A Country Run by Engineers

Also Inside
- Untamed Genius
- Quest for Quality
Can't Beat The Real Thing.
FOR A PORTABLE CELLULAR PHONE WITH GEORGIA TECH COLORS, GIVE US A BUZZ.

Here's an offer all true-blue Tech fans will be swarming over!

A BellSouth Mobility portable cellular phone, manufactured by Motorola, specially designed in Georgia Tech colors. So make a beeline for the phone and order yours today. Each BellSouth Mobility cellular phone comes with a Georgia Tech custom-carrying case and is only $349.00 in market. Or $489.00 out of market. Include an additional $9.99 for shipping and handling.

There's only one way you can place an order for this special phone. For complete details, give us a buzz at: 1-800-947-7177.

©1991 BellSouth Mobility

THERE'S NO BETTER WAY TO STAY IN TOUCH!
With Tech Degrees And Delta Tickets, They Can Go Just About Anywhere They Want.

Delta and The Delta Connection® now offer over 4,800 daily flights to more than 300 cities worldwide. We thought you should know this because, with a diploma from Tech, you’re undoubtedly going places.

© 1991 Delta Air Lines, Inc.

Delta Connection flights operate with Delta flight numbers 2000-5999.
Features

**Engineering Democracy in Nicaragua** ............ 14

In a country emerging from years of dictatorships and civil war, Tech grads are helping write the national agenda.
*Written by John Dunn*

**Untamed Genius** ..................................... 28

Tech alumnus Kary Mullis has invented one of biotechnology's hottest and most far-reaching techniques.
*Written by John Morkes*

**The Quest for Quality** ............................... 34

Under Tech graduate Thomas Malone, textile giant Milliken has made quality more than a buzzword—it's a way of life.
*Written by Gary Goettling*

Departments

**Letters** .................................................. 5

Designs on manufactured products; High-voltage lines.

**Technotes** .................................................. 7

Tech keeps growing; Olympic prestige?; Improving retention; Mentors sought; New phones; That's entertainment?; Killer bees; Scott socked.

**Pacesetters** ............................................... 40

Tech grad John Kaweske: healthy portfolio.
Aleksander Szlam: telephone entrepreneur.

**Research** .................................................. 47

Archeologists study Civil War medicine in South Carolina dig.

**Profile** .................................................... 50

Prof. Peter Skelland: Gold from the sea?

---

**Engineering Democracy in Nicaragua**

Antonio Lacayo leads a cadre of alumni who are helping bring democracy to the new government of Nicaragua. Read about their efforts to resurrect the Latin American nation after six decades of dictatorships, beginning on page 14.

*PHOTOS BY JOHN DUNN*

*ILLUSTRATION BY MAC EVANS*

**Untamed Genius**

Tech alumnus Kary Mullis has invented one of biotechnology's hottest and most far-reaching techniques.

*Written by John Morkes*

**The Quest for Quality**

Under Tech graduate Thomas Malone, textile giant Milliken has made quality more than a buzzword—it's a way of life.

*Written by Gary Goettling*
It takes more than love and good intentions to support and raise a family. You have to be smart, plan ahead, and make tough financial decisions.

C&S Bank is here to work with you every step of the way, from the time you first start out, to well after you retire.

We’ll help you pay bills, buy a car or a house, send your kids to college, save for your retirement, and plan your estate to protect those you do things for.

We’ve helped families for over a hundred years. And we’ll help yours. From this generation to the next.
Designs on Manufactured Products

Editor:

As a graduate of the first class in industrial design, I was pleased with the feature article in the fall issue, "Design is Everything."

Although our small group at that time was considered somewhat weird because of our tactile charts and other abstract design implementations, the foresight of Professor Harold Bush-Brown and our Professor Andi Schiltz in starting the ID program should now be given proper recognition.

As a spinoff of the Department of Architecture, our small group was patterned after the teachings of the Bauhaus. We perhaps failed to appreciate the role of marketing at that time. We ridiculed Raymond Loewy and other popular industrial designers for their fetish toward "streamlining," though admittedly they did understand the impact of marketing on successful design. Happily, a balance seems to have been achieved.

Industrial design is certainly not limited to electronic products and packaging, but has its place in every manufactured product. My own experience happened to be in building products.

Thanks for recognizing that design truly is everything.

Ed Wengenroth, BS '43
Branchville, N.J.

High-Voltage Lines Cause for Concern

Editor:

I should like to submit one area of possible concern, particularly where I live in eastern Pennsylvania—the problem of electromagnetic fields, specifically high-tension lines.

The transmission of electric power over long distances is more economical as voltages are increased, but the effects on human life are still not easily defined. We need some unbiased information and facts on a problem which isn't going to get any less important.

I would also be interested in what differences, if any, would be found if high-tension DC transmission were used, where power could be increased some 30 percent by a corresponding increase in voltage, in existing lines.

Carlton S. Hulbert, ME '34
Langhorne, Pa.

Editor's Note: The atmosphere is saturated with many forms of electromagnetic radiation, from cellular phone masts to the high-tension wires mentioned by the writer. But the health effects from exposure to all this radiation are unknown. Studies on the subject are often contradictory or inconclusive in their results.

At Georgia Tech, Professor Jim Toler is conducting research into the health effects of microwaves, but not of radiation specifically from high-voltage transmission. His conclusions will be published in Georgia Tech Alumni Magazine when they are available.
DON'T LET OUR YELLOW JACKET WEEKEND FLY BY. $105 PER NIGHT.

Take off for a grand weekend at The Ritz-Carlton, Buckhead. You can shop next door at Phipps Plaza and Lenox Square. Give our pool and fitness center a workout. Or enjoy elegant surroundings featuring live jazz in The Bar. And delicious dishes created by our award-winning chefs. On Sundays we boast Atlanta's best brunch. And finally—a gracious room with a lovely view of Atlanta. Just call 800-241-3333 or 404-237-2700 for reservations. At a price that doesn't sting.

THE RITZ-CARLTON
BUCKHEAD

..."The Spinet of Heads of the World..."
Tech Keeps Growing

The openings of the Student Services Building and the Manufacturing Research Center at Georgia Tech this fall herald many additional changes in the campus physical plant that are in various stages of completion.

- The Student Center Galleria Theater is set to open in January.
- Construction of a new graduate student residence hall is also scheduled to begin in January.
- Groundbreaking for another dorm, located next to the Woodruff Residence Hall, is set for summer 1992.
- The Student Success Center will be completed in October 1992 and occupy the site of the Knowles Building, which was demolished in December to make way for the new $10 million structure.
- Lyman, Savant and Emerson buildings have received renovations in the past year.

Olympic Prescience?

Utilizing Atlanta’s existing sports infrastructure for the Olympics would allow the city “to construct relatively few new structures while implementing changes in those structures already in use. By this method, the prohibiting factors of hosting the Olympic Games could conceivably be eliminated.” That was the assertion of a thesis written by architecture student William Howard Bruning—in 1977. Titled “An Olympic Village for a Summer Olympic Games in Atlanta,” the paper focused on urban neighborhood revitalization, and how a

The Student Services Building contains office space for student programs and a 1,200-seat auditorium.
winning bid to host the Olympic Games could be a catalyst for redevelopment, specifically in the Bedford-Pine section of the city.

Bruning, who graduated in 1978 and now lives in Tampa, Fla., detailed how an Olympic Village of manufactured townhomes could be constructed in Bedford-Pine to house 10,000 athletes. While Bruning dismissed Georgia Tech as a potential Village site because of inadequate housing, he accurately forecast use of the campus for Olympic venues and training sites.

**Improving Retention**

One-third of all students leave Georgia Tech within their first two years, according to Robert Pierotti, dean of the College of Science. And he is determined to do something about it.

A Center for Education in Science, Mathematics and Computing has been established under the auspices of the College of Sciences. The center will look for ways to enhance education in math and science at both the high school and introductory college level, with the goals of increasing student interest in those fields and also improving Tech's retention rate.

"The question is, how can we make courses more exciting and relevant for students?" Pierotti said.

Students, along with representatives from Tech colleges and schools, will serve on the center's advisory board and help formulate recommendations to school directors. The center also hopes to bring the Science Olympiad, a national high school bowl competition, to Atlanta in 1996.

**That's Entertainment?**

According to an entertainment survey conducted by *The Technique*, the favorite television programs of Georgia Tech students are "Cheers," "Star Trek: The Next Generation," and "The Simpsons." Cable News Network also placed among the top TV fare.

The library fountain was most often cited as being the best place to watch people on campus, while The Spaghetti Factory and Houston's vied for "best place to take your parents out to eat."

In the favorite bands category, Dreams So Real was the top choice from among Atlanta groups, and R.E.M. was named the favorite Georgia band.

Some respondents apparently felt that answering the survey itself was supposed to be entertainment. Krystal and The Varsity both appeared in the tally of best ethnic restaurants. And Georgia Tech hockey games were mentioned as a first-date activity of choice. Dinner and a movie came in second.

**New Phones**

The Georgia Tech Alumni Association has installed a new telephone system to provide service and information more efficiently and promptly. The general information numbers—(404) 894-4646 for records, (404) 894-2394 for placement, and (404) 894-2391 for publications and all other departments—will remain in effect.

But each area of the Alumni Association also has a direct line, as follows:

- Address changes ... 853-0754
- Address queries ... 853-0752
- Advertising, publications ... 894-9270
- Alumni magazine ... 853-0760/0761
- Clubs ... 894-9275
- Matching Gifts ... 853-0755
- Parents' Association ... 853-0767
- Programs ... 853-0759
- Public Relations ... 894-9271
- Roll Call ... 853-0762
- Tech Topics ... 853-0760/0761
- Tours ... 894-9278
45th Roll Call
5 Million Dollar Dash

Amount to date
$1,969,657
Some compile clients.

AT BALENTINE & COMPANY, we believe the only way to effectively safeguard your financial well-being rests on a simple philosophy — build personal, long-term relationships with our clients.

We understand that you are entitled to objective investment recommendations, timely communications and consistent performance. Balentine & Company provides you strategic advice involving individual account management, pension consulting, investment manager selection, and corporate finance services. Our advice comes from an in-depth examination of your needs.

The success of our clientele is based on a simple concept we've believed in over the years — your financial well-being does not come from a short-term transaction — it's the result of a long-term relationship.

BALENTINE & COMPANY
ELEVEN HUNDRED PEACHTREE STREET
SUITE 1900
1100 PEACHTREE STREET, N.E.
ATLANTA, GEORGIA 30309-4519
(404) 885-9600
FAX: (404) 881-4295
Killer Bees

It may have been the largest gathering of Yellow Jackets in South Carolina ever, but it wasn't a club meeting or a Georgia Tech football game.

A shed in Charleston was opened this summer for the first time in two years, revealing to startled onlookers a huge yellow jacket nest hanging from the rafters. The nest measured 6 feet high by 4 feet wide, and contained about 250,000 of the stinging insects, according to animal control officers called to the scene. The jackets could have killed anyone who tampered with the nest, the officers said. After spraying the nest with insecticide, it was glazed and will go on display somewhere in Charleston. What made the nest so unusual besides its size, is that Yellow Jackets typically make their home underground. But who is surprised to see some yellow jackets show a flair for architecture?

Scott Socked

For Scott Gillispie, a mere $2 meant the difference between Gitano socks of the past year against each other, with a shot at $100,000. An electrical engineering senior, Gillispie participated in the Jeopardy! Tournament of Champions in November by virtue of his college championship title, which he won on the popular TV show this past May.

Gillispie advanced to the semi-finals of the annual tournament, which pits the 15 best Jeopardy! players of the past year against each other, with the final three competing for a $100,000 grand prize. He emerged from Final Jeopardy! with $16,800, but missed the Final 3 cut when an opponent wound up with $16,801. Gillispie's second-place showing earned him the money he had won, plus an assortment of prizes—including a number of pairs of the designer socks.
Georgia Tech
recognizes and honors the 1991 CORPORATE LIAISON member companies for their support of scientific research and academic excellence:

AEL (American Electronic Laboratories, Inc.)
ALCOA
Asea Brown Boveri
Bell Communications Research
BellSouth
Boeing
Duke Power
GTE Telecommunications Products and Services
Hayes Microcomputer Products
HBO & Company of Georgia
Hercules
Hughes
Kimberly-Clark
Lockheed
Martin Marietta
MCC/Panasonic
Metallgesellschaft AG
Michelin
NCR
Nippon Shokubai
Northern Telecom/
Bell Northern Research
Northrop
Phillips Petroleum
Rockwell International
R.R. Donnelley & Sons
Russell
Shaw Industries
Teledyne
Union Pacific Railroad
United Technologies
Yokogawa

For membership information, please contact the Georgia Tech Corporate Liaison Program at (404) 894-7488
Thanks to the dedicated effort of our employees – including the 47 alumni of the Georgia Institute of Technology – Merck has been voted “America’s Most Admired Corporation” in a Fortune magazine survey of 8,000 business leaders and financial analysts.

This is the fifth consecutive year that Merck – the world’s largest prescription pharmaceutical company – has been so honored.

As we celebrate our Centennial, we rededicate ourselves to the values that have built our corporate reputation in the categories of the Fortune survey.

Community and Environmental Responsibility; Innovativeness; Quality of Products or Services; Value as Long-Term Investment; Ability to Attract, Develop, and Keep Talented People; Financial Soundness; Use of Corporate Assets; Quality of Management

Merck & Co., Inc. Rahway, New Jersey 07065
Engineering Demo in Nicaragua

In a country emerging from years of civil strife, Tech graduates are creating a new national agenda

By John Dunn

Arms outstretched in the traditional victory greeting, Violeta Chamorro smiles at well-wishers following her stunning win in Nicaragua's 1990 presidential election. Seeking an era of peace, Chamorro brought into the government a number of engineers trained at Georgia Tech.
When Violeta Chamorro was first approached by a 14-party coalition to run for president of Nicaragua against incumbent Sandinista President Daniel Ortega, she declined. But the coalition returned, convinced that she was the only person who could meld the fragile National Opposition Union (UNO) and defeat Ortega, and she told her son-in-law, Antonio Lacayo, she would run. She asked him to manage her campaign.

Lacayo, a 1971 industrial engineering graduate of Georgia Tech, was a successful businessman, but a political novice. Yet in 1982, when the Sandinistas took over his company and booted him out, he responded with a dogged five-year legal battle, finally wresting his company back. He acknowledges the unlikely prospect of what happened: "I was one of the few who was able to do that."

Political analysts considered Violeta Chamorro’s prospect of winning the election even less likely.

“We had two challenges,” recalls Lacayo. “One was to win. The other was to convey the message to the Sandinistas that if they were to lose, they would only be losing power—not their lives or property. We had a dual purpose: to win the election and to build a democratic system.”

The people of Nicaragua could identify with Violeta Chamorro. She was the widow of a national hero and her own family—like Nicaragua—had divided loyalties. Her husband, Pedro Joaquín Chamorro, crusading publisher of La Prensa and an opponent of Nicaragua’s Somoza-family dictatorship, was assassinated on a Managua street in 1978. Anastasio Somoza Debayle was blamed and public outrage ushered the Sandinistas into power. Two of her four children have sworn allegiance to the Sandinistas.

“The power that the Sandinistas had in this country was overwhelming,” Lacayo says. “Except for Cuba, I don’t think there has been a party [in Latin America] with so much power.”

The Sandinistas agreed to allow monitored elections, and Georgia Tech alumnus and former President Jimmy Carter was among those monitoring the ballots.

When Chamorro won the Feb. 25, 1990, election to a six-year term, receiving 55 percent of the vote to Ortega’s 41 percent, the Sandinistas and much of the world were stunned. It was President Carter who brought word to Chamorro that Ortega was conceding defeat; she informed Carter she was ready to claim victory.

National reconciliation has been Chamorro’s theme from the beginning. After the transition of power in April 1990, Antonio Lacayo became Nicaragua’s prime minister. Described by The Wall Street Journal as a workaholic, he puts in workdays that typically begin at 8 a.m. and end at 9 or 10 p.m. He dresses comfortably, usually wearing a long-sleeve shirt without a coat or tie. He shrugs that his workload often ties up his weekends.

Between sips of coffee in the conference room that adjoins his office, Lacayo discusses the new democratic government: its successes and the problems it faces.

Lacayo applies his engineering background to managing the government—keeping an eye on the blueprint, yet performing the nuts-and-bolts duties necessary to achieve
Nicaragua was discovered by Columbus on his fourth and last voyage to the New World in 1502, and is believed to take its name from a peaceful Indian chief, Nicarao, and agua, which is Spanish for water. It was Spain’s first secure Central American province.

- In the midst of four decades of conflict, inspired by struggles in Mexico, Nicaragua became independent of Spain in 1821.

- The discovery of gold in California in 1848 transformed Nicaragua into an immigration route because of its strategic location between the Atlantic and Pacific oceans. Cornelius Vanderbilt began a transit service utilizing steamships, carriages and a rail system to link the two oceans.

- William Walker, an adventurer from Tennessee, was invited in 1855 to help the liberals in their quest for control of Nicaragua. Within a year, Walker made himself president. In 1857, he was driven from office through the efforts of five Central American republics.

- José Santos Zelaya, a liberal president who served from 1893 to 1909, began to plan a German-Japanese-led canal to link the Atlantic and Pacific.

- The execution of two U.S. citizens, accused of participating in a revolution against Zelaya, angered President Taft’s administration, initiating an era of U.S. intervention. When Zelaya resigned in 1909, the U.S. refused to recognize his successor.

- In 1911, Adolfo Díaz, with U.S. backing, led a coup and became president. During his term, U.S. banks lent money to Nicaragua and managed its shipping lanes, customs collections and railway.

- The Bryan-Chamorro treaty in 1916 authorized the U.S. to give Nicaragua $3 million for the right to build an interoceanic canal and establish naval bases. The treaty was abrogated in 1970.


- In 1928, Moncada, under U.S. auspices, was elected president, followed by Sacasa in 1933. Sandino rejected the agreement and continued to fight. Sandino’s army was called the “crazy little army” which for many Latin Americans came to typify the cause of resistance against yanqui imperialism.

- U.S. Marines departed in 1933, and Anastasio Somoza García, a nephew of President Sacasa, commanded the U.S.-trained Nicaraguan national guard. When the Marines left, Sandino agreed to lay down arms.

- Sandino was assassinated by Somoza’s national guard in 1934. In 1936, Somoza deposed President Sacasa, and assumed the presidency on Jan. 1, 1937, controlling Nicaragua for 20 years.

- Hours after being nominated for re-election in 1956, Somoza was fatally shot. Luis Somoza Debayle succeeded his father, and power was passed to his brother, Anastasio Somoza Debayle.

- Cuban Premier Fidel Castro—probably because Somoza assisted in the U.S.-planned Bay of Pigs invasion of Cuba—helped launch the Sandinista National Liberation Front in Nicaragua in 1961.

- Pedro J. Chamorro, publisher of La Prensa, was assassinated in 1978. Public outrage swelled against Somoza. Chamorro’s widow, Violeta, became publisher of the paper.

- In July 1979, Somoza fled to Miami. President Jimmy Carter warned Somoza he would be extradited to Nicaragua. Somoza fled to Paraguay, where he was murdered in 1980.

- A coalition junta, which included Violeta Chamorro, was formed, but she and many other members resigned when it became apparent that the Sandinistas were using it as a front to gain control of the country.

- In 1981, the contras, organized with U.S. support, initiated a civil war against the Sandinista government.

- On Feb. 25, 1990, Violeta Chamorro defeated Sandinista President Daniel Ortega and was elected to a six-year term.

José J. Berrios, a 1976 architecture graduate, is a native of Nicaragua who resides in Atlanta. Berrios owns an Atlanta-based construction management service.
Chamorro's objectives of reconciliation, economic recovery and democracy. The government has abolished the military draft, ended the country's 10-year civil war, convinced the Contras to demobilize, and reduced the Sandinista army from more than 90,000 to 21,000.

Chamorro's government has paid the country's $360 million past-due debt to the InterAmerican Development Bank, World Bank and International Monetary Fund, and has been reinstated as a member of the international financial community, which means it can obtain critical long-term loans necessary for revamping the nation's economy.

"This is a country run by engineers," says Lacayo. "We are professionals—engineers and economists—and most of us have never been involved in politics before. We are doing this for Nicaragua. We believe this country has to be rebuilt. We have to make democracy work in Nicaragua—democracy, free enterprise and social justice."

Half of Lacayo's 12-member cabinet either have their doctoral degrees or are candidates to receive their doctorates. Lacayo also has a master's in management from MIT.

Georgia Tech graduates serving in high-level government positions include: Dayton M. Caldera, a 1976 industrial engineer, president of CORNAP, the government agency that is managing and selling many of the large state enterprises created by the Sandinistas; Ernesto Leal, vice minister of foreign affairs, who received his master's degree in civil engineering in 1969; Benjamin Lugo, a 1975 industrial engineer who works directly under Lacayo and is charged with rebuilding Nicaragua's infrastructure; and Alfonso Ortega, an advisor to the Ministry of Economics, who received his master's degree in industrial management in 1976 and is a Fulbright scholar and PhD candidate in economics at New York State University.
"When you are running a country, you have to be damned precise."

The big advantage of engineering is that it teaches you to be precise," Lacayo says. "When you are running a country, you have to be damned precise.

"We tend to be very exacting in what we are doing because we know the country has limited foreign assistance and the task of reconstruction is massive. We cannot afford to waste any resource.

"We inherited the largest per-capita foreign debt in the world," Lacayo emphasizes. "We began with close to an $11 billion foreign debt. We would have to invest almost 30 years of exports just to pay the debt. We are renegotiating this with a lot of countries. At the same time, we have to stabilize the economy, we have to achieve peace, we have to reduce the size of the army. It's quite different from what an engineer does when he's working on one project. Here you work on 20 projects at the same time, all of them very risky, very major."

At the end of its first year, the government curbed hyper-inflation that soared to 50 percent per month in 1990.

"We have eliminated deepening inflation—the worst taxes you can have on the shoulders of the people," Lacayo says. "We have been seven months without a single devaluation and the currency is firm.

"The task we have ahead is to create jobs," he adds. "We have too many unemployed. We have a lot of people who were shooting each other a year or two ago. Now they need a job. We're talking about tens of thousands of former Contras, former officers in the army, former soldiers. And we are talking about tens of thousands of refugees who have come back from Honduras and Costa Rica. They've come back, but they don't have anything."

"Antonio Lacayo is a very capable person," says alumnus Benjamin Lugo. Before joining the government, Lugo had never had a boss, operating his own furniture manufacturing company in Nicaragua, establishing a city of contrasting scenes: a militaristic statue and one of several picturesque lagoons that surround Managua.
"After 60 years of dictatorship, democracy will never be lost again."

Lacayo has displayed surprising savvy in his ability to deal with the Sandinistas, who present the most serious threat to the success of the fledgling democracy. It was at his urging that Chamorro allowed Gen. Humberto Ortega, Daniel Ortega's younger brother, to continue as commander of the Sandinista army—now serving as the national army.

Lacayo says Humberto Ortega has helped stabilize the transition of power from the Sandinistas to the new government.

“Humberto, as head of the army, understood from the minute they lost the election that there was no alternative other than to accept the results,” Lacayo says. “I think he understood that the change of government was a good thing for Nicaragua.

“The Sandinistas had become prisoners of their own mistakes. Even though some of them understood that they had to change, they didn’t know how. It would not have been an easy task for them to change even if they had won the election.

“I have found Humberto Ortega, up to a point, an ally in building new rules of the game here in Nicaragua—which doesn’t mean that everybody in the Sandinista party agrees. In fact, his brother, Daniel, who is head of the party and the former president, doesn’t see it that way. He has a different point of view on several things, which makes it difficult for us to move faster.”

Lacayo is concerned, but not dismayed, that some Contras are rearming. He estimates that only 2 percent of the Contras are involved.

“They don’t want to fight the government; they know the government is not the source of their problem,” Lacayo emphasizes. “What is interesting is that the great majority of the Contras are now producing rice and beans, and trying to make a living. We have radical Sandinistas on one hand, and we have radical right-wing people on the other, which makes it difficult. But we have to move. That’s the mandate we have. We have to solve the problems of this country. We have to create a new Nicaragua. We are going to do it.”

Alumnus Alfonso Ortega (no relation to Daniel Ortega), advisor to the Ministry of Economics, sees economic recovery as a major challenge. “We are working on a long-term, very tough agenda—control the government’s budget deficit, reduce government expenses, improve the tax base and tax revenues, control imports and promote exports,” Ortega says matter-of-factly.

Before the Sandinistas came into power, Nicaragua was the breadbasket of Central America; its annual exports totalled $800 million. “The main exports have been coffee, bananas, sugar, cotton and meat,” Ortega says. “We need to rehabilitate the coffee and banana plantations and develop roads and get produce to market. We must also induce the private sector to produce and export non-traditional products. This government has to achieve economic recovery—to improve the growth rate of the economy.”

President Chamorro’s office is an elevator ride and a winding corridor away from the prime minister’s office. The wall behind her desk—covered with awards, plaques, and memorabilia—is dominated by a large black and white map of Nicaragua.
A white photograph of her late husband. Annoyed at the inevitable and frequent comparisons to Philippines President Corazon Aquino, another widow of a martyr, that circulated immediately after her election, she told *Time*, “I would rather be thought of as a Latin Margaret Thatcher.”

Chamorro is gracious and, speaking English, explains that she takes English lessons twice a week. In a meeting that includes Lacayo and alumnus Dayton Caldera, she stresses that she hopes schools like Tech will benefit Nicaraguan students.

“Nicaragua needs college scholarships,” Chamorro continues in English, and then asking Caldera to translate, resumes her appeal in Spanish. “In this era of national reconciliation between the resistance and the Sandinistas, I would like for Nicaraguan students to be able to go to universities such as Georgia Tech so they could return to Nicaragua with new hopes, new ideas and a new outlook.

“I am proud and delighted that many university graduates who were outside Nicaragua, left better-paying jobs to return home and work for democracy,” she adds. “Many of these graduates are from Georgia Tech.”

“The work the government is doing—whether by the president, ministers, vice ministers—is not for us, but for the people of Nicaragua. After 60 years of dictatorship, we have had one-and-a-half years of democracy. That democracy will never be lost again.

“The world is changing everywhere—socialist countries are turning to democracy. We are trying to implement democracy and economic recovery. It is very difficult.”

---

**DAYTON M. CALDERA**

*Champion of Free Enterprise*

During the heyday of the Sandinista government, Caldera was a champion of the free enterprise system. Now, as president of the government organization known as CORNAF, he manages the mammoth state-owned enterprises created under the former Marxist regime—with a major difference. CORNAF is selling many of the companies and returning them to private ownership.

“Because of their ideology, the Sandinistas promoted a central planned economy—like the communist countries—trying to have the state run as many things as possible,” Caldera says. “They confiscated a lot of property. Some confiscations were compensated, some were not.”

CORNAP manages 351 large companies, but within those companies are what he calls “independent productive units.” For example, within one of the enterprises created by the Sandinistas is a “company” made up of 15 farms that formerly belonged to private owners—some of which, he says, were unjustly confiscated. There are more than 700 productive centers that CORNAF is returning to private ownership.

“The purpose of CORNAF is to manage these companies and engage in a privatization process as quickly as possible,” Caldera states. “This government promotes free-market and private enterprise, and gets away from involvement in those areas where the individual can do better than the government.”

The privatization process has three objectives, Caldera explains:

- sell state-owned enterprises to help fund the national budget;
- reactivate the economy through private enterprise; and
- diversify the property so that more people become owners.

---

Tech graduate Dayton Caldera is working to return enterprises nationalized under the Sandinista regime back to private ownership.

Following are profiles of several alumni helping rebuild Nicaragua.
Problems abound, however. Thousands of peasants were given land titles by the Sandinistas, and many Sandinista leaders, including President Ortega, took possession of fine homes in the capital of Managua. Property owners, impatient to have their land returned, are frustrated by the slow process.

Opposition to privatization also comes from Sandinista labor unions. "For the past 10 years, the Sandinistas have been telling the labor unions that the state-owned enterprises belong to them—to the workers of those plants," Caldera states. "Of course, they never had any real possession. Now this government tells them they are going to privatize the plants, that they are going to have a real owner—a private individual. They claim they do not oppose privatization—they want the plants for themselves."

In some circumstances it may be feasible for the workers to own the factory, Caldera says. But factories will not be subsidized by the government. "We have closed some factories because they were not efficient."

After receiving his bachelor's degree from Tech in 1976, Caldera returned to Nicaragua where he became plant engineer of a plant owned by Nicaragua's Bank of America. In 1979, Caldera resumed studies at Georgia Tech, earning his master of science degree in 1981. He returned to Nicaragua to become general manager of a contracting firm founded by his father. Caldera became director of the Chamber of Industry in Nicaragua, a long-time association of private companies, and it was there that he met Lacayo.

"I was very dedicated to the promotion of private enterprise and protested against any regulations that would kill private enterprise initiatives in the economy of our country," Caldera says.

After Chamorro's election, Lacayo invited Caldera to become a coordinator of the transitional government. He served as vice minister of economy and development before being appointed president of CORNAP.

"I feel proud to be a part of our government," Caldera states. "It means hope for everybody in Nicaragua. They see in this government the possibility of a new Nicaragua—not a Nicaragua in the days of Somoza, nor a Nicaragua in the days of the Sandinistas—but a new Nicaragua in democracy. It is something this government is strongly promoting and enforcing—once and for all, a democratic system for our country."

**ERNESTO LEAL**

**Healing the Nation’s Wounds**

Leal bears the scars of Nicaragua's violent past. Now he is playing a role in a government he hopes will heal the wounds of his compatriots.

Living in exile in Costa Rica, Leal was 9 years old when his father was arrested in 1954 because of opposition to the regime of Nicaragua dictator Anastasio Somoza. Eight days later, his father was killed.

Leal's family returned to Nicaragua in 1959, although they remained opposed to the Somoza dictatorship.

After receiving his master's degree in civil engineering from Georgia Tech in 1969, Leal returned to Nicaragua and founded a company that manufactured construction materials. The 1978 slaying of newspaper publisher and crusader Pedro Chamorro...
thrust the nation into political furor, and Leal joined other businessmen in demanding a change in government.

In 1980, the year after Somoza fled, Leal became a member of the coalition junta. But he resigned with Violeta Chamorro, protesting the government's Marxist leanings and the growing size of the Sandinista army.

Within a few years, Leal relocated his family to Costa Rica, and started business anew. But when Chamorro decided to run for president, he returned to Nicaragua to support her election campaign.

"I am 46 years old, and I voted for the first time in my life on Feb. 25, 1990," Leal says, and smiles.

"Nicaraguans have been acquainted with violence for 50 years. We have had the right-wing governments of Somoza's regime—the dictatorship of the right; we have had the leftist government—the dictatorship of the Sandinistas. We, the present government, have a definite objective—to create democracy in Nicaragua," Leal adds, his words laden with conviction.

"This is the first time in Nicaragua's history when the Congress is really independent of the executive power, and the judicial system is independent of the other two powers.

"We are working toward reconciliation of our society.

"We cannot continue with war. We have to live in peace. The only way to live in peace is with reconciliation. Nicaraguans have to forget the past. We have to look to the future."

BENJAMIN LUGO

Rebuilding the Economy

I think Nicaragua is the poorest country in Latin America," says Lugo, whose responsibility is rebuilding the country's infrastructure. "We have the highest per-capita foreign debt in the world. But we are a rich country; we are just impoverished."

Lugo is working with the United Nations to restructure the government. He anticipates a return to prosperity. "One of the characteristics of a socialist government is to make huge bureaucratic states. We're modernizing and restructuring the whole government apparatus. The UN is helping us with technical advisors."

After graduating in industrial engineering in 1975, he returned to Nicaragua to start a furniture-manufacturing firm. But his outspoken criticism of the Somoza dictatorship kept him constantly in hot water.

"We used to criticize Somoza's national guard," he says passionately. "They would use loans from the national bank to build houses that would be worth half-a-million dollars—in a country like this! When there are people who don't have enough to eat and you build a house like that, you are stealing food from people. You could build hospitals, you could provide basic nutrition. But they didn't care. That was very immoral."

He left Nicaragua in 1978 to found a furniture-manufacturing firm in Guatemala, but after Somoza fled Nicaragua, Lugo returned.

"In 1979, when the revolution toppled Somoza's dictatorship, 95 percent of Nicaraguans thought that was the ideal solution," Lugo recalls. "That is what all of us wanted."

But, he says, the Sandinistas betrayed the country.

"They became corrupt themselves," he says.

In 1982, his company was confiscated by the Sandinistas and he lost everything he owned.
"There is nothing worse than an ignorant person in uniform."

Lugo returned to the plant he had founded in Guatemala, and from there went to the U.S. He and a friend started a firm manufacturing brooms and mops in Miami, and a few years later they began manufacturing brooms and mops in Honduras. "We export $9-$10 million dollars a year in brooms and mops to the States," Lugo says. "We supply a couple of manufacturing companies, but our major market is supermarkets and chemical companies."

Lugo says reconciliation is imperative:

"Even though the Sandinistas betrayed our ideals, even though they tried to get us into a 100-percent-state-owned economy and make it a Cuban-style state, even though they behaved like old Somoza people and liked to live in those big houses, even though they took our belongings—even though all of that happened, we have an obligation to our future generations to reconcile—to say: Okay, from now on let's look at tomorrow and see what we can do. Because if we don't, there may be another war—a never-ending war."

GUILLERMO A. QUANT
What Lasts Is Knowledge

Businessman Quant was arrested by the Sandinistas in 1986 on suspicion of working for the CIA. Almost three years later, it took West German Chancellor Helmut Kohl to get him out of jail.

Quant, who owned a trucking business and a mechanical engineering firm, was serving as vice president of the Chamber of Commerce and president of the American-Nica-
everything should be returned to me. Part of the bureaucracy of government is the promise, and you have to have patience."

Quant, who did the mechanical engineering design both for both Managua airport and the National Theater, says all the Sandinistas could take of his mechanical engineering consulting firm was his drawing board. "The rest is knowledge."

The Sandinistas will continue in their efforts to regain power, Quant says. "But it is publicly known that they did so many wrong things. And usually they didn't think; they just acted impulsively. The problem is none of them has worked before."

The Sandinista army, he says, was "military because of their uniform, not their training. There is nothing worse than an ignorant person in uniform."

Quant is discouraged that the Chamorro government has not been more responsive in resolving his dilemma. "The government could be stronger in its policy," he says. "The government hasn't yet earned the confidence of the people. Honor, confidence and trust are earned. They cannot be imposed."

**ERIC AHLERS**

**Survival Strategy**

I hope Fidel Castro's Cuba goes down the drain," says Ahlers, co-owner and manager of his family's cosmetics firm. "That would help us—really help to ensure a good future for Nicaragua. It is my personal feeling that the good times are starting for Central America."

Ahlers, a 1974 industrial engineering graduate, saw his business fortunes dwindle from $6 million annually before the Sandinista government took power to less than $200,000 annually.

The business, founded by his father, formerly made cosmetic products for U.S. companies such as Dial Corp. and British concerns such as J.B. Williams, makers of Aqua Velva.

Under the Sandinistas, an embargo ended the manufacture of U.S. brands. "We worked with raw materials from East European countries and with Cuban packaging materials. We manufactured local brands to survive—very poor quality, but we did survive," recalls Ahlers. "Our main goal was to keep the infrastructure operating."

Ahlers says the firm was placed under the operation of a general manager, and he and his family relocated in Costa Rica. "I could have stayed; I could have made a lot of money. But I would have had to enlist with the Sandinistas, so I left."

He started a successful business in heavy-duty machinery. "My ISyE degree gave me enough knowledge of technology to adapt myself," Ahlers says. "I had a partner. We were very successful."

Ahlers returned to Nicaragua to vote for Violeta Chamorro. "We won that day, so I decided the door was open to Nicaragua—there was no other way but to come back."

Democracy is slowly taking hold in Nicaragua, he says.

"I would like a stronger government," he adds. "But this is democracy. We have to go soft, even though we would like to run, instead of walk, toward democracy."

"I see things over the long run. If you see things for the short run in this situation, you might get desperate. You have to see 10 or 15 years from now. You see things that bother you now, but not the war. When the Sandinistas were in power, they would win a battle on some things politically or economically, but not the war."

"Democracy is going to win the war."

"We would like to run, instead of walk, toward democracy."

Even in a nation ripped by civil war—or, perhaps especially in a nation convulsed by war—there is still time for sports and for love.
Buzz Back To Campus This Weekend!

Special Georgia Tech Alumni Rates
From $69* per night, not per person
Including Breakfast For Two

Enjoy your next Yellow Jacket reunion in style at the Sheraton Colony Square Hotel. Located just blocks from the Georgia Tech campus, this brand-new Sheraton features all of the fine amenities you have come to expect from a luxury hotel, including:

• 461 elegantly-appointed guest rooms
• Outstanding dining and lounge alternatives
• Refreshing outdoor pool, with athletic club, jogging trails and tennis nearby
• Ideal location in the heart of Atlanta's entertainment district and adjacent to Colony Square Mall

*Single or double occupancy; subject to availability. Taxes and gratuities are not included. Free full American breakfast for two adults per room per day each Fri., Sat. or Sun. morning, including meal tax.

Don’t let this offer fly by! Call (800) 422-2527 or (800) 422-7895 (outside GA)

Sheraton Colony Square Hotel
Midtown Atlanta
Peachtree at 14th Street • Atlanta, GA 30361
(404) 892-6000

ITT Sheraton. The Natural Choice.
The Official Georgia Tech Alumni Signet Ring

Available in either solid 10 karat or 14 karat gold, in both men's and ladies' styles.
Featuring a richly detailed re-creation of the Georgia Institute of Technology Seal in striking bas-relief.
Convenient interest-free monthly installment plan.

For faster service, credit card orders may be placed weekdays from 9 a.m. to 9 p.m. and weekends from 9 a.m. to 5 p.m. (eastern time).
Telephone toll-free 1-800-523-0124 and request Operator 461JM.

---

Personal Reservation Form

Mail Orders to: Operator No. 461JM

GEORGIA TECH ALUMNI ASSOCIATION
P.O. Box 670
Exton, PA 19341-0670

Please accept my order for the following Official Georgia Tech Alumni Signet Ring(s):

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Quantity</th>
<th>Size(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ladies' 10K Gold Signet Ring (GET-SRL10)</td>
<td>$250 ea.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ladies' 14K Gold Signet Ring (GET-SRL14)</td>
<td>$295 ea.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Men's 10K Gold Signet Ring (GET-SRM10)</td>
<td>$325 ea.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Men's 14K Gold Signet Ring (GET-SRM14)</td>
<td>$395 ea.</td>
<td></td>
</tr>
</tbody>
</table>

*Plus $7.50 handling and insured shipping charge per ring. On shipments to Pennsylvania, add 6% state sales tax to total of order.

PLEASE PROVIDE YOUR DESIRED PERSONALIZED INSCRIPTION TO APPEAR INSIDE THE GOLD BAND. (NOTE THAT THE INSCRIPTION MUST BE LIMITED TO NO MORE THAN 20 TOTAL CHARACTERS INCLUDING SPACES). PLEASE PRINT CLEARLY. INSCRIPTION TO READ:

________________________________________________________________________

Purchaser's Name

Street Address

City State Zip

Daytime Phone

If 'ship to' address is different from above please attach correct address to order form. Please allow 6 to 8 weeks for delivery.

RING SIZER INSTRUCTIONS
1. Cut out paper sizer.
2. Open slot A.
3. Roll into a circle with numbers on the outside. Insert the end of tab B into slot A.
4. Place onto finger and pull tab through slot until the paper is snug on your finger.
5. Read finger size on scale.

---

I prefer to pay as follows:

☐ ENCLOSED IS MY INITIAL INSTALLMENT — $25.00 for each ladies' 10k gold ring, $29.50 for each ladies' 14k gold ring, $32.50 for each men's 10k gold ring, or $39.50 for each men's 14k gold ring — payable by check or credit card (information provided below). I agree to pay the balance due in 9 equal monthly installments.** Please include shipping and handling charge of $7.50 per ring with initial installment. (On shipments to Pennsylvania only, please also add 6% state sales tax on the total of your order with your deposit.)

☐ IN FULL BY CHECK. Enclosed please find my check or money order for the full amount due, made payable to "Official Georgia Tech Ring".

☐ IN FULL BY CREDIT CARD. Following shipment of my ring(s), please charge the full amount due to my credit card as indicated below.

Credit Card Information: ☐ VISA ☐ MasterCard

Full Account Number: ________________________ Expiration Date: ______/____

SIGNATURE

"All orders are subject to acceptance. There is no finance charge on the payment plan. The amount of payments (total sales price) is equal to the single payment price. If purchaser fails to pay any portion of the total payments scheduled, the entire balance shall become immediately due at the election of the ring distributor, Wayeco Enterprises. See Ring Sizer Instructions in lower left of order form."
Kary Mullis is an untamed genius, a free spirit with a hyperactive mind and a curiosity that quickly leads him to distraction.

Despite these attributes, or perhaps because of them, Mullis—a 1964 chemistry graduate of Georgia Tech—invented one of today's hottest techniques in biotechnology: the polymerase chain reaction (PCR). In recognition of this achievement, Mullis was named R&D Magazine's 1991 Scientist of the Year.

From a single sequence of DNA, PCR can reproduce the sequence in huge quantities much more cheaply and faster than other techniques. The process works exponentially, yielding a two-fold amplification of genetic material for each cycle of use. Producing 100 billion similar molecules in one afternoon is no problem with PCR, which has no size limitations. "It can make DNA in vats if you want," Mullis says.

PCR can be used to find toxic genes in bacteria and to help police track murderers and rapists. The technique also plays a role in genetic research and is helping scientists study viruses and cancer.

The idea for PCR came to Mullis in 1983 while he was driving his Honda Civic on a moonlit mountain road in Northern California. "I do my best thinking while driving," he says. "Driving puts me where I can't be distracted—I can't get up and do something else, which is my tendency if I'm stationary for very long."

That night Mullis knew he was onto something significant. "It was difficult for me to sleep with deoxyribonuclear bombs exploding in my brain," he later wrote.

Mullis developed the process while working for Cetus Corp., Emeryville, Calif. Cetus fended off a legal challenge by DuPont Co., which claimed PCR had been described almost 20 years ago in papers by MIT Professor H.G. Khorana.

"When I searched the literature to see if there was anything remotely resembling PCR, I found nothing," Mullis said. "The U.S. Patent Office did a search too, and they didn't find anything. I knew that if somebody had invented it, I would have heard about it. The technique is not the kind of thing anybody would hide because it's so eminently useful."

Today Mullis works as a consultant, free to jump from project to project, which is the way he thinks, quickly jumping from one idea to the next. Ideas come so fast that they often collide, forcing Mullis to interrupt himself when he is speaking.

And he constantly fidgets. "I really don't like the idea of Monday through Friday being work week," he says, bending an arm behind his back. "I like to come and go."

The 46-year-old scientist has married and divorced three times, which has been good for science, because he feels more creative when he's romantically involved. "The juices that flow when I'm in a romantic relationship sometimes really cause things to go on in my life," he says. He has three children, not counting those he fathered as a donor to an artificial insemination program.

"Kary is eccentric, very excitable, and exciting to work with," says Fred Faloona, Mullis's friend and technician while PCR was being developed. "He has a real knack for solving complex problems."

"He's a very young person at heart. He relates to everyone very well. They think he's nuts in some ways, but they really love his energy and openness."

When Mullis is not working in his car, he works in clients' labs, or in his La Jolla, Calif., apartment, which overlooks the ocean. The entrance is guarded by a jungle of potted plants and toy dinosaurs.

He has planned for a while to set up a lab on his 30 acres of land in Mendocino County, where he's building a house. But there's just too much other work, too many ideas racing through his head. "It's been a project forever," he says of the property he bought in 1975. So far he's managed to build some ponds and stock them with...
fish. He also installed his own windmill invention, that drags a piece of metal across a pipe, making an unpleasant noise that keeps gophers and moles from digging in the ground.

But Mullis always had an itch for science, even as a young boy growing up with three brothers in Columbia, S.C. At an early age he started playing with electricity. "I shut down power in the house quite often," he says.

Says his mother, Bernice Frederick, "He was a very active little boy. He was mixing things all the time. When he was 3, he beat up eggs into a paint and painted the house yellow. Frequently I found jars of bugs and worms that he had collected. I thought he was wild. He was into everything. I realize now that his brain was overactive."

His first serious invention was a fuel for toy rockets developed when he was 17. It was made by heating potassium nitrate and sugar. "We had some mishaps, but no one got hurt," Mullis says. "One time about a pound of fuel went off at once. It made a huge flame, scared the hell out of my mother, and filled the neighborhood with smoke. Fortunately, it smelled sweet."

Mullis used his fuel and a four-foot rocket to send a frog a mile and a half into space. Incidentally, the frog was recovered alive.

In high school, Mullis was vice president of the student council, a National Merit Scholar, president of the Forensic Club, a member of the German Club, and a writer of published poetry and essays. But he always knew his career would be in science. "I never really thought of any other possibilities," he says.

After earning his Tech degree, Mullis received a doctorate in biochemistry from the University of California, Berkeley, where he studied from 1966 to 1972.

In 1968, Nature published one of Mullis's papers, "The Cosmological Significance of Time Reversal," in which he suggested that exactly half the universe is hidden inside black holes that consist of antimatter running backward in time.

After spending several years doing post-doctorate work, Mullis joined Cetus, where he developed PCR. From 1986 to 1988 he was director of molecular biology at Xytronix Inc. in San Diego, where he developed an ultraviolet sensitive plastic that changes color in response to sunlight. He started working as a consultant in 1987.

His continued success as a consultant seems guaranteed, as new uses for PCR multiply.

For one company, Specialty Laboratories, Santa Monica, Calif., he's developing a method to rapidly remove DNA from blood in order to screen the blood for various viruses. PCR is an excellent way to find out which viruses are present in organs destined for transplant, Mullis says, though researchers are still trying to find out at which levels the viruses are dangerous. Inoculation may help transplant patients avoid problems in the future.

One issue this work raises, Mullis points out, is how much people want to know about their own futures. "If we can tell you all kinds of diseases that you're going to be susceptible to and can draw that out in more and more agonizing detail, and we can say what strengths and weaknesses you're going to have, down to whether or not you'll be a chronic liar, do you want to have that written on your birth certificate?"

"Right now I wouldn't want to know all that about myself because in my culture and upbringing, it's been assumed that I wouldn't know it. Perhaps 500 years from now, it may not seem as scary to us."

Mullis is starting a company that will use PCR to make DNA from famous people to sell as relics. "If we could get a sample of Elvis Presley's DNA for use as a drug, Mullis says. "You could try to wipe out specific organisms by targeting their genes, by inhibiting biological processes by hitting them with DNA."

The method is also a quick way to find out if a fetus has sickle-cell anemia, and could be used to diagnose other genetic diseases.

PCR is ideally suited to detect cancer, Mullis says. "We're gathering the data now on cancer, which could help us look for early warnings in the future. Researchers are working so one day we can isolate cells and say, 'These are the earliest forms of this type of cancer. This is a definite indication that you need therapy.' We need to find the mechanism to look six months into the future."
hair, we could make his DNA," Mullis says. "I know that would sell. Of course, we'd have to get permission, and we're going to try to do it in a respectful kind of way."

He's also developing a new technique "that could dwarf PCR in terms of applications," he says. It's an analytical system involving scanning probe microscopy that will identify the concentration of hundreds of compounds in a blood sample.

"I want to make a dedicated instrument for $2,000 for that purpose," Mullis says. "Then I can say, 'Company A, do you want it or do you want to die? Company B? Who wants it? Whoever gets it wins all of clinical chemistry.'"

Mullis has many projects under way but has a hard time finishing them. Once he starts a project, he's often tempted to stop and do something else. "I'm not attached to the act of doing things," he says. "In fact, I much prefer to not do anything. It's a lot more fun to lay out on my pond and watch my fish and drink sangria. I don't like to do things that are hard. That's the important part of being an inventor—trying to figure out an easy way to do something."

Mullis has broad interests. He enjoys writing and has published some fiction. "I really would like to write more," he says. "I've got a lot of stories in my head."

Photography is another hobby. Sometimes he generates fractal patterns on his computer and projects them as slides onto friends posing for the camera.

Mullis also plays the keyboards. "Recently I started exploring the potential of playing my Casio keyboards with the frogs," he says. "Those keyboards make froglike noises. Sometimes I get the feeling that, by God, these frogs are gradually accepting the fact that I can honk like them, and they respond in some way. I don't think I fool many into thinking I'm one of them, but I'm getting to know them more."

Now Mullis is looking for "time and space" to put down on paper a lot of the ideas that have been colliding in his head.

"I really want to take a slower pace and transfer my life up to Mendocino," he says. "Eventually that place will overlap with my life completely. Then I'll escape from the world and maybe I'll write."

If only there weren't so many distractions. •

John Morkes is associate editor of R&D Magazine


GEORGIA TECH • Mullis: Untamed Genius 31
The Quest for Quality

Under Tech alumnus Thomas Malone, Milliken has made quality more than a buzzword—it's a way of life

By Gary Goettling

When Milliken & Co. won the Malcolm Baldrige National Quality Award in 1989, it was more than a moral triumph for a textiles giant at the forefront of a very troubled industry.

The award was also a personal victory for Georgia Tech alumnus Thomas J. Malone, president and chief operating officer, who had staked the company's fortunes—and perhaps his own—on making fundamental changes in Milliken's corporate culture.

In the early '80s, Malone and Chairman Roger Milliken could foresee that competitive pressures on a global scale would seriously undercut Milliken's leadership role in the industry if more effective ways of managing people and products were not found.

For answers, the two men looked to Japan, where concepts relating to the improvement and management of quality had been refined over the past 40 years. Working with a cadre of experts, including Dr. W. Edwards Deming, who is credited with having

Continued next page

Tom Malone (left) and company Chairman Roger Milliken discuss the future of American textiles.

Continued next page
brought the concept of quality improvement to Japan shortly after World War II, a quality improvement process was devised for Milliken & Co. that not only changed what is done, but more importantly, changed how things are done.

Milliken’s stated goal is to provide the best quality products, customer response and service in the world. It is a deceptively simple, almost self-evident objective, but at Milliken, it has become institutionalized to a degree unheard-of in most American companies. And to leaders like Tom Malone, it is all-encompassing—an obsession. The quest for quality improvement “literally drives everything we do,” he says. Malone has another saying, one that is found everywhere at company headquarters emblazoned on walls, tacked on bulletin boards, and dot-matrixed on computer-generated banners: “Good is the enemy of best, and best is the enemy of better.”

Tom Peters, author of In Search of Excellence and A Passion for Excellence, has called Milliken one of the best-managed companies in America. There is plenty of credit to be shared for such an approbation, from Chairman Milliken to the loading-dock workers, but the person who breathes life into the quality process each day with relentless energy and enthusiasm is Tom Malone.

Thomas Joseph Malone received a bachelor’s degree in chemical engineering from Tech in 1963, and a doctorate, also in chemical engineering, in 1966. As a student, the Mississippi native received National Merit, Ethyl Corp., and Procter & Gamble fellowships, and memberships in Tau Beta Pi and Sigma Xi honorary scholastic fraternities. His Ph.D. thesis received the Sigma Xi Research Award as the most outstanding in 1966.

After graduation, Malone joined Milliken as a researcher in the engineering department. He rose steadily through the ranks, and in 1983 was named to his current position.

Malone is a member of the Chief Executives’ Organization, and serves on the advisory committee for the Directorate of Engineering of the National Science Foundation, the Council on Competitiveness, and the World Business Council. He is a trustee of the Institute of Textile Technology in Charlottesville, Va., and of the Georgia Tech Research Corp. He also holds membership in a number of textile associations, chemical institutes and professional societies.

Malone and his wife, Patricia, are the parents of five children.

An ardent supporter of education, he established the Dr. Thomas Joseph Malone Scholarship Fund at Georgia Tech. In 1989, he was chairman of the National Advisory Board of Georgia Tech.

What caused you and other top officials at Milliken to take a critical look at the way you were doing business?

Milliken was a leader in our industry in 1980 in almost any way you wanted to measure. Our customer survey showed us that, and our suppliers told us that. We were pretty much the leader in every way, and were enormously committed to being a technology leader, people leader, and the results and the performance of our customers were perceived to be very, very good.

But we saw performance in Japan that was far greater than anything we’d ever seen in the world, and better than what we were doing. And despite the fact that these companies were in the same kind of manufacturing that we are, they did not have more modern equipment—in fact, they had older equipment and older technology, but were outperforming the best we’d ever seen in the world and doing better than we were doing. That’s what motivated us to take a whole new approach to quality improvement.

It led to Roger Milliken reading a book called Quality is Free by Phil Crosby, who wrote that the very best-managed companies in America spend 18 to 20 percent of their revenue in correcting things that had been done wrong. It also described a whole new approach to managing people for quality improvement.

We embraced that concept in February 1981, and launched what we call our “Pursuit of Excellence Pro-
innovation,” which is the ability to introduce a new product rapidly, economically, and with minimal problems.

So that quality improvement process which started 11 years ago has now evolved into a strategic process for the entire company—all 43-plus businesses in Milliken embrace these 3 legs: quality improvement, total customer response and extraordinary innovation.

We've been going down that road ever since. It's been an extraordinarily exciting one.

The basic concept is that you have to utilize the total people-resources in your organization effectively—a lot more effectively than we've done historically.

What was the most difficult part of starting that process?

We learned there are three obstacles to implementing a successful quality-improvement process: top management, middle management and lower management, in that order. It's very hard to get the leadership of the company to really embrace a different approach to managing the organization and changing their culture. And that is clearly the problem America's having to deal with.

The only way it can change is if the No. 1 person—the leader—embraces those new paradigms with a passion and drive. You can't do it passively. You can't say it's a great idea and I understand it and it's worthwhile—now you guys go do it. If he does that, it doesn't work. He's not only got to embrace it, he's got to be totally involved because if he isn't, the next level of management will end up abandoning pursuit of the new paradigm.

Was it your original intention to reform the management process, or was it more product-focused?

Our quality process has evolved from quality improvement, which was basically started to reduce that 18-to-20-percent cost of doing things wrong. Since then, it has evolved into another leg of the quality improvement process, and we call it total customer responsiveness.

We mean quality of responsiveness in every way—from how fast you answer the telephone to how you follow up on every opportunity. It's having the flexibility of supplying customers with what they want, when they want it, in the quantity they want, and where they want it—with good value. That's required us to develop the capability of making very short production runs, and of delivering products very fast with a terrific variety of products.

Once you have your quality process in place, that leads to your manufacturing process being far more flexible and reliable. Then you have the two basic building blocks for a third leg, called "extraordinary innovation," which is the ability to introduce a new product rapidly, economically, and with minimal problems.

So that quality improvement process which started 11 years ago has now evolved into a strategic process for the entire company—all 43-plus businesses in Milliken embrace these 3 legs: quality improvement, total customer response and extraordinary innovation.

You speak of total customer response as something relatively new, but it sounds like the old-fashioned concept that the customer is always right.

Well, it certainly embodies that, but it goes way beyond. We believe that total customer responsiveness means delighting customers, not just satisfying them. It means giving them things they never dreamed possible. You have to measure it quantitatively, qualitatively, every way that you can.

How do you objectively measure something like "satisfaction"? Isn't there a potential conflict when a company tries to evaluate itself?

There are outside companies that are experts at doing this. We've found that customers won't always tell you directly what they think, but they are very open and willing to share through a third party. We survey over 90 percent of our customers every year with outside firms. In those surveys, the customers tell what things are important to them, and the order of importance, and then they score you on how well you're doing that.

That score becomes the driving

GEORGIA TECH • Milliken's Malone 37
force behind all our efforts to delight our customers. We've been doing that now for quite a few years. We're amazed to find some areas where we thought we were doing just great, but in the eyes of the customer, we weren't doing very well at all. As a result of getting that scoreboard in place, we've made really dramatic progress in our customer-satisfaction service.

Does having a quality process mean not making mistakes?

No, it means continuously improving. Unfortunately, we may never see the day where we don't make any mistakes. But putting into place processes and systems, with the entire organization obsessed with not making mistakes and with doing things fast and reliably and doing what the customer wants, doesn't eliminate all mistakes. It's continuous improvement.

Are your quality concepts based on a Japanese way of doing things or is it an American adaptation? In other words, the Japanese also have a unique culture that has contributed to their success.

That was probably the major contributor—their willingness and effectiveness in implementing those quality concepts. Many companies in America felt like they weren't transferable to America because of our difference in culture. In our opinion, that's wrong. They are very, very transferable. But they have to be modified to fit the American culture in order to get maximum results. But not only do you have to adapt the process to the country, you also have to adapt it to your own company. The concepts themselves are uniform. Actual application and technique can vary quite a bit.

Just about every company would say that it provides a quality product or service. How does one differentiate between quality, and quality as simply a marketing buzzword?

Quality must become the strategic process—the umbrella—over your entire company. At Milliken, it drives everything we do.

The successes at other businesses are coming slowly. The bigger the company, the harder for them to do it because it is a dramatic change in culture. The difficulty in changing the culture in an organization increases exponentially with the size of the organization. Smaller organizations can move a lot faster simply because of their size and can implement these concepts rapidly.

Unfortunately, we don't have an organization like they have in Japan that has taught these quality concepts. JUSE—the Japanese Union of Scientists and Engineers—has taught these concepts to Japanese management for 40 years. It's a joint academic-industry organization with about 1,800 members that has a massive ongoing education program.

Some people in the country—including Drs. Deming and [Joseph M.] Juran, Phil Crosby and others—understand these concepts and are teaching them. There just aren't enough. And we don't have 40 years to do it. Our manufacturing base is fighting for survival right now.

Another issue is that there is a tremendous adversarial relationship between our government and industry, and a lack of cooperation between education and business. That lack of joining together, which is a way of life in Japan, has made it very, very difficult for us to move these concepts forward.

There's a tremendous effort being made to educate our government, and for government and academia and business to come together.

Companies are coming together and teaching each other in an extraordinary way, and sharing in great depth the things that we are talking about. Those of us who started in the early '80s, like Milliken and IBM and Xerox and several others, are going down unexplored roads in this country. It has been very, very slow and difficult because we had to learn a step at a time. We made lots of mistakes. A lot of things that we tried to implement didn't work very well in our culture in America.

By sharing with each other, which we've done over the last 11 years, we've learned how to overcome those problems. At Milliken, we've had over 95,000 business executives visit with us from over 9,000 companies over the last five years. It's extraordinarily powerful and, I think, unanticipated. It has gotten industries and businesses moving forward much more rapidly than they might have otherwise.

**Winning the Baldrige award in 1989 must have been, in large measure, a very satisfying affirmation of your management direction.**

It was a great recognition of our people and their accomplishments. We in America love competition, team competition in particular. What you're talking about is a team competing for the most coveted award.
we can imagine—the national quality award. Competing was tremendously stimulating, and helped us drive harder toward improvement. Fortunately, we also learned that we've only begun. The opportunity for further improvement is absolutely incredible.

We were concerned that we might think that now we are the best, we won't have to work so hard. The fact is, we recognized that the opportunity to improve was far greater than what we had already accomplished. We continue to have an internal award among plants, businesses, corporate support areas and staff areas, where they can win an internal Milliken version of the Malcolm Baldrige award. We intend to do that forever. We think it contributes to the new paradigms of quality where people are having fun while striving to continuously improve.

Is a quality improvement process transferable to an educational institution such as Georgia Tech?

Well, certainly the Tech education is a very high-quality one. Tech is fortunate enough to attract the top students in the country. But I believe the education paradigms at Tech are going to have to change just like the paradigms in business leadership are going to have to change. The new paradigm means working together as a team with a common goal of everyone winning—a supportive environment in which you attract the very best talent and you accept the challenge of everyone succeeding and being the best that they can be. It is much more powerful than just stacking up everybody and seeing who falls. I believe that [President Pat Crecine] has that vision of a far more supportive environment. I believe that it will build on the great strengths Georgia Tech built through the old paradigm.

A lot of people thought that participatory management was going to destroy business. They said it wasn't strong, tough, demanding. We found that's absolutely not the case. When you empower people and applaud them, as opposed to challenging and destroying a percentage of them, everyone becomes very excited because they have a vision of winning instead of losing. I think that will come to Georgia Tech in the coming years. It can build on its strengths of leadership, faculty and students to have a positive vision of their futures, as opposed to a negative vision. That can lead to Tech being far better in the future.

Changes in education are long-term solutions. But isn't the problem more immediate than that?

We are fighting for our survival in America as world-class organizations, whether it be universities, government or business. We can compete in America today—we don't have to wait until our education system has been overhauled, which is going to take years but which is absolutely essential.

We can compete today with American workers if the leadership of the companies and the organizations establishes a positive vision and then makes a personal commitment not only to put into place an action plan that makes that vision a reality, but to become totally involved in that plan. It's not a matter of just empowering your people. It's a matter of tapping the total people-power of the organization.

The single-most-difficult thing that American leaders are struggling with is understanding that not only have they got to lead it, they've also got to be involved in it.

The other thing is that it has to be fun. This is a very foreign idea to American leaders, business or academic. The belief is that you work hard and play hard, but never shall they mix. What we have learned at Milliken is that these quality concepts, and achieving everybody's potential day-in and day-out, can only be achieved if the people in the organization have an exciting vision of where they are going and are having fun doing it.

You embrace these concepts, or you're not going to be competitive in the world. We have to be obsessed with getting better every day, because the rest of the world is.
Healthy Portfolio

By Susan Hasty

When in 1985 John Kaweske joined Denver-based Invesco Trust Co. as manager of its year-old Financial Strategic Health Sciences Portfolio, the fund was about $2 million. By October 31, 1991, he had built it to $718 million, accruing the best track record of any of the more than 4,500 mutual funds on the market.

In the past five years, Financial Health has returned 320.3 percent to investors, and during the past three years while the economy has slid into recession, Kaweske's fund returned 248.2 percent. His outstanding performance has not gone unnoticed.

Most of that growth, over $700 million, had taken place since 1988, when the fund was still small ($10 million) but already posting impressive returns.

"When you're number one, everyone wants to be a part of that," acknowledges the 50-year-old portfolio manager and 1966 industrial management graduate.

Kaweske recently hired an associate, but remains firmly in control of Financial Health and Financial Industrial Income, a $1.3 billion growth and income fund, which has remained in the top 10 percent of stock funds, posting gains of 117.3 percent and 82.9 percent for the five- and three-year periods, respectively.

Of course, running a sector fund in the burgeoning health-care industry contributes to his record. Kaweske concentrates his holdings in pharmaceuticals, biotechnology, hospital supplies, medical technology and health-care delivery. But the secret to his success was something he learned at Georgia Tech while an undergraduate.

"The key to staying on top is the research, doing your homework," he says. "What was invaluable to me at Tech was the breadth of the education. Certainly in any of the Tech curriculums you take the basic engineering..."
If you want a bank that gets things done, welcome to Personal Banking. Welcome to Wachovia.
An aging population promises to provide continued opportunities
courses, and they provide a good technical foundation for understanding
how science was developed and is developing. That kind of understanding is
essential for the research we do, especially when dealing with newer medical
technologies.”

Kaweske went on to get a master’s in business administration from the
University of Wyoming in 1968, and he feels that any Tech grad aspiring to a
securities analyst career should also augment his education with an
advanced business degree. But as always, experience shapes the opportunities,
and Kaweske’s early experience was as a research analyst.

His first job was with Fidelity in Boston, which he joined on April Fool’s
Day, 1968. He spent three years with Fidelity researching oil and gas firms,
and the pulp and paper industry. He left Fidelity in 1972 to become a securities
analyst for Aetna Life and Casualty in the transportation arena, analyzing
airlines, railroads, trucking companies.

In 1980, he joined IDS in Minneapolis, where he was again an analyst in the
oil and gas industry, as well as doing some work in hotels, restaurants and
telephone utilities. It was while he was with IDS that he got his first taste of
fund managing, when he was given responsibility for part of one of IDS’s
larger funds.

And it was as a fund manager in 1985 that he came to Invesco Trust Co.,
a wholly owned subsidiary of Atlanta-based Invesco MIM Inc., which with $21
billion under management is the largest money manager in the Southeast and
the 15th largest in the nation. Invesco MIM is headed by another Tech
graduate, Charles William Brady, IM ’57.

To stay abreast of his industry and up with the latest developments in
medicine, Kaweske attends courses at the University of Colorado (“along with
other 22-year-olds”). He’s currently enrolled in a course on immunology,
the science that is breaking new ground in cancer and AIDS research.

Kaweske encourages Tech undergrads to consider careers in his profession despite recent shake-outs and scandals in the
securities industries.

“Scandals are endemic in every part of our society—politics, religion, business,” he says. “They’re pervasive and they’ve always been here and always will be. But that shouldn’t discourage someone from coming into this profession.”

“I had one instructor at Tech, Roderick O’Conner,” he continues. “He taught a management philosophy course, a very inspiring course that had a big impact on me. He said that the most important trait you’ll have to go forward with in the business world is integrity. I still very much believe in that.”

Kaweske won’t be relying on integrity alone to stay on top with the Financial Health fund, although historically, some other top-rated funds that grew as quickly have become cumbersome to handle.

While he admits that might be true in other sectors, the health-care market is so huge that his fund is in no danger of outgrowing it.

“The health-care industry had revenues of over $700 billion last year. That’s 12 percent of the gross national product and it’s predicted to be 14-15 percent by the year 2000,” Kaweske asserts.

With the graying of America and new developments in biotechnology and health-care distribution, he sees ample opportunity for his fund to continue to grow and stay up front. The only difference for his is that it now “requires more research input to keep us where we are.”

Susan Hasty is a free-lance writer in Atlanta.
When Aleksander Szlam entered Georgia Tech in 1969, he was a Polish immigrant who hadn't finished high school and knew very little English. Five years later, he received his bachelor's degree in electrical engineering, followed by his master's degree in electrical engineering in 1980.

When Szlam went to work for Solid State Systems Inc., a Kennesaw, Ga., firm, he didn't know the principles of telephone communications. Less than a year later, he invented an auto dialing and receiving system called PhoneFrame that has revolutionized the phone industry.

This year, Inc. magazine named Szlam entrepreneur of the year for the Alabama-Georgia-Tennessee region. His company, Melita International, is worth $60 million—three times that amount, many analysts say, if its stock was sold on the open market.

Szlam built the company without bank loans; it has remained debt-free since it began in 1979.

With his parents, Szlam immigrated to the United States from Poland in 1969. At the time, Poland was in political unrest; Jews, pointedly blamed by the government for internal problems, were encouraged to leave. The Szlams left behind all their possessions, and for seven months waited in Rome while the Hebrew Immigrant Aid Society sought sponsors for them. When they arrived in Atlanta, Polish-speaking Jewish volunteers greeted them; the Atlanta Jewish community helped them start over, providing housing, food and clothes.

One of the family's new friends, Clara Rubenstein, brought Szlam to Georgia Tech and pleaded his case with the director of admissions. "I still don't know what she said," he admits. But the opportunity changed Szlam from a swaggering 18-year-old interested mainly in "girls and music," into a serious, eager student. "Always my hand is up," he says. "I have question after question." He smiles. "Sometimes I think I am the stupidest person in school."

Today, Szlam works long hours, often spending early evening with his family—wife, Halina; daughter, Julie; son, David—then continuing to work when they're asleep. He spends much time on the road, handling difficulties and meeting customer needs himself. "The customer is first," he says. "If there's a problem, I won't send someone else to take care of it."

And as good as Szlam believes his PhoneFrame...
Szlam is, he insists it can be better. The system allows companies to manage large volumes of calls, and is especially valuable to those involved with bill collection and telephone sales. If an operator puts through a call and the line is busy, the system automatically re-dials until the call can be completed.

Szlam believes PhoneFrame elements can be scaled down, made to operate more efficiently, and fit into a more convenient package. He hopes to combine the functions of a telephone receiver, television screen, fax machine, answering machine and word processor into a mobile office. "The workstation of the future must fit in a briefcase," he says.

Szlam compares this concept to the evolution of message delivery—the progress from Pony Express, to the U.S. Mail, to Federal Express, to the fax machine. "We have gone from weeks to seconds," he explains. "But we're still not satisfied."

Szlam's awareness of the U.S. consumer's insistence on convenience came early. After Poland's austerity, the United States seemed extravagant. "At first I cannot believe there is a dry cleaners and a gas station on every corner," he says. "Why is this so?" he asked himself. "Why does this country need so many of these things?"

When Szlam graduated from Tech and became involved in the daily aspects of electrical engineering, he pondered his earlier questions, adding a new one: What does the customer need? As Szlam learned more about the computers and telephone communications, he became convinced that a link between the two would fill a void. "That turned my life around," he says.

He began experimenting in his garage; within a few months he had created the PhoneFrame's forerunner. When he had perfected it, a friend took orders and Szlam continued to work out of his garage. His dreams, his ideas and his company grew.

He believes that by the turn of the century, Melita will be a billion-dollar corporation.

"I see only good things ahead," he says.

Phyllis Thompson is a freelance writer in Atlanta.

A special rate for Tech fans only. Weekends throughout football and basketball seasons. Afterward, relax with a drink. Or enjoy sumptuous dining in The Restaurant or The Cafe. Then settle back in a luxuriously appointed room at the heart of downtown Atlanta. For reservations, call 404-659-0400 or 800-241-3333 and ask about the Yellow Jacket Weekend. And for just $105 a night, you can stay at a legend when you cheer on...
COME BACK TO SCHOOL FOR A SONG. $59

Yellow Jackets get special savings at the Wyndham Midtown Atlanta. For just $59 on weekends and $75 weekdays* you can relive those college days. Only blocks from campus, we offer luxuriously appointed guest rooms and superb service. Popular dining and entertainment. And the state-of-the-art Midtown Athletic Club. Call now for reservations at (404) 873-4800 or 800 822-4200. As Ramblin’ Wrecks from Georgia Tech you get a helluva Wyndham deal!

*Rates are per room, per night, based on availability.

WYNDHAM MIDTOWN ATLANTA
A TRAMMELL CROW HOTEL

Peachtree & 10th Streets, N.E., Atlanta, GA 30309  (404) 873-4800
U.S. 800 822-4200  CANADA 800 631-4200
RICOH

One of the world's largest copier and facsimile manufacturers.

Acme

The South's largest copier and fax dealer.

RICOH & ACME, The SAFE Choice

"Professional sales and service since 1972"

Acme Business Products

An ALO Office Products Company

For a free demonstration contact the Acme office nearest you.
Albany, GA (912) 432-2344; Athens, GA (404) 553-0368;
Atlanta, GA (404) 279-5500; Atlanta South (404) 366-6162;
Augusta, GA (404) 863-2263; Brunswick, GA (912) 264-6675;
Columbus, GA (404) 327-5114; Dothan, AL (205) 793-0005;
Dublin, GA (912) 272-6465; Ft. Walton, FL (850) 664-2707;
Gainesville, GA (404) 531-0593; Griffin, GA (404) 227-5566;
Gulfport/Biloxi, MS (601) 865-0406; Hilton Head, SC (803) 686-2050;
Macon, GA (912) 788-7416; Marietta, GA (404) 425-2043;
Mobile, AL (205) 342-9408; Montgomery, AL (205) 271-4133;
Pensacola, FL (850) 762-3061; Pensacola, FL (904) 474-0227;
Rome, GA (404) 295-7247; Savannah, GA (912) 232-8576;
Valdosta, GA (912) 241-9401; Warner Robins, GA (912) 328-3229;
Waycross, GA (912) 283-2767
Civil War Survival

By John Toon

Cutting-edge chemical analysis techniques and a rare discovery on what is now a South Carolina golf course have given archaeologists a unique opportunity to look back 125 years at how the U.S. Army practiced medicine during the Civil War.

Scientists at Georgia Tech used gas chromatography and mass spectrometry to analyze the contents of bottles and "white-ware" jars unearthed from a field surgeon's refuse pit discovered on Hilton Head Island, S.C.

One stoppered bottle still contained a clear liquid, while salve material in one jar bore the finger imprints of its last user. Analysis of their contents confirmed some of what was already known about Civil War medicine—and provided a chilling reminder of how far medical practice has advanced since then.

Civil War doctors had a "fairly interesting group of chemicals from which to choose," says Dr. Kenneth Busch, associate professor of chemistry and biochemistry at Tech.

"But they did some nasty things to people in trying to treat them. In many cases, the soldier either healed by himself or he didn't make it."

Analysis by gas chromatography and mass spectrometry showed that the stoppered bottle contained arsenic acid, a compound containing arsenic and is best known as rat poison. The acid, says Busch, was once used by Army physicians to treat infections resulting from combat wounds, as well as common fungus infections of the skin.

"One way they could disinfect a wound was to pour acid on it," he explains. "That would eat the tissue away and remove the infection. It was not very sophisticated, but it was all they had."

Another sample showed the presence of elemental sulfur, also used as a disinfectant. Busch and research technologists David Bostwick and Sarah Shealy identified fatty acids and triglycerides from the contents of the jar, but they could not be further identified as to their origins in plants or animals. Busch believes those materials were part of salves used to treat wounds and skin conditions, much like modern skin creams.

"To his surprise, the samples did not contain narcotic drugs. Opium and morphine, Busch notes, were "overprescribed in every possible form" during the Civil War to alleviate pain and to treat a wide range of medical problems including diarrhea, the leading killer of soldiers.

"The narcotics may have disappeared over time, or because of their value, they may not have been discarded along with the more common drugs."

Other commonly used Civil War drugs contained mercury and lead—heavy metals that physicians now know are extremely toxic. Surgeons of the time did have ether and chloroform for use in anesthesia, but these volatile compounds would not have survived for 125 years even in well-stoppered containers. The physicians used hydrochloric and sulfuric acids to fight infections, applied turpentine and creosote to wounds, and relied on herbal extracts such as belladonna.

The 125-year-old medicines were found during archaeological excavation of an 1864 encampment. The 32nd U.S. Colored Infantry, composed of black soldiers recruited from the New England states, stayed at the site—known as Camp Baird—for five weeks while building an earthen fort nearby.

Atlanta consulting company Brockinton and Associates is unearthing a glimpse of Civil War medicine.

Using mass spectrometry, Sarah Shealy analyzes artifacts found at a Civil War site in South Carolina. Tech scientists' use of modern analytical techniques is unearthing a glimpse of Civil War medicine.
The dig also raises questions about the role of black soldiers

Associates did the survey work for the Greenwood Development Co., which was constructing homes and a golf course on the site.

"It looks like the regiment surgeon dumped whatever he didn't need before he left," explains archaeologist Christopher Espenshade. "All are typical forms for medicine during the Civil War."

The surgeon's refuse was found by company archaeologists after they removed the topsoil from much of the site. The company also found larger refuse pits, a line of privies, several walk-in wells, and hundreds of post holes that showed where the regiment's platform tents once stood.

"We were able to recognize company streets and the camp layout from the pattern of the post holes," Espenshade says. "They stand out very nicely against the subsoil."

In digging through the pits and privies, the company found bottles, tins, canteens, jars, buttons, beef bones and other garbage left by the soldiers during their five-week stay in the fall of 1864. But what they did not find also proved interesting.

The refuse contained few oyster shells, indicating that the residents of Camp Baird did not obtain food from the local market. That suggests the soldiers may have remained isolated from the other occupants of busy Hilton Head Island.

"The artifacts suggest that the regiment was pretty well stuck in camp," says Espenshade. "The town of Hilton Head had stores, restaurants and all kinds of supplies, but the artifacts in camp are limited in non-military items."

Espenshade doesn't know whether the isolation was due to racial reasons or simply because of pressure to complete the fort. Union commanders did not believe that black soldiers should be used in battle, so they were often consigned to manual labor. About 180,000 African-Americans—many of them escaped slaves—served in the Union Army.
The Perfect Gift For Any Tech Grad or Fan!

...and at a special savings to you!

“Dodd’s story...is more than a story of Georgia Tech. It’s a chronicle of college football, then and now.”

—The Asheville, Citizen-Times

“The book is awash with descriptions of historic games and plays, and with names that cause old Tech grads to become misty-eyed.”

—The Atlanta Journal/Constitution

“Dodd’s Luck is a long overdue book. It is both funny and angry; always magnetic, never tiresome or fawning, as sports books so often are. An enjoyable read.”

—The Florida Times

Just in time for the holidays, the Georgia Tech Alumni Association is offering this inspirational biography of Tech legend, Bobby Dodd. Written by Bobby Dodd and author Jack Wilkinson, DODD’S LUCK captures the charm of this legendary sports figure. ACT NOW, and you will can enjoy this fascinating and remarkable account of Tech football at a substantial savings. Don’t miss this opportunity to get a rare glimpse of Tech history at its most unique.

PHONE ORDERS: With MasterCard or VISA
call (404) 894-2391
MAIL ORDERS: Send your check or money order payable to The Georgia Tech Alumni Association to:
DODD’S LUCK
Georgia Tech Alumni Association
Alumni/Faculty House
Atlanta, GA 30332-0175
Please include name, address, and daytime phone with your mail order.

SPECIAL HOLIDAY PRICE

Original Offer
$16.95
(+ tax & shipping)

NOW!
$14.95
(including tax & shipping)

ORDER TODAY!
Quantities are limited
Gold from the Sea?

By Gary Goettling

Imagine a kidney patient being able to eschew painful dialysis, and instead drink a specially formulated "milkshake" that would trap the urea his or her kidneys had failed to remove, and allow it to be eliminated.

That's one of the possible applications of liquid membranes, according to an expert in the field, Dr. A.H.P. "Peter" Skelland. A member of the Tech faculty since 1979, the Birmingham, England, native is a professor in the School of Chemical Engineering. The author of three books and more than 70 papers on extraction, mass transfer and non-Newtonian phenomena, Skelland is in demand as a lecturer and consultant.

His students appreciate his talents, too. During a 10-year stint at the University of Kentucky, he was twice honored with the college-wide outstanding teacher award. In 1985, he received the Walt T. Ziegler Award for the Most Outstanding Professor in the School of Chemical Engineering from the Georgia Tech student chapter of the American Institute of Chemical Engineers.

As a scientist, Skelland is concerned with ways to remove industrial pollutants from water, and his research has focused on a technique known as a liquid membrane.

There are different types of liquid membranes, but all are designed to remove dilute amounts of a substance from a liquid, either for purposes of recovery or purification. How does a liquid membrane work? Skelland illustrates with the principles of an immobilized membrane.

"Imagine that this might be a piece of plastic for purifying some industrial wastewater containing a toxin of some sort," he explains, holding up a yellow legal pad sideways. "Over here, on one side of the plastic, let's say we have aqueous phenol, and on the other side is aqueous caustic soda." Skelland pokes at the pad with his pencil. "Suppose I punch some holes in here with a pin. The trouble then is that all components here would pass through the holes. But if now I fill those holes with globules of kerosene, then the phenol will dissolve in the kerosene, but the water won't. The phenol would diffuse and come out the other side, and react with the caustic soda." The new compound will not dissolve in kerosene, and therefore cannot go the wrong way back through the kerosene membrane.

The trick is to ensure that when substances converge at the membrane, they are directed properly to accomplish the separation process.

Of course, in the most sophisticated emulsion liquid membranes like the milkshake example, the membrane exists on a microscopic level in droplets and does not involve any support apparatus.

The potential applications of such membranes are enormous, Skelland says, and range from removing toxins from the human body to eliminating waste from industrial discharges. The process may even lend itself to recover uranium, copper, zinc and a host of other minerals from seawater.

But the key word is "potential." Although the idea has been around for about 25 years, scientists have yet to solve certain stability problems associated with the liquid-membrane process. But Skelland believes that his latest research may finally address those concerns.

"Our work is to overcome the major stumbling
Skelland’s research into liquid membranes may one day make the ocean’s mineral wealth accessible.

block that permeates the entire spectrum of liquid-membrane processes,” Skelland says. “Namely, how to render the membrane more stable without losing the high rate of permeability of this material through the membrane. If you make the membrane more viscous, stability increases, but substances travel through it much more slowly, rather like wading through molasses compared to running through water.

“There’s been something of a disillusionment in the field because of the intractable problem of stabilization of the membrane,” he adds. “And if indeed we are right in being able to overcome that, then this should revitalize interest in this technique.”

Precedent exists for use of a liquid membrane process on a commercial scale, Skelland says, citing a synthetic fiber plant in Austria, where it was used to remove zinc sulfate from wastewater.

Among the virtues of a liquid-membrane technique is that it doesn’t require as much energy to operate as do conventional processes.

“In any aqueous system, which industrial wastewater clearly is, to use distillation you have to supply the latent heat of vaporization for the water to change from a liquid form into a vapor form,” he explains. “One of the things that holds the molecules together in liquid form is hydrogen bonding, which is a peculiarity of the hydrogen atom. Commonly, water clusters together in aggregates of molecules, and you have to put in enough energy to break the bonds between the individual molecules so water can escape into vapor form. And because of that hydrogen bonding, you’ve got to put in a lot of energy, relatively speaking, to break them.”

Additionally, large amounts of water can be treated with a relatively small amount of liquid-membrane material, about a 20:1 ratio, Skelland says. And the process is rapid and over 95 percent effective, he adds.

Skelland’s professional affiliations include membership in the Royal Society of Chemistry, the Institution of Chemical Engineers, Sigma Xi and Tau Beta Pi. He is a fellow of the American Institute of Chemical Engineers and the Institute of Petroleum.

Skelland has also served on several university committees, including the University Senate, Graduate Council and the Senate Student Affairs Committee.

This summer, Skelland took his expertise to Washington, D.C., where he testified before the Science Subcommittee of the House Committee on Science, Space and Technology.

The committee members were interested in “water reclamation, both in terms of desalination of seawater and detoxification of industrial wastewater, which is produced in billions of gallons around the country all the time—around the world for that matter,” Skelland says.

His written and oral testimony focused on his research into liquid-membrane technology. But at least one member of the committee may have had more than science on his mind. “A congressman wanted to know if it could be used to recover gold from the sea,” Skelland recalls. “And it could!”
A Brief Case For Your Business.

$48^{00}$ week-days
$40^{00}$ week-ends

The plush Board Room in our Conference Center is ready to serve our Ga. Tech VIP's.

- Excellent service
- Spacious rooms, newly decorated
- 27,000 square feet of meeting space
- Confirmed rates 365 days a year
  - Week-days $48.00, single or double
  - Week-ends $40.00, single or double
- Free transportation to and from Georgia Tech and Lenox Square
- Two restaurants, two lounges, large pool and garden area

At Lanier Plaza, service is our specialty!

418 Armour Drive / I-85 North at Monroe Drive / Atlanta, Georgia 30324
(404) 873-4661 / 800-554-8444 / 800-282-8222 (in GA)
Two Big Bedrooms.

One Small Price.

Great For 2 Couples!

With today's tight travel budgets you need to save money wherever you can. But, you don't want to sacrifice quality.

So when you and an associate are traveling to Atlanta for business or if you're bringing the family to a Georgia Tech event, stay in a Summerfield Two-Bedroom Suite.

Each Two-Bedroom Suite features two private bedrooms (including separate bathrooms and TVs), joined by a large living area and fully-equipped kitchen. Best of all, you'll be very comfortable in a Summerfield Two-Bedroom Suite for considerably less than you'll pay for two rooms in a comparable hotel.

So next time, stretch the budget without feeling the pinch. At Summerfield Suites Hotel!

Summerfield Suites Hotel

1-800-833-4353

Atlanta-Buckhead / 505 Pharr Road / 404-262-7880
Atlanta-Perimeter / 760 Mt. Vernon Highway N.E. / 404-250-0110
Where Are They Now?

Last Chance!
Remaining Inventory Sale

Phone Orders: MasterCard or VISA call (404) 894-2391

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Street</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>State</td>
</tr>
<tr>
<td>Zip</td>
<td></td>
</tr>
<tr>
<td>Daytime phone</td>
<td></td>
</tr>
</tbody>
</table>

MAIL ORDERS: Send your check payable to the Georgia Tech Alumni Association and the information above to:
Directory Closeout
Georgia Tech Alumni Association
Alumni Faculty House
Atlanta, GA 30332-0175

Standard Soft Cover Edition .......... $32.95 .... $19.95
(price includes tax and shipping)

The 1990 Georgia Tech Alumni Directory
Drawing together good friends and good memories