medical care for America's poor.

In the early 1980's Dr. Coulter donated a COULTER EPICS ® laser-based cell separator to the US Resource for Flow Cytometry at Los Alamos.

Cont'd.....Page 3

Ms. Shirley M. Green
THE WHITE HOUSE

A COULTER COUNTER particle analyzer was used to study soil taken from the moon and one is currently being used for special blood studies in space.

Several COULTER COUNTER analyzers were sent to the Soviet Union, along with reagents and controls, to be used to monitor the health of victims of the Chernobyl disaster.

A COULTER COUNTER analyzer was donated for use in the treatment of victims of the Armenian earthquake.

Countless U.S. hospitals, medical schools, clinics and research centers have been recipients of Dr. Coulter's largesse. He has funded or supported many research programs, and awarded many grants and endowments. The most recent was the endowment for a lecture series through the Department of Laboratories at the University of California, San Francisco.

The Coulter Corporation grew from its humble beginnings in a Chicago basement to become the worldwide leader in clinical laboratory instruments. Today, Coulter has companies and offices in 20 countries -- the first was founded in England in 1959. Coulter has sales, service and distribution operations in more than 100 other countries and employs over 5,300 people world wide.

While the Japanese were busy buying U.S. companies, Coulter was acquiring their Japanese distributor in order to meet the challenge of Japanese competition. Coulter's Japanese company is a wholly owned subsidiary.

More than 50% of the company's business is international and, at this writing, there are more than 58,000 Coulter hematology devices operating in the world, running more than 3,000,000tests a day. Thousands of Coulter systems and devices for chemistry, fine particle, and flow cytometry analyses are also in use daily around the world.

The Coulter Principle has provided the gateway to all subsequent hematological advances. From the Coulter Principle discovered by Wallace Coulter in 1947, an entire industry has emerged.

More than 95% of the blood tests done around the world today are conducted with the use of a Coulter device or its clone.

Wallace Coulter's discovery and the products that emerged from the Principle are providing the powerful tools being used by clinicians and scientists to diagnose and design treatment for killer diseases such as Aids, Leukemia, Lymphoma, etc.

Dr. Coulter's contribution has been considerable. Both the man and his work exemplify the American spirit at its best -- ingenuity and inventiveness combined with caring and community service.

Cont'd.....Page 4

Ms. Shirley M. Green
THE WHITE HOUSE

We honor Dr. Coulter for his contributions to the health care of mankind, and we join Dr. Lupovich in urging President Bush to consider him as an honored and worthy recipient of the **Medal of Freedom**.

Sincerely,

Anne-Lynne Keplar
Director of Business Development

ALK:PF
90241

encl: WHC Biography
Coulter Corporate Brochure

Group Health Association, Inc.
Department of Laboratories, 1709 New York Avenue, N.W.
Washington, D. C. 20006
Telephone: (202) 383-1800

October 9, 1990

Director of Laboratories
Penn Lupovich, M. D.

Associate Director of Laboratories
James D. MacLowry, M. D.

The Honorable George Bush
President Of The United States
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20006

Dear Mr. President:

I should like to take the liberty of nominating Wallace H. Coulter, for The Medal Of Freedom. He is a great American who has contributed in no small way to the health, welfare and economy of our people in ways which represent the best of the capitalist tradition of our wonderful Country. Mr. Coulter is the discoverer of the Coulter Principle and the founder of Coulter Electronics, Inc. of Hialeah, Florida. He is a scientist and engineer of extraordinary talent and accomplishment.

When I was a young man in the 1950's doing volunteer work at The Montefiore Hospital in Pittsburgh, Pennsylvania, I remember learning how to do "blood counts" the old fashioned way. We were lucky if we could get the basic information that was needed for the patient's care within forty minutes. When I became a first year resident in pathology at that same institution in 1965, I recall that our laboratory director purchased one of the first models of the original Coulter counters. Because of Mr. Coulter's ingenious invention we were then able to achieve far more accurate information in less than five minutes. To date, evolution of the principal which Mr. Coulter discovered has caused a monumentally beneficial change in the quality of patient care at a cost which has been readily affordable. It is rare that an evolving technology produces that kind of result for not only our advanced, relatively wealthy society but for the rest of the world as well. Any physician in any country today can verify the contribution of the "Coulter Counter".

Please know that I have no connection whatsoever with the Coulter organization and I am rather certain that Mr. Coulter would not even know who I am. I feel it to be my duty to try to see that Mr. Coulter receives recognition in his later years by the American people for the incredible contributions that he has made, and in fact, continues to make to this day. He is hard at work in the development of technology which once again is revolutionary and I suspect that a man of his vision has much yet to teach the rest of us mere mortals.

Enclosed is a copy of the brief biography which was supplied to me by one of the Coulter Sales staff who has no idea what I have in mind. Also enclosed is a copy of my own C.V. so that my credentials for presuming this nomination may be known. I ask that you weigh his accomplishments in consideration of nominating him for the Medal of Freedom.

Respectfully,

Penn Lupovich, M.D.

PL/jeg

WALLACE HENRY COULTER

Biography

Wallace H. Coulter, co-founder and Chairman of the Board of Directors of the world-wide Coulter Corporation, is best noted as the discoverer of The Coulter Principle, the most widely used method for counting and sizing microscopic particles suspended in a fluid. His method has been called the "first viable basis for flow cytometry," and from it grew an industry that changed the world of diagnostic medical research for all times.

Born in Little Rock, Arkansas, Wallace grew up in an era of invention! During his pre-teens, when radio began coming into its own, he was caught up in the fascinating new field, building crystal sets and experimenting with electricity.

The fascination continued through his school years and carried him to Westminster College in Fulton, Missouri, and further study of electrical engineering at Georgia Institute of Technology.

New vistas were opening to adventurous young men, and Wallace, whose role models included such great inventive genius' as Thomas Edison and Guglielmo Marconi, was drawn into this challenging new world.

An avid reader and insatiable explorer, problems looking for solution drew him like magnets.

His early career in electronics began in 1934 when he took a job as a radio station engineer-announcer.

In 1937 he joined the General Electric X-Ray Corporation taking on responsibilities as sales engineer.

G.E. sent him to the Far East, where he worked in Manila, Shanghai, Singapore and the nearby islands where he sold and serviced x-ray equipment to local hospitals. When the Jap-anese invaded Singapore he escaped to Java, and from there, for almost a year, he island-hopped his way back to the United States.

From 1942 until the end of World War II he worked in electronic development for Press Wireless in New York. He later participated in electro-medical instrumentation development for Raytheon Manufacturing Company.

Upon returning to Chicago in 1946, he worked for Illinois Tool Works and the Mittelman Electronics Division of Century Steel, spending his spare time in his basement workroom building electronic amplifiers and generators for local firms. Here he and his brother Joe also spent many hours experimenting with a variety of novel ideas including a method for counting microscopic particles.

It was this activity that finally led him to discovery of The Coulter Principle a method for counting and three dimensional sizing of microscopic particles -- a technology that was to have a profound effect on the practice of hematology.

The Coulter Principle provided the much desired and long hoped for means of sizing particles on the basis of volume, the most meaningful single measure of size.

Using the Coulter Principle, biological cells or industrial particles could be counted and sized at a rate of several thousand a second -- a wondrous feat when compared to the time consuming manual method used by lab technologists with a microscope.

From the principle evolved an instrument, created with a grant from the US Department of Naval Research for use at the National Institute of Health.

Wallace's first patent was approved in 1953, and he and his brother Joe, an electronic engineer, began the one-on-one production of a commercial instrument, the Coulter® Counter cell and particle analyzer.

Research continued, sales increased, and in 1958 Wallace and Joe Coulter launched a company -- Coulter Electronics, Inc.

From the Corporation evolved an industry -- development of automation in the hematology laboratory!

Today, the wholly-owned Coulter Corporation has over 5,000 employees working in manufacturing facilities and sales, service and education operations in 20 companies around the world.

In Coulter's wake followed many companies that developed instruments using Wallace's Principle. It has been estimated that at least 95 percent of the automated blood counts done in the world today are done on Coulter instruments, or their clones.

Always searching for newer horizons, he used his Principle and the first COULTER® Counter cell analyzer to spawn entire families of instrumentation and reagents and controls, not just in hematology, but also in industrial fine particle counting, chemistry, and other related lab instrumentation.

Such research led to the discovery of valuable new parameters of cell opacity. The combination of The Coulter Principle and opacity opened new avenues for cell classification and analysis.

In the 1970's the Corporation invested heavily in the research of image analysis.

In the 1980's research was begun in immunology, which resulted in products in retrovirology, studies in the area of cell kinetics in both normal and tumor populations, characterization of specific cellular enzymes, cell surface markers, hematopoiesis and tissue transplant rejection.

His expansion of biomedical research efforts in development of monoclonal antibodies and flow cytometry systems represents the beginning of the integration of three distinct disciplines: hematology, immunology and flow cytometry.

Wallace Coulter continues guiding explorations of new areas of research of nuclear and other intracellular markers to better define cell function. He has also expanded his Corporations's research in oncology, with development of tumor markers for diagnosis, prognosis and monitoring patient therapy.

The image analysis work of the 1970's will complement this work by providing modernized visual measurement in such areas as DNA content and estrogen and progesterone receptor levels.

Wallace Coulter holds several honorary doctorates in science and engineering.

He has been honored with many awards, among them the 1960 John Scott Award for Scientific Achievement, previously awarded to such notable achievers as Thomas Edison, Guglielmo Marconi, Marie Curie, Jonas Salk, and Orville Wright.

An Adjunct Professor in the University of Miami's School of Medicine's Department of Biomedical Engineering, Dr. Coulter is a member of the Miami Chapter of Sigma Xi. He is a Fellow of the Institute of Electrical Engineers and was recently named a Trustee of Clarkson University in New York.

Among the honors he has received are: the IEEE Morris E. Leeds Award in 1980; the 1988 "Florida Industrialist of the Year Award," a state award presented by the Museum of Science and Industry in Tampa,

Florida; the 1989 M.D. Buyline's SAMME Lifetime Achievement Award; the American Society of Hematology's Certificate for Distinguished Achievement in 1989, and he was the 1989 recipient of the Association of Clinical Scientists' Gold Headed Cane Award.