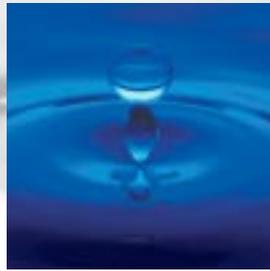
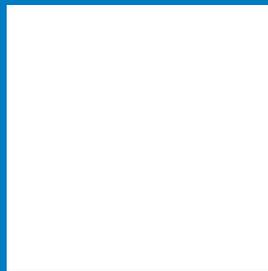


*turning knowledge into practice*





RTI International\* is an independent organization dedicated to conducting innovative, multidisciplinary research that improves the human condition. With a worldwide staff of more than 1,950 people, RTI is active in health and medicine, environmental protection, technology commercialization, education, and decision support systems. Universities in North Carolina founded RTI in 1958 as the first scientific organization in and centerpiece of the Research Triangle Park. Today, RTI serves clients in government, industry, academia, and public service throughout the United States and abroad.

*\*RTI International is a trade name of Research Triangle Institute.*

*RTI's discoveries,  
innovations, and research  
findings ripple throughout  
society to improve the  
human condition.*

*Our 2001 Annual Report  
provides highlights of how  
we're turning knowledge  
into practice, and—in the  
process—improving the  
lives of people around  
the world.*





## *president's message*

In 2001, RTI semiconductor engineer Rama Venkatasubramanian, Ph.D., made a breakthrough in thermoelectric technology, developing a new composite that is 2.4 times more efficient and 23,000 times faster than what had long been considered the theoretical limit. Also this past year, a woman-focused drug abuse and disease prevention program developed by RTI substance abuse researcher Wendee Wechsberg, Ph.D., was so successful it was exported to South Africa, where it will be used to help control the spread of AIDS. In addition, a compound invented by RTI chemist Ivy Carroll, Ph.D., as a treatment for drug addiction has been selected as a clinical candidate.

These are only three examples of RTI at its best: taking the state of the art to new heights and turning that knowledge into practice. In 2001, researchers in over 130 disciplines applied their knowledge to improve the human condition on projects for more than 150 clients. In addition, RTI researchers used their expertise to help our nation respond to the challenges of September 11. In the aftermath of the tragedies, we assembled mobile laboratories

*RTI president Victoria Franchetti Haynes (in foreground) and RTI's management team (clockwise): Elizabeth Andrews, Richard Kulka, James Gibson, John Crites, Allen Miedema, Sally Johnson, Alvin Cruze, Dale Rowe, Scott Merrell, Edo Pellizzari, Lon E. Maggart, Donald Camburn, Walter Goodlett, Jr., Ronald Johnson, Lisa Gilliland, and Dennis Naugle.*

to monitor airborne hazards, such as asbestos, in New York and Washington, D.C., and we are providing information about the prevalence of post-traumatic stress disorder following the terrorist attacks. Currently, we are helping to create early warning systems to detect outbreaks of anthrax and other diseases.

In these troubling and uncertain times, we remain financially secure. In 2001 we achieved our financial goal: to generate 10 percent annual growth in revenue and cash. With \$265 million revenue from research contracts and grants in 2001, an 11 percent increase over last year, we met our target. Also in 2001, our staff increased by 126 to 1,952 people.

As we work with our clients around the world, we remain committed to our mission: to improve the human condition. RTI's mission is our foundation as we journey toward becoming the world's premier research institute. This annual report charts our progress in 2001.

*Victoria Franchetti Haynes*

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*turning knowledge into practice  
through commercialization*

By getting the results of our research into the marketplace where they can benefit both the public and the U.S. economy, commercialization helps us achieve our mission to improve the human condition. Commercialization also has the potential to generate cash for investment in RTI research, facilities, and people—investments that will, in turn, lead to even more opportunities for our researchers to turn knowledge into practice.

To date, Ziptronix, Inc., represents the biggest stride in our drive to commercialize the results of our research. Ziptronix technology makes it possible to fuse and electrically interconnect silicon wafers to make chips that are cheaper, faster, and more powerful than existing chips. RTI used in-house funds to develop this new bonding technology, which grew out of over 10 years of basic semiconductor research funded by the U.S. Department of Defense.

In 2001 Ziptronix secured \$6.5 million in venture capital. Also during the past year, Ziptronix chips were successfully manufactured and delivered to Motorola, Xilinx, Northrup Grumman, and a fourth company for testing. The chips passed these industry tests with flying colors.

**Ziptronix chips  
pass industry tests  
with flying colors.**

**RTI Health Solutions'  
clients number over 30.**

Another venture aimed at bringing more of RTI's R&D to the marketplace is RTI Health Solutions (RTI-HS), a separate business unit created in 2000. RTI-HS was formed to grow RTI's work in health economics, outcomes research, epidemiology, psychometrics, survey research, and market research and business strategy for the pharmaceutical, medical device, and biotechnology industries. During 2001, we continued to invest in RTI-HS, which grew from a staff of 15 to more than 50. By the end of fiscal year 2001, RTI-HS's clients numbered over 30.



*Elizabeth Andrews heads RTI Health Solutions, a separate business unit created in 2000. Buddy Worrell is one of the new members of the RTI-HS team.*

*... we're turning knowledge into  
more powerful electronic chips ...*





*... we're turning knowledge into  
cleaner transportation fuels ...*

## RTI technology could help meet EPA mandate for low-sulfur fuels.

Fuel desulfurization technology is another area we have identified as a promising candidate for commercialization. RTI's desulfurization technology portfolio includes eight issued U.S. patents and several pending U.S. and foreign patents. One of our technologies, which makes it cost-effective to remove sulfur from transportation fuels, is ripe for commercialization. Low-sulfur fuels are important because sulfur contributes to noxious air pollutants and sulfur's presence in fuels reduces the effectiveness of catalytic converters. The U.S. Environmental Protection Agency has mandated that, by the middle of this decade, only low-sulfur gasoline and diesel fuel be available for transportation use. Compared to existing processes, the ultra-clean fuel process RTI is developing has lower capital costs, lower operating costs, and a higher yield of refined fuel.



*Brian Turk is the lead RTI researcher developing technologies to remove sulfur from fuels.*



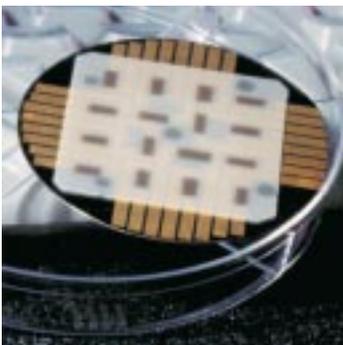
*Brian Thomas and his colleague, Luke Utley, are among those at RTI searching for promising new compounds with therapeutic effects.*

On another front, RTI's drug discovery research has continued to produce a number of promising compounds. For example, in 2001, Massachusetts-based Addiction Therapies, Inc., selected and licensed a compound discovered by RTI chemist Ivy Carroll, Ph.D., for clinical development as a therapeutic for drug addiction. Dr. Carroll continued to work on a National Institute on Drug Abuse project in 2001 to develop other promising compounds as substance abuse treatment medications. During the coming year we are investing additional funds in our drug discovery R&D.

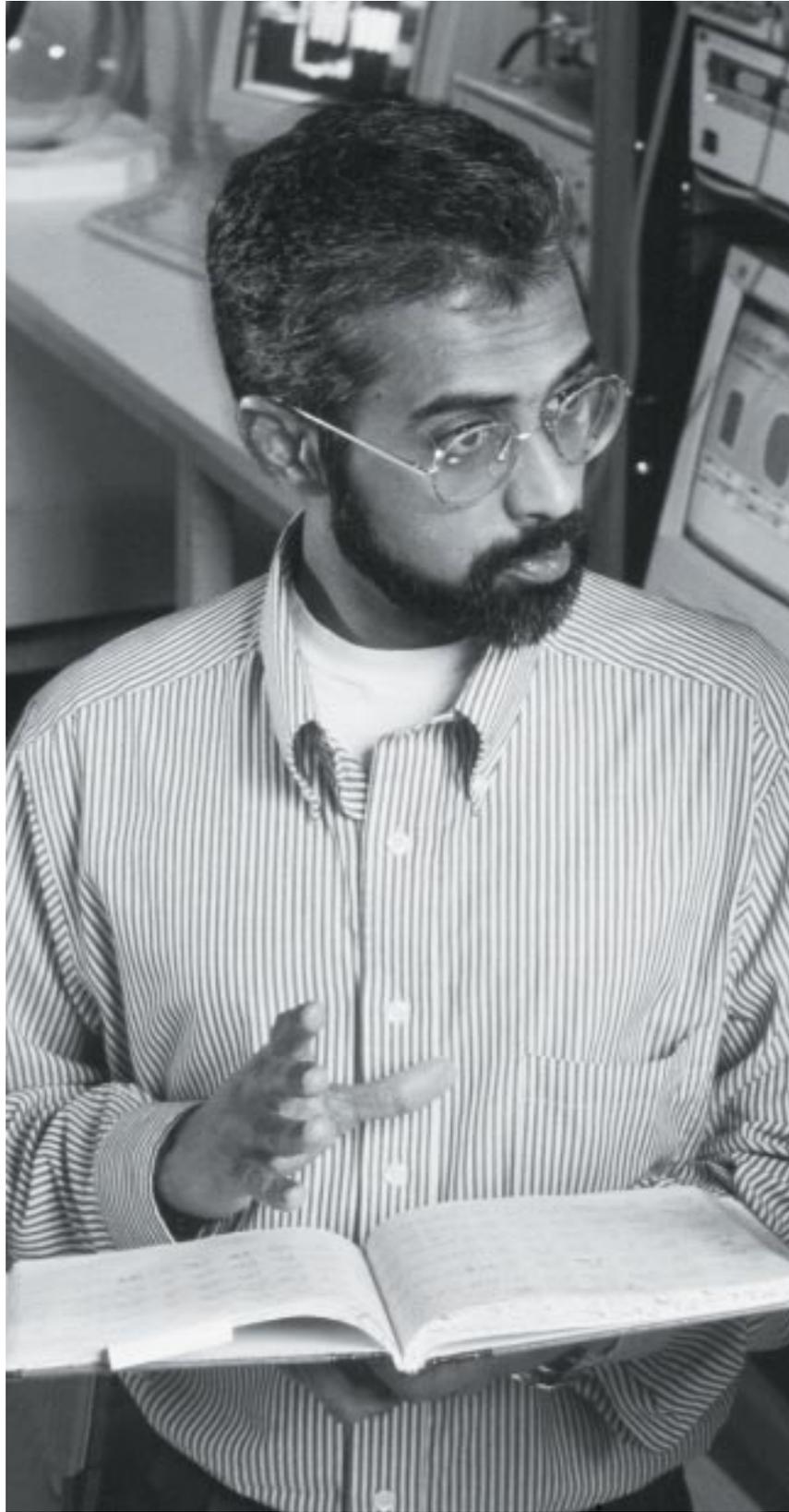
## Drug discovery research produces promising compounds.

## RTI research yields major advance in thermoelectrics.

The RTI technology that generated the most interest in 2001 was in the area of thermoelectrics. A paper published in *Nature* by RTI semiconductor researcher Rama Venkatasubramanian, Ph.D., described a major advance in a field that had stagnated for over 40 years. The new thermoelectric material he and his colleagues developed is 2.4 times more efficient and 23,000 times faster than existing materials. Devices made with this new material are very compact and can be microscopic in size. As a result, they require little in the way of natural resources—an important characteristic because these new devices could have widespread applications ranging from household refrigeration to photonic switches. The applications of RTI's new material in thermoelectric devices—solid-state heat pumps that can provide cooling, heating, precise temperature control, and conversion of heat into electricity—are numerous. The Office of Naval Research and the Defense Advanced Research Projects Agency have funded RTI's thermoelectric materials and device technology research since 1993. During the past two years, RTI has invested in further commercializing thermoelectrics technology.



*Rama Venkatasubramanian and his RTI colleagues fabricated this wafer-scale, thin-film superlattice thermoelectric material in 2001.*



### **Rama Venkatasubramanian, Ph.D.**

During graduate school in the late 1980s, one of Rama Venkatasubramanian's Ph.D. thesis advisors mentioned the lack of progress in the field of thermoelectrics. A few years after he joined RTI in 1989, Dr. Venkatasubramanian saw an advertisement for a thermoelectric cooler in *Electronic Products*. The ad, together with his advisor's comment, sparked Dr. Venkatasubramanian's interest in thermoelectrics. He called the company featured in the ad, and he learned that thermoelectric materials had not changed since the early 1960s. That was the challenge Dr. Venkatasubramanian needed. He began immersing himself in the world of thermoelectrics, reading all he could find on the subject. He discovered that no new books had been published on thermoelectrics in almost 20 years, and only a few people were doing research in the field.

At about the same time, the U.S. Department of Defense (DoD) identified thermoelectrics as a field that needed to be reexamined. In September 1992, when the U.S. Army Night Vision Laboratory released a request for proposals to conduct basic research to advance thermoelectrics, Dr. Venkatasubramanian was ready. He knew the state of the art, and he had several ideas about how thermoelectric materials could be improved. The U.S. Office of Naval Research secured funding for the program, and RTI was awarded a contract in 1994. Seeing the significant progress in superlattice materials, the Defense Advanced Research Projects Agency (DARPA) funded a major initiative in translating these early results to devices. RTI has received funding from DARPA since 1997.

By 2001, Dr. Venkatasubramanian and his team had achieved a stunning breakthrough by developing a new, thin-film thermoelectric material that is an exceptional conductor of electricity while remaining a bad thermal conductor, a combination not easily found in nature. "The potential, enabling impact of RTI's discovery is truly staggering," said Valerie Browning, Program Manager at DARPA's Defense Sciences Office. "This revolutionary development will almost certainly improve the performance and capability of many cooling and power generation systems for DoD and commercial applications."

*"The next few years should be  
an exciting time for RTI as we begin  
to identify and commercialize  
intellectual property we have developed  
during the past 44 years."*

— RTI president *Victoria Franchetti Haynes*

To increase RTI's commercialization successes, RTI formed Corporate Ventures, a virtual organization that is charged with reviewing promising RTI technologies and deciding which are ready to be commercialized. Also in 2001, we created a Venture Circle, which includes scientists from across the institute. This group's charge is to communicate the benefits of commercialization to RTI staff and to make researchers aware of the resources we have to commercialize intellectual property. The Venture Circle is also pursuing effective ways to identify and evaluate commercial ideas.

"RTI is a rich source of intellectual property that we are just beginning to tap," explained RTI president Victoria Franchetti Haynes, Ph.D. "In addition to electronics technologies and pharmaceuticals, we have environmental technologies and research methodologies that are ripe for commercial development. The next few years should be an exciting time for RTI as we begin to identify and commercialize intellectual property we have developed during the past 44 years." □

*turning knowledge into practice  
through health-related research*

Our multidisciplinary health teams combined efforts in 2001 to encourage the adoption of healthy ways of living and to develop new drugs. Our goal is longer life expectancy and improved quality of life—both in the United States and abroad. Efforts covered several areas, including global health; maternal, child, and adolescent well-being; substance abuse prevention and treatment; food safety; drug discovery research; and genomics and molecular epidemiology.

### Report details economics of TB drug development.

During 2001, RTI played a key role in the publication of an important report on the economics of tuberculosis (TB) drug development. The report addressed the global burden of TB, the market for new TB drugs, TB drug development costs, and the potential for partnerships. Developed with support from the National Institute of Allergy and Infectious Diseases and in collaboration with the Global Alliance for Tuberculosis Drug Development, the report will help industry and government agencies make informed decisions about the development of new drugs to treat TB. Dr. Gro Harlem Brundtland, Director-General of the World Health Organization, described the report as “an enormously important step in moving new R&D forward.”

*Doris Rouse heads the RTI team bringing together industry, government organizations, and international health groups to develop and commercialize new drugs for the treatment of tuberculosis. Here she collaborates with RTI colleagues Rick Satcher (right) and Jon Schmidt-Davis.*

### Study aims to prevent spread of HIV/AIDS.

Also in 2001, we moved forward with global projects devoted to preventing the spread of HIV/AIDS and other sexually transmitted diseases. To measure the effectiveness of various prevention interventions, we collected data and biological samples and analyzed them in an innovative, multifaceted study for the National Institute of Mental Health. We collected data and samples from six countries—China, India, Peru, Russia, Uganda, and Zimbabwe—using computer-assisted personal interviewing and audio computer-assisted self-interviewing. Based on the results, we will design the main trial for the study.

We also began work in 2001 on a five-year contract awarded by the National Institute of Child Health and Human Development to improve the reproductive health and lower the mortality and morbidity rates of mothers and children in seven developing countries—India, Bangladesh, Pakistan, Brazil, Guatemala, Uruguay, and Argentina.





*... we're turning knowledge into  
more efficient drug development ...*

*... we're turning knowledge into improvements  
in the child welfare system ...*



This past year, we conducted the National Survey of Child and Adolescent Well-Being (NSCAW), a congressionally mandated survey sponsored by the Department of Health and Human Services. We collaborated on this study with the University of North Carolina at Chapel Hill and San Diego Children's Hospital. The study evaluates children and families who are at risk of abuse or neglect or who come in contact with the child welfare system. The first national longitudinal study of its kind, NSCAW examines the characteristics, needs, experiences, and outcomes of these children and their parents. Preliminary results of the survey will be released in 2002.

## Reports provide information about youth smoking.

We worked closely with the American Legacy Foundation (Legacy) in 2001 on its youth smoking prevention campaign called "Truth." Legacy was formed as a result of the Master Settlement Agreement between the states and the tobacco industry to curb youth and adult smoking. We produced five research reports on youth smoking, conducted two national youth surveys, and made presentations at American Public Health Association meetings and at the National Conference on Tobacco and Health.

RTI substance abuse researchers also began an evaluation process in 2001 to determine if a woman-focused, community-based HIV/AIDS intervention approach will work effectively in different cultures. RTI participated in several focus groups in South Africa to gather and document information on the similarities and differences between South African and U.S. women's drug use and patterns of sexual behavior.



*Wendee Wechsberg developed a woman-focused drug abuse prevention program that was so successful in the U.S. it has been exported to South Africa. Here she confers with her colleague Tonya Milligan, the site supervisor of the Durham, N.C., Women's CoOp.*

Food safety was also a topic of study at RTI in 2001. RTI economists neared the end of a four-year study for the U.S. Department of Agriculture's Food Safety and Inspection Service to evaluate how well—and at what costs—a major regulation issued in 1996 has improved the safety of meat and poultry products. RTI is assessing whether the regulation is reducing hazards in foods and lowering the incidence of food-borne illness without seriously impacting businesses.

## Mushrooms analyzed for anticancer compounds.

RTI's drug discovery program continued in 2001, with RTI chemists working to identify compounds with promising anticancer activity. With a grant from the American Cancer Society, we are searching for anticancer compounds in mushrooms collected throughout North America. In the preliminary study for the grant, our researchers screened over 600 mushroom specimens and found that approximately 3 percent had the ability to kill cancer cells. Over the next four years, RTI chemists will work with these active specimens and screen a repository of over 10,000 different mushroom specimens in a quest for new chemotherapy agents.

At the end of 2001, we launched a new program—the Partnership for Genomics and Molecular Epidemiology (PGME). PGME brings together researchers from across RTI and from the larger research community to develop state-of-the-art capabilities in bioinformatics and proteomics,

to collect genetic data, and to create procedures for assessing social and economic effects of genomics. One of our first projects was to provide consulting services to the U.S. Environmental Protection Agency for microarray data analysis. We expect this new partnership to flourish in the years ahead. □



**Nicholas Oberlies, Ph.D.**

Research chemist Nicholas Oberlies, Ph.D., is returning to his roots, literally. With a doctoral degree in pharmacognosy, he is on the hunt for new cancer-fighting compounds from nature. Through a Research Scholar Grant awarded this year by the American Cancer Society, he is investigating potential anticancer compounds from mushrooms. All of these specimens have been collected from the wild throughout North America, where they have to fight for their survival. Presumably, some of the compounds these mushrooms produce to give themselves a competitive advantage may have properties that benefit humans by killing cancer cells.

Our Natural Products Laboratory (NPL) has been a pioneer in natural products chemistry since 1960. Dr. Oberlies' mushroom study is inspired by the tools and ideas used by RTI scientists Monroe Wall, Ph.D., and Mansukh Wani, Ph.D., to discover Taxol® and Camptothecin™. These two pharmaceuticals are noted as the most important discoveries in cancer chemotherapy of the 1990s. Dr. Wall and Dr. Wani now lead the NPL, where Dr. Oberlies is searching for new natural products to fight cancer. "Working with Dr. Wall and Dr. Wani, two of the greatest natural product chemists ever, on the search for new anticancer pharmaceuticals is both a learning experience and an honor," Dr. Oberlies said.

"Nature is smarter than humans," he added. "In the case of mushrooms, nature has spent thousands of years evolving chemical defenses. Often, these chemicals have complex structures that humans are unable to create on their own. As pharmacognosists, we search for unique, bioactive chemicals in nature—ones that humans haven't thought of—to improve the human condition."

*Taxol®*, a word coined by Dr. Monroe Wall of RTI, is a trademark of Bristol-Myers Squibb Company. *Camptothecin™* is a trademark of RTI.

*turning knowledge into practice  
with education and training*

Virtual reality and other technologies are proving to be valuable training tools. In 2001, RTI researchers worked to advance the state of the art of these new teaching aids.

For example, RTI's Virtual Standardized Patient program allows medical students and novice physicians to practice conversations with patients, including how to take patient histories and how to communicate better with children. Based on how the student responds, a virtual patient displays a range of emotions, such as fear, confusion, or trust. Polite and relevant responses, telling the truth, using the patient's correct name, and choosing words the patient can understand are among the many factors that determine how the virtual patient will react.

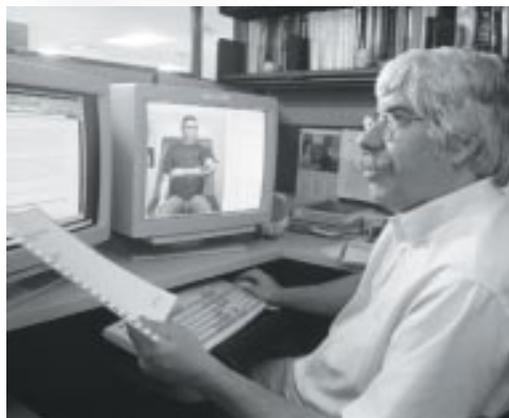
In another program, called VirtualEMS™, emergency medical personnel treat simulated trauma patients, such as people who have been in a car crash or experienced domestic violence. Students maneuver within a three-dimensional environment and assess the patient's injuries and internal trauma. Medical symptoms are accompanied by life-like physiological behaviors. With assistance from the U.S. Department of Defense and U.S. Department of Health and

**VirtualEMS™ includes  
several trauma  
simulations.**

**JUST-TALK used  
to train law officers.**

Human Services, RTI is collaborating with the University of North Carolina School of Public Health to develop training scenarios for chemical accidents and bioterrorist attacks.

RTI's JUST-TALK uses the same virtual human technology as Virtual Standardized Patient and VirtualEMS. Like health care professionals, law enforcement personnel often face challenging situations that require careful and effective people skills. RTI's JUST-TALK helps law officers practice interviewing mentally ill people and negotiating with them more successfully. Many other law enforcement



*Paul Kizakevich has led the RTI effort to develop human simulation technologies for health, medicine, and terrorism preparedness.*

applications are being explored, including training airport security screeners and preparing soldiers to deal with refugees during a military conflict.

With the help of a \$2.1 million grant from the National Science Foundation, we will work during the coming year to learn more about how best to use responsive virtual human technology for interaction skills training.

## Technology provides tool for individuals with disabilities.

Technology can also provide a valuable tool for individuals with disabilities. For the National Institute on Disability and Rehabilitation Research (NIDRR), RTI is studying our nation's infrastructure for delivering assistive technology devices and services to individuals with disabilities. NIDRR will use the study's findings to determine how to improve the availability and use of technology among individuals with disabilities.

In 2002 we will continue to explore ways technology can be used in training and education. We have assembled a team of engineers, education researchers, and others to determine how we can apply RTI's unique mix of research disciplines to advance the field of education and training. □



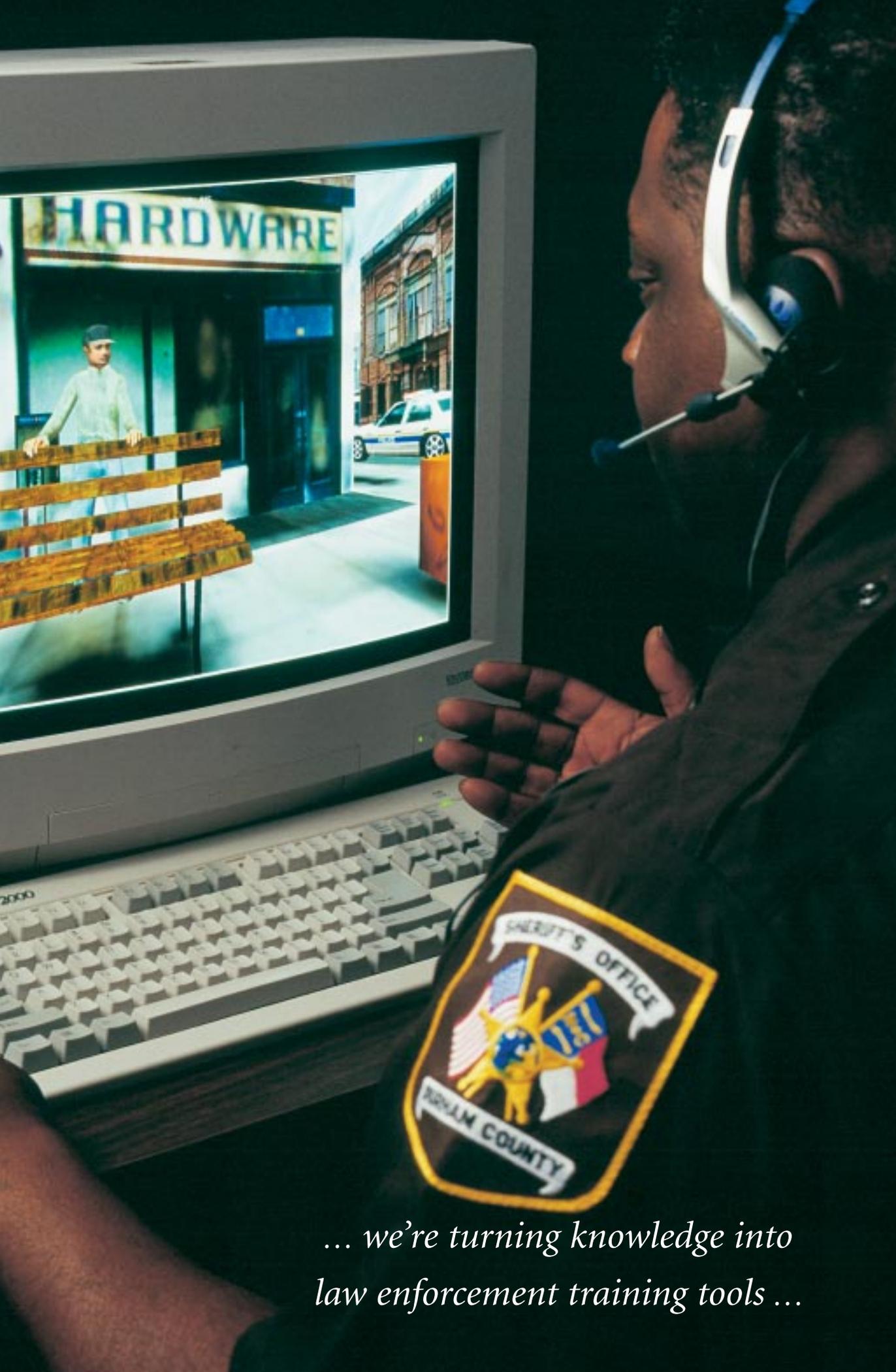
### **Robert Hubal, Ph.D.**

“I went back to get my master’s degree in computer science at NC State University because I knew I wanted to develop computer-based instruction applications,” explained Robert Hubal, Ph.D. “I soon realized, though, that to be effective in this career, I’d need to understand not just how computers work but also how people learn.”

That realization led him to get his Ph.D. in cognitive psychology at Duke University, a degree he now puts to use at RTI developing training applications using responsive virtual humans. While other members of RTI’s virtual human design team perform the critical tasks of building virtual worlds and characters and developing the natural language programs that allow a student to interact with virtual humans, Dr. Hubal focuses on behavioral modeling. He makes sure that, as the interaction progresses, the virtual characters’ cognitive and emotional states adjust appropriately. He also helps the team create realistic and appropriate facial expressions, gestures, and body movements for their virtual characters.

To get the behavioral details correct, Dr. Hubal relies on subject matter experts. For example, to develop RTI’s JUST-TALK program, Dr. Hubal and his colleagues used the input of mental health professionals and law enforcement officials to create mentally ill virtual humans who behave realistically in a number of different scenarios.

“Virtual human technology has come a long way since we began in 1998, and I credit Dale Rowe and Dr. Al Cruze with seeing the potential of what was then an emerging technology,” Dr. Hubal said. “The team is making great advancements now, and the National Science Foundation grant we just received should help us make this technology an even more effective learning tool.”



*... we're turning knowledge into  
law enforcement training tools ...*



*... we're turning knowledge into  
safer air transportation ...*

# *turning knowledge into practice through technology*

RTI researchers and engineers are developing new technologies and applying existing ones to improve the safety of the aerospace industry, to improve the functioning of industry cleanrooms, and to create portable energy sources.

## **Addressing safety concerns of commercial space travel.**

The Federal Aviation Administration (FAA) awarded RTI a \$25 million, five-year contract this past year to help address safety concerns associated with commercial space travel. RTI's Florida office, located near the Kennedy Space Center, is widely recognized as an international leader in public safety issues involving space launch sites and re-entry operations. Over many years, the office has worked with the FAA, the National Aeronautics and Space Administration (NASA), and the U.S. Air Force to enhance launch and recovery safeguards.

In another aviation safety project sponsored by NASA and the FAA, RTI is leading a team of six companies in developing a system that will allow pilots to see a three-dimensional simulation of their surroundings in darkness or bad weather. Test flights using the synthetic vision information system began in 2001, using hardware and software developed by Archangel Systems, Inc., one of the companies involved. The system uses a database of surrounding terrain and the global positioning system to display the images.

In RTI's home state of North Carolina, we are helping five community airports install highly advanced instrument landing technologies by 2005, part of the NASA-sponsored Small Aircraft Transportation System (SATS) program. The objective is to achieve more efficient use of the nation's air traffic corridors and community airports by upgrading instrument landing systems and radar surveillance needed to keep aircraft a safe distance apart. Universities, state government, airlines, and private companies are assisting in the effort, which will upgrade airports serving the North Carolina communities of Andrews-Murphy, Rocky Mount-Wilson, Edenton, Washington, and Manteo.

In 2001 we continued our work to help industries achieve state-of-the-art cleanroom standards. We helped clients identify and eliminate contaminants, and we tested materials used in clients' cleanrooms for potential contamination. RTI's clients for these efforts are in the computer, medical device, and pharmaceutical industry sectors.



*Jenni Elion folds a cleanroom coverall garment for the Helmke drum test, which measures airborne particle shedding. She and RTI colleague David Ensor are part of an Institute of Environmental Sciences working group that revised the test method to make it more repeatable within and reproducible among laboratories.*

This past year also saw the establishment of an RTI Nanotechnology Laboratory. Several RTI research units have been working successfully for years in this area, especially in the fields of thermoelectric materials and membrane materials. (See pages 8 and 9 for more about our thermoelectric research.)

In another project begun in 2001, RTI is developing miniature fuel processors that can convert liquid fuels to hydrogen fast enough to power a 20-watt proton

exchange membrane fuel cell. Both projects are being conducted for the Defense Advanced Research Projects Agency as part of an effort to develop new forms of miniaturized, portable energy sources that an individual person might use, sometimes referred to as "Palm Power."

During 2002, work will continue on all of these technologies and others that promise to improve the way we work and live. □



### **Elizabeth Hill**

In the rapidly evolving world of the Internet and telecommunications, Elizabeth Hill is among those at RTI focusing on how these systems can benefit our commercial and government clients. During 2001, she headed an interdisciplinary team that charted the most strategic ways for us to use the Internet to provide services to our clients.

"RTI has routinely used e-business approaches for procurement and similar internal needs," she said. "Now we are expanding into new uses to better support the many diverse needs of our clients." Several areas within RTI have already benefited from the addition of e-commerce and e-business techniques, and more are being implemented in 2002. The possibilities are evaluated on an ongoing basis.

For example, Ms. Hill's own area of expertise is in industrial cleanrooms, places where particles, humidity, and temperature are carefully controlled during manufacturing processes. Help for curtailing contamination through better cleanroom practices and contamination control testing will soon be available from RTI via the Internet, as one of our first e-business services.

In 2001, the strategic development team led by Ms. Hill provided a blueprint for cultivating e-business opportunities. Ideas from throughout RTI have led to testing or implementation of several promising services. For example, an assisted learning program called VirtualEMS™, which trains emergency medical personnel to treat simulated victims of trauma, is expected to become available via the Internet during 2002. Meanwhile, government and commercial clients are being surveyed to identify other e-business opportunities.

"If used to its full advantage, e-business can become an invaluable tool that will help us meet our goals more efficiently," Ms. Hill explained. "We should always look for the best and the brightest ideas, the most efficient and effective ways to perform our work."

*turning knowledge into practice  
through environmental research*

In 2001 RTI's environmental research ranged from large national studies conducted for the federal government to smaller, targeted assessments for industry. Projects spanned indoor and outdoor air, surface and ground water, and solid and hazardous waste. RTI also performed economic analyses and provided information to local, state, federal, and international environmental policy makers.

### **RTI's PM<sub>2.5</sub> analytical services grew in 2001.**

Particles with diameters of 2.5 micrometers or less, known as PM<sub>2.5</sub>, are high on our nation's list of current environmental concerns. They are also a major area of research at RTI. These small particles can penetrate into the deepest part of the lungs, and scientific studies have linked them to numerous health problems. Also, these fine particles contribute to acid rain, and they are a major cause of visibility impairment across the United States.

To learn more about their prevalence, the U.S. Environmental Protection Agency (EPA) established a monitoring network in 1997 that measures the concentration of PM<sub>2.5</sub> over a 24-hour period. Originally only PM<sub>2.5</sub> mass was measured. The measurements have since been expanded to include elemental analysis, ions, and organic and elemental carbon. RTI has developed the capability to do all

of these measurements. Every month, approximately 1,250 samples from all 50 states are shipped to RTI for analysis.

Also in 2001, with funding from EPA, RTI conducted a study to develop associations between particle exposures and adverse cardiopulmonary responses. Participants wore specially outfitted vests containing compact particle monitors designed by RTI as they performed their daily activities, while RTI field technicians monitored health metrics and recorded lifestyle information. EPA acknowledged the technical success of the study in its 2001 Report to Congress on particulate matter exposure research, which highlighted RTI's role as lead research collaborator. In a parallel study for the National Jewish Medical and Research Center in Denver, miniature versions of the RTI particle monitors were used to relate the exposures of inner-city, elementary-school-age children to the usage frequency of asthma medications.



*Deborah Franke tests products used for dust suppression and soil stabilization as part of RTI's work as an EPA Environmental Technology Verification Center.*

In another project, RTI operated one of EPA's Environmental Technology Verification Centers, of which there are currently six. The center at RTI—the Air Pollution Control Technology Verification Center—verifies the environmental performance of commercial-ready air pollution control technologies. Verification provides potential purchasers and permittees with an independent and credible assessment of what they are buying and permitting. Products tested in 2001 include baghouse filtration products and products for dust suppression and soil stabilization. Tests are planned in 2002 to verify devices to control emissions from mobile diesel engines, nitrogen oxides control systems, and bioreactors to control emissions of volatile organic compounds.

Also this past year, RTI completed the construction of a national, geospatial database of surface water features. With funding from EPA, RTI scientists merged EPA and U.S. Geological Survey databases containing information about our nation's waterways into one database: the National Hydrography Dataset (NHD). It describes the location, shape, and type of surface water features across the entire United States. The NHD has become, in short time, an essential resource for hundreds of federal, state, and local government agencies and for private industry and the public at large.

*Bill Wheaton (right) and David Chrest examine one of the printouts from the National Hydrography Dataset, which RTI helped create for EPA.*

## Visualization tools used to simplify complicated data.

RTI environmental scientists also focused on mapping and visualizing ground water resources and contamination in 2001. Using innovative visualization tools, we were able to present the results of hydrogeologic investigations in ways that made complicated data much easier for managers, regulators, and the public to understand. The data used to develop these visual presentations came from exploratory drilling and surface and borehole geophysical surveys, as well as from ground water flow and transport models. Besides work for EPA, RTI worked for a major industrial client to expand its preparedness for disaster scenarios by predicting the spread of environmental contamination that might result from a terrorist attack.



*... we're turning knowledge into  
environmental protection tools ...*





*... we're turning knowledge into revitalizing  
vacant business properties ...*

Presenting information in a way that is easy to use is also a characteristic of another RTI project. Smart Sites<sup>®</sup>, an Internet tool developed and hosted by RTI for listing or locating idle properties for development, helps businesses and developers find properties that meet their needs. Property owners pay to list their sites, and there is no cost to browsers. Smart Sites analyzes and highlights the smart growth potential of each site. It also provides information about the site's environmental status and about available redevelopment incentives. In 2001 RTI launched the beta version of Smart Sites, and Version 1.0 will be released in the spring of 2002.

## Smart Sites<sup>®</sup> promotes smart growth.

Policy makers are faced with difficult decisions about how to allocate scarce resources to the most pressing environmental problems, and in 2001, RTI economists helped inform these decisions. We developed models to estimate the benefits and costs of policy and program alternatives for environmental and natural resource protection and enhancement. We evaluated the cost-effectiveness of approaches to mitigate global climate change through biological carbon sequestration. We also determined the benefits of extending a safe and sanitary water supply to poor urban households in Kathmandu, Nepal, and we evaluated restrictions on snowmobile use in national parks.

Besides continuing to work on these projects and others in 2002, we will apply RTI's environmental monitoring, technology, and measurement expertise to bolster our homeland defense. The tragedy of September 11 has heightened awareness of the potential of the environment to transmit dangerous contaminants, as well as the importance of increased vigilance. With our expertise in various aspects of environmental modeling, RTI is well prepared to play a key role in helping our country plan its response to terrorist threats. □



### Michael Bryan

One of the researchers coordinating RTI's efforts to respond to the challenges of September 11 is environmental scientist Michael Bryan, who was named a leadership intern in RTI's engineering group on October 1, 2001. The original plan was for Mr. Bryan's internship to focus on innovative, cross-disciplinary environmental and management issues. But after September 11, things changed. Mr. Bryan is now focusing half of his time on bioterrorism.

"I'm excited about my new role because it will give me an opportunity to see the big picture at RTI, rather than just focusing on my area of expertise," Mr. Bryan said. "Also, I think the work I have been doing with brownfields redevelopment has prepared me well to help coordinate RTI's efforts to respond to the environmental challenges the threat of bioterrorism poses. Both require a multidisciplinary approach.

"RTI's environmental work spans a variety of media, including air, surface water, and ground water, and much of what we do has the potential to monitor the environment for bioterrorism," he explained. Others at RTI, including scientists involved in the public health arena, are also looking for ways to use their expertise to help our nation cope with the aftermath of September 11.

"From monitoring sensitive surface and ground water supplies to providing information about the prevalence of post-traumatic stress disorder, RTI's expertise can play a major role in making our nation more secure and better prepared to deal with the threat of terrorism," he said. "The work we do now has an added relevance."

## *turning knowledge into practice through social and economic development*

Improving access to services, developing human capital, reducing poverty, and applying information technology—these are among the ways RTI helped to improve social and economic development in the United States and abroad during 2001.

### **RTI helps governments plan and finance services.**

By helping increase access to core services—such as health care, education, water and waste systems, and other basic infrastructures—RTI contributed to sustainable and equitable growth around the world. For example, with funding from the U.S. Agency for International Development (USAID), RTI worked with more than 40 municipal governments in El Salvador to plan, finance, and implement basic municipal services programs.

Also in 2001, with support from USAID and the Asian Development Bank, we helped various central government ministries in Indonesia develop regulations to support the implementation of Indonesia's national decentralization policy. Along with the national-level policy work, we are assisting more than 30 municipal governments and community groups as they finance and plan services in their communities. In another project that aimed to improve urban service quality, RTI helped the Kathmandu, Nepal, municipal development authority improve financial management, resource mobilization, and private sector participation.

In the area of human capital, we worked in the United States and around the world to improve literacy and education levels. We focused on designing and implementing training programs and on introducing systematic education reform in a number of countries.

In South Africa—where RTI has been the leading U.S. organization helping to build the human capital base since 1990—RTI is working with USAID support in four provinces to reduce the gap in skilled people power. RTI and its South African counterparts have improved the educational situation of more than 260,000 disadvantaged pupils through additional training of nearly 7,000 teachers, 600 school principals, 1,200 members of school governing boards, and hundreds of district officials.

The Republic of Tajikistan, which gained independence from Russia in 1991, faces the daunting task of developing the skill base for its education system. Under contract with the Open Society



*Stephen Pereira (left) discusses RTI's work in El Salvador with Hiske Leegstra and David Palacios.*

*... we're turning knowledge into  
decentralization policy in Indonesia ...*



*... we're turning knowledge into improved  
prenatal health care in Africa ...*



Institute of Tajikistan and with funding from the Soros Foundation, RTI is helping the government develop the human and organizational capital necessary to collect and analyze educational data and engage stakeholders throughout the country in discussions about the state of education in Tajikistan.

In the U.S., RTI supported the efforts of the Southern Regional Education Board (SREB) as it addressed the critical shortage of public school principals. SREB is implementing a variety of field-based strategies for training teachers and other school personnel

## RTI researchers aim to improve global literacy.

to assume school leadership positions. One of these strategies is to create state leadership institutes where teams of current and aspiring principals and lead teachers complete a program comprising classroom and practical studies. Another strategy is the formation of leadership academies, and a third involves the development of flexible curricula that follow a part-time schedule similar to that of executive MBA programs. In 2002, RTI will evaluate these various approaches and help SREB make appropriate changes in program design and delivery.

RTI researchers also worked to alleviate the problem of unsafe drinking water and the ensuing morbidity and mortality, which are a particular concern for the poor, particularly in developing countries. With



*In addition to South Africa and Tajikistan, Vietnam is another country where RTI researchers, including Myles Elledge (shown here), are helping to improve the quality of education.*

funding from USAID and the U.S. Centers for Disease Control and Prevention, RTI has been leading an effort to assess national sanitation policies in Peru, Uganda, and South Africa, especially policies that affect the urban poor in large cities and families in small towns and rural communities.

Also in 2001, RTI pioneered the use of Internet technologies to develop online networks of people working on a variety of development issues, from decentralization, governance, and urban management to citizen participation, health, education, and gender issues. In Africa, for example, central and local government officials, journalists, and community and professional organizations meet on the Dialogue on Democratic Decentralization Web site, funded by USAID, to share news and events, research, case studies, and innovative practices.

In another project, RTI is working with the University of Alabama at Birmingham (UAB) to design and implement a computerized patient records system for public obstetric clinics in Lusaka, Zambia. This system

will make extensive use of Web and wireless networking technologies. The Bill & Melinda Gates Foundation is funding this project through a grant to the UAB. The University Teaching Hospital in Lusaka, 23 medical clinics, and the Zambian Ministry of

Health will be able to access the Web-based perinatal record system. RTI and the UAB hope to produce a system that is readily adaptable to other countries and that has the potential to make a huge difference in the lives of women and children around the world. □



### **Michel Welmond, Ph.D.**

Michel Welmond, Ph.D., was in Vietnam on September 11, 2001, working with that nation to improve its education system. Two days later, while visiting a school in Lang Son, the school director and teachers presented Dr. Welmond and his colleagues with a bouquet of roses to express their condolences for what had happened in the United States. “Everywhere we went people told us how sorry they were about what had happened, demonstrating a level of empathy and concern that truly left us humbled,” he said.

September 11 left Dr. Welmond even more committed to his work, because he became more pointedly aware that peace requires greater access to knowledge, which is what improving education systems is all about. “We are practitioners in the field—helping countries around the world build education systems,” Dr. Welmond explained. “At the same time, we help answer broad research questions about education management, planning, and finance.”

Before joining RTI in 1999, Dr. Welmond worked for USAID and The World Bank. He holds a Ph.D. in international comparative education from Stanford University and a master’s degree in international affairs from the Johns Hopkins School of Advanced International Studies. “I joined RTI because I had worked as a consultant on RTI projects, and I respected the integrity and professionalism of the RTI team,” Dr. Welmond said. “I liked their approach and was excited about working with them on education reform.”

Currently, RTI education researchers have a long-term presence in several countries, including South Africa, Nigeria, Guinea, and Ethiopia. Also, at present, they are providing short-term technical assistance in Georgia, Vietnam, and Tajikistan, among others. “The portfolio of countries we are working in is always changing,” Dr. Welmond noted.

But in whatever country they find themselves, Dr. Welmond and his RTI colleagues credit their sophisticated understanding of the political environments in which they work with much of their success. “When we provide technical assistance, we are careful to take the prevailing political forces and interest group agendas into account because they can have an impact on education systems,” he explained. “We work to get all of the stakeholders involved. Our goal is to create an environment that will enable schooling to take place. And in doing so, we hope to have a great impact on the lives of children around the world.”

RTI's capabilities are greatly expanded by frequent collaboration with scientists at our founding universities—Duke University in Durham, the University of North Carolina at Chapel Hill (UNC-CH), and North Carolina State University (NC State) in Raleigh. A sampling of 2001 collaborations are described below.

## UNC-CH

With the UNC-CH Kenan-Flagler Business School, we developed tools to analyze the market for Small Aircraft Transportation System (SATS) capabilities (see page 19). The key objective of the SATS program is to develop and demonstrate technologies that will enable faster, more cost-efficient air travel to more of the nation's suburban, rural, and remote communities. In 2002, as one element of the SATS program, RTI and the UNC-CH Business School will conduct, in North Carolina, the first formal analysis of the market for SATS services in the country.

In another joint effort with UNC-CH, this one with the Schools of Public Health and Medicine, we collaborated to create Internet- and personal-computer-based simulation tools to train primary care physicians and nurses to handle rare patient cases resulting from bioterrorist attacks and emerging infectious diseases. The U.S. Agency for Healthcare Research and Quality (AHRQ) funded this project. Called VirtualClinic, the new tools provide both information and practical training for clinicians. Simulations include cutaneous and inhalation anthrax, smallpox, influenza, and Rocky Mountain spotted fever.

## Duke

We worked with Duke University Medical Center and Duke Clinical Research Institute in 2001 to learn more about *Hypericum perforatum* (St. John's wort), the

extracts of which are widely used in Europe to treat depression of varying severity. RTI served as the data management and statistical analysis center for the study. Together with our Duke colleagues, we concluded a three-year study that tested the efficacy and safety of a standardized extract of St. John's wort as treatment for major depression. The study was funded by the National Center for Complementary and Alternative Medicine and the National Institute of Mental Health. Results will be published in the *Journal of the American Medical Association* in April 2002.

## NC State

With NC State, we collaborated to test polymer materials that can be used in the desulfurization of synthetic gas, which is composed mainly of H<sub>2</sub>, CO, CO<sub>2</sub>, and H<sub>2</sub>S. Of this mixture, H<sub>2</sub> is the valuable fuel product. The goal is to remove H<sub>2</sub>S and CO<sub>2</sub> by selectively permeating the larger molecules through a membrane, which leaves the smaller H<sub>2</sub> particles at high pressure, where they have the greatest economic value. NC State has been synthesizing the polymer materials, and we have been testing them for performance. The novel, low-energy membrane materials show promise as a way to provide high-pressure H<sub>2</sub> for fuel applications and to keep CO<sub>2</sub> from entering the atmosphere.

Besides the joint projects described here, we have close ties with our founding universities in other ways. Many RTI researchers have adjunct faculty appointments at Duke, UNC-CH, and NC State, and faculty members at these institutions often serve as consultants on RTI projects. In addition, representatives from these three universities constitute more than half of our Board of Governors. In the coming year, we hope to expand our collaborative efforts with our founding universities, as well as with other universities in the Triangle area.



All of the awards and accomplishments of RTI staff in 2001 would fill a book. RTI researchers produced numerous professional reports and publications on a wide variety of topics, they made presentations at meetings around the world, and they received recognition from their peers. The list below includes just a sampling of 2001 highlights.

### *Selected 2001 Accomplishments*

- Martin Backhouse** received an award for the best contributed paper at the International Society for Pharmacoeconomics and Outcomes Research Third Annual European Conference.
- Mike Baylor, Ph.D.**, was named a Fellow of the American Academy of Forensic Science.
- Shulamit Bernard, Ph.D.**, was elected a Fellow at the Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill (UNC-CH).
- Paul Biemer, Ph.D.**, published articles in the *Journal of the Royal Statistical Society* and the *Journal of Official Statistics*.
- Les Britt, Ph.D.**, and his RTI colleagues in Hampton, Virginia, **Chi Nguyen, George Switzer, and Carroll Lytle**, received the NASA Turning Goals into Reality Award for their work on the Aircraft Vortex Spacing System. **Joe White** also received a NASA Turning Goals into Reality Award for his work on the Enhanced Vision Systems program.
- Ivy Carroll, Ph.D.**, received the 2001 Charles H. Herty Medal from the Georgia Section of the American Chemical Society.
- Luis Crouch** prepared an advice memorandum on the financing of public schools for the Government of South Africa.
- Victoria Franchetti Haynes, Ph.D.**, was chosen to serve a three-year term on the National Medal of Technology Nomination Evaluation Committee. The committee reviews and evaluates all nominations for the technology medal and makes its recommendations to the Secretary of Commerce, who in turn makes recommendations to the President for final selection.
- James Hersey, Ph.D.**, was one of three winners of the President's Prize from the American Evaluation Association.
- R.K.M. Jayanty, Ph.D.**, made the keynote presentation, "Recent Advances in Measurement of Air Toxics and Particulates," at an international World Environment Day meeting held at Jawaharlal Nehru Technological University in Hyderabad, India.
- Kathleen Lohr, Ph.D.**, was elected a Senior Research Fellow at the Cecil G. Sheps Center for Health Services Research at UNC-CH.
- Josephine Mauskopf, Ph.D.**, served as co-editor of *Value in Health*.
- Brian Murray, Ph.D.**, made an invited presentation on carbon sequestration in forestry to the U.S. Senate Agricultural Committee.
- Nicholas Oberlies, Ph.D.**, was named chair of the organizing committee for the July 2003 Annual Meeting of the American Society of Pharmacognosy.
- Julie Robison** was appointed co-chair of the Town of Cary, N.C., Economic Policy Commission. She is serving a four-year term on the Cary Town Council (2001–2005).
- Lucy Savitz, Ph.D.**, was appointed to the 2001 Board of Examiners for the Malcolm Baldrige National Quality Award.
- Charles Turner, Ph.D.**, and his colleagues published one article in the *Journal of the American Medical Association* and had two more accepted for publication.
- Rochelle Tyl, Ph.D.**, was invited to make presentations on her toxicology research at more than a dozen professional and government meetings and symposia.
- Blake Wilson and Dewey Lawson, Ph.D.**, were guest speakers and guests of honor at international conferences in India and Germany that addressed cochlear implants and signal processing.
- Rama Venkatasubramanian, Ph.D.**, published an article in *Nature*.
- Ziptronix, Inc.**, was named 2001 Spin-off of the Year by North Carolina's Center for Entrepreneurial Development. Ziptronix was also honored by the North Carolina Electronics and Information Technologies Association as the 2001 Early Stage Company of the Year.

In 2001 we made great strides toward refining our infrastructure and improving our business processes. For instance, we launched a new initiative, the RTI Fellow Program, which is designed as a professionally satisfying alternative to a career in scientific management. Staff who are selected to be RTI Fellows perform a wide variety of senior-level duties, including serving on a Scientific Advisory Committee that routinely updates RTI's president on the state of our technology. We will announce our first RTI Fellows in 2002.

With the support of PeopleSoft® products, we made it faster and easier for our staff to revise personal information and verify benefits choices using a new intranet-based system we have called the Global Enterprise Management System. The automated system, which consolidates human resources, payroll, and benefits information, was the most comprehensive business process improvement undertaken in RTI history. It will replace the majority of the separate systems originally used to track employee information.

A core RTI value is integrity: we perform with the highest principles of individual and group integrity and honesty. To reinforce this critical value we enhanced our ethics program by developing a new Code of Ethics and Business Conduct, establishing a toll-free, confidential telephone line, and creating a comprehensive ethics Web site on our intranet. The new program is intended to guide our staff's business decisions and behaviors as they reflect on the institute's credibility and integrity. Each year, staff are asked to complete an acknowledgement form through the ethics Web site indicating their understanding of RTI's Code of Ethics.

Also in 2001, we grew in size by a total of 151,300 square feet. We expanded our facilities to include a five-story, 141,000-square-foot leased office building in Research Triangle Park. The innovative open architecture provides 300 of our staff with more individual work and meeting space.

In addition, we purchased a state-of-the-art call center for telephone surveys in Raleigh that occupies 10,300 square feet and provides space for over 300 staff. In close collaboration with Cisco Systems and Vista IT, we developed a facility that uses the latest in voice and data networking technology. In fact, our new call center is one of only a few in the country that is run completely on voice-over Internet protocol. The technology offers a wide range of new and potential features, including Internet-based reporting and management tools and the flexibility of establishing interviewing and tracing capabilities anywhere on our data network, including several off-site offices.



*RTI's new call center for telephone surveys, located in Raleigh, N.C., uses the latest in voice and data networking technology.*

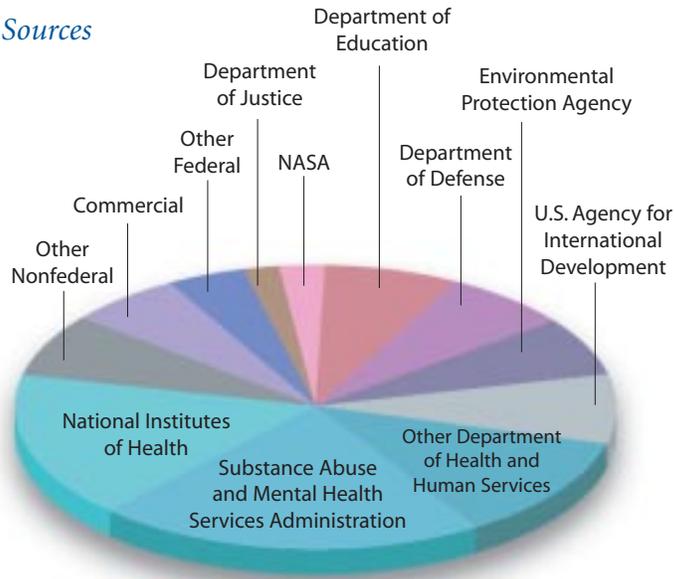
The financial statements below show the results from the fiscal years ending September 30 of 2001 and 2000.

- Revenue from research operations of \$265.0 million for fiscal year 2001 exceeded fiscal year 2000 revenue by \$25.9 million, an increase of 11 percent.
- Total Institute capital at the end of fiscal year 2001 was \$89.9 million, a one-year increase of \$4.6 million.
- Net revenue decreased due to increased internal investments in commercialization.

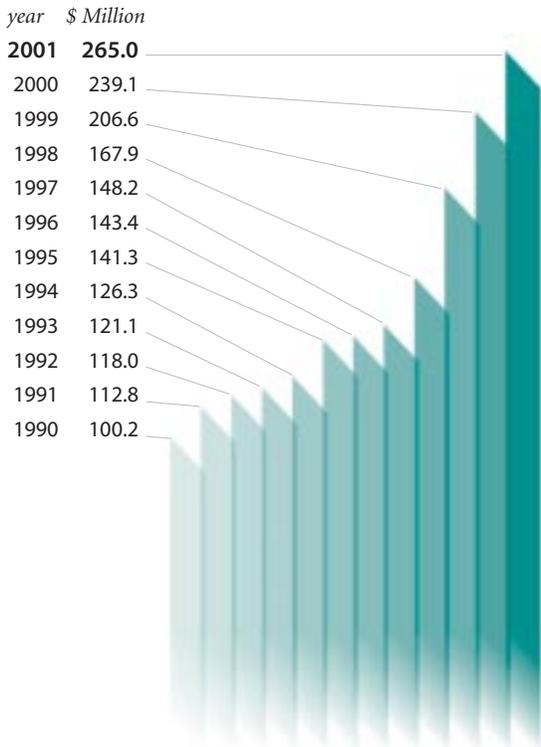
RTI also received \$273 million of new funding for research projects in fiscal year 2001, an increase of 10 percent compared with fiscal year 2000.

For the year:	2001	2000
<b>Income Statement</b> (in thousands of dollars)		
Revenue from research contracts	\$265,039	\$239,087
Direct and indirect labor	(124,001)	(111,347)
Other direct costs	(105,963)	(94,133)
Other variable costs	(16,245)	(13,027)
Fixed costs	<u>(13,644)</u>	<u>(11,234)</u>
Net revenue from operations	5,186	9,346
Other income (net of interest expense)	<u>(569)</u>	<u>628</u>
Net revenue	<u>\$4,617</u>	<u>\$9,974</u>
<b>Balance Sheet</b> (in thousands of dollars)		
<i>Assets</i>		
Current assets	\$73,688	\$62,294
Property and equipment	117,736	108,856
Accumulated depreciation	(58,409)	(53,021)
Other noncurrent assets	<u>2,661</u>	<u>2,219</u>
Total assets	<u>\$135,676</u>	<u>\$120,348</u>
<i>Liabilities and Institute Capital</i>		
Current liabilities	\$44,845	\$35,020
Long-term liabilities	<u>887</u>	<u>0</u>
Total liabilities	45,732	35,020
Contributed capital (unrestricted)	4,879	4,879
Contributed capital (restricted)	1,636	2,145
Accumulated net revenue invested in research operations	<u>83,429</u>	<u>78,304</u>
Total Institute capital	<u>89,944</u>	<u>85,328</u>
Total liabilities and Institute capital	<u>\$135,676</u>	<u>\$120,348</u>

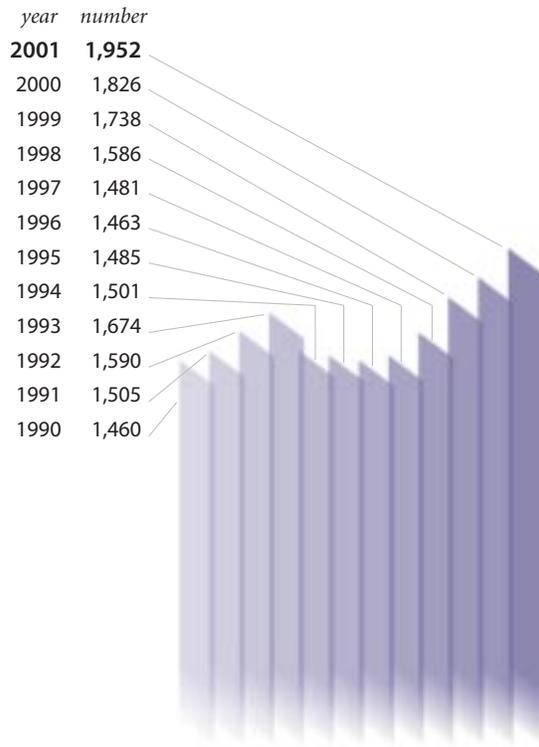
*FY 2001 Revenue Sources*



*Revenue*



*Staff*



RTI's Board of Governors consists of up to 32 governors, six of whom hold the seat by virtue of their positions: the presidents of The University of North Carolina, Duke University, and RTI, and the chancellors of North Carolina State University and the University of North Carolina at Chapel Hill; three are specified in the bylaws: William C. Friday, Marcus E. Hobbs, and William F. Little; nine are appointed annually to represent Duke University, The University of North Carolina general administration, North Carolina State University, and the University of North Carolina at Chapel Hill; and up to 15 governors are selected from the business and scientific communities.

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