

1991



COMPUTER CENTER · COMPUTER SCIENCE · RESEARCH IN STATISTICS · SURVEY RESEARCH · ELECTRONICS AND SYSTEMS

SYSTEMS ENGINEERING · SEMICONDUCTOR RESEARCH · TECHNOLOGY APPLICATIONS · BIOMEDICAL ENGINEERING

LIFE SCIENCES · ORGANIC AND MEDICINAL CHEMISTRY · LIFE SCIENCES AND TOXICOLOGY · BIOORGANIC CHEMISTRY

SCIENCES AND INTERNATIONAL DEVELOPMENT

Research Triangle Institute

POLICY STUDIES · SOCIAL RESEARCH

RESEARCH · RESEARCH IN EDUCATION



ANALYTICAL AND CHEMICAL SCIENCES

ANALYTICAL SYSTEMS · BIOMETRICS RESEARCH

ENERGY · STATISTICS · EPIDEMIOLOGIC

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SCIENCE · CHEMISTRY AND LIFE SCIENCES

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RESEARCH AND POLICY ANALYSIS · RESEARCH

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ENGINEERING · ENVIRONMENTAL MEASUREMENTS

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PHYSICAL SCIENCES · COMPUTER SCIENCE · RESEARCH IN STATISTICS · SURVEY RESEARCH · ELECTRONICS AND

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Research on environmental protection, advanced technology, social policy and public health, are some of the national scientific priorities to which RTI's technical staff responds with interdisciplinary research.

RTI was founded in 1958 as the initial scientific organization for North Carolina's Research Triangle Park.

The Institute now employs more than 1,500 people, with nationally-recognized specialists in chemistry, life sciences, environmental sciences, social sciences, statistics, engineering, electronics, and many more fields.

Under contract to governmental and industrial clients, RTI's staff conducts applied and fundamental research. In 1991, revenues in support of this research were \$112.8 million.

Research Triangle Institute

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Research Triangle Institute is 1,500 talented, energetic people who conduct applied and basic research for clients in government and industry. These scientists and engineers develop cost-effective ways to protect the environment, create new technology, identify effective policies for social goals such as improved education and reduced

drug abuse, and provide new approaches to enhance public health.



RTI's staff takes well-deserved pride in the Institute's response to society's most pressing scientific priorities. This brief report summarizes their current research activities and technical capabilities.

*F. Thomas Wooten, President
January 1992*

..... SCIENTIFIC PRIORITIES

ENVIRONMENTAL PROTECTION

To reduce indoor and outdoor environmental risks, RTI develops and applies methodologies to measure the presence of toxic pollutants, to determine human exposure and health effects, to assess risks, and to optimize strategies to mitigate risks.

Accurate measurements of

chemicals in the environment are key to developing and enforcing pollution control policies. RTI's staff is at the forefront of developing laboratory and field methods, as well as quality assurance procedures, for measurements in all outdoor and indoor environmental media.

RTI's toxicology program involves fundamental research to identify chemicals that are poten-

tially harmful. Using both *in vitro* and *in vivo* methods, RTI conducts applied research to prevent human exposure to potentially harmful chemicals, food additives, and pharmaceuticals.

To determine which pollutants pose the greatest threats to human health, scientists must determine not only that a harmful chemical is present in the environment, but also that the chemical invades the

human metabolism. This is the role of RTI's research in exposure assessment, which combines disciplines as diverse as chemistry, statistics, and biomedical engineering.

By combining the results of measurements, exposure assessment and toxicology, policy analysts at RTI provide the technical basis for governmental and industrial decisions on pollution control and prevention. RTI also analyzes economic impacts of pollution prevention options.

Focusing on some of the most important environmental issues, such as acid deposition and indoor air quality, engineers at RTI develop new cost-effective technology for environmental protection. One recent development has been a highly efficient process that removes sulfur from coal gas.

TECHNOLOGY

To develop new technology responds to only half of a pressing public need. To advance competitiveness requires applying technology to meet marketplace needs. RTI's staff conducts much govern-

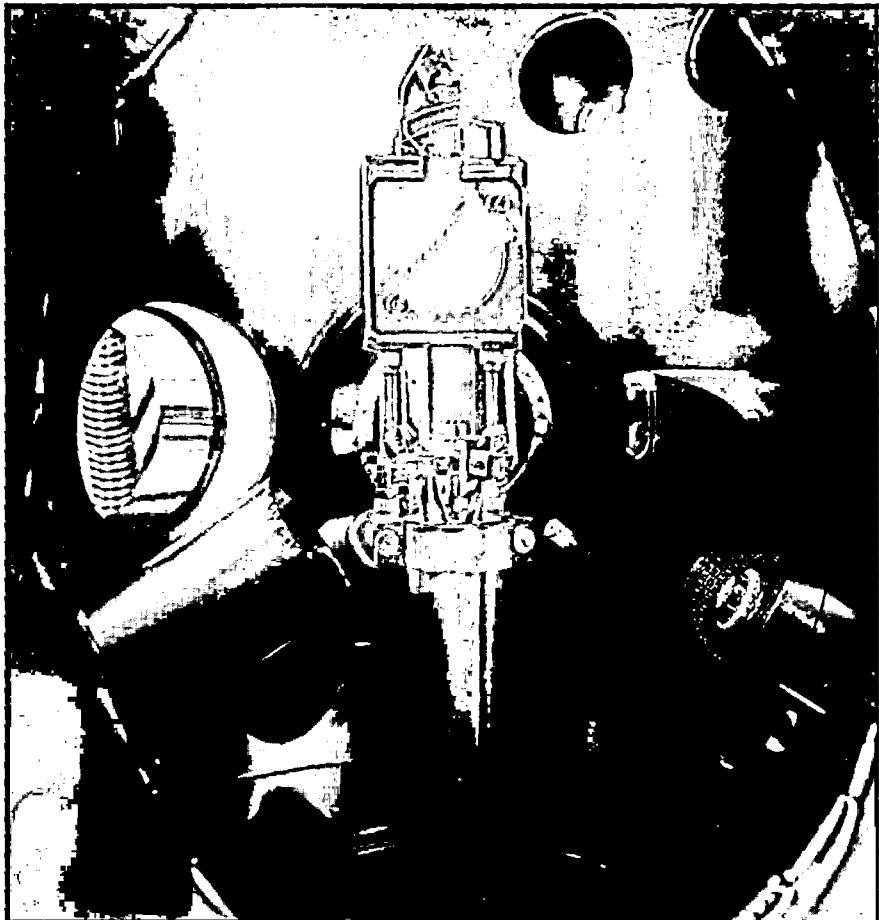
ment-sponsored applied research, but they take particular pride in their opportunities to apply technology, knowledge and experience in work for industry.

Special needs require special materials, and RTI's semiconductor engineers respond with research on materials such as gallium arsenide and synthetic diamond. They develop devices for applications such as space

photovoltaics and high-speed processing.

Electronics for aerospace, industrial and biomedical applications are of particular interest to RTI's engineers. Current research includes high-speed processors, improved efficiency for electric motors, and software for medical applications such as hearing prostheses and blood banking.

The heater stage in an analytical chamber drives off surface contamination from a semiconductor sample. The equipment is used for the chemical analysis of semiconductor materials.



To manufacture modern electronic devices requires surfaces free of even the tiniest particles of dust. Electronics companies face the further challenge of achieving this cleanliness without chlorofluorocarbons, effective industrial solvents that damage the Earth's protective ozone layer. RTI's Surface Cleaning Technology Consortium is helping the industry meet these challenges.

NASA develops much new technology and software for its aerospace activities, and works hard to transfer this technology to other uses. RTI plays a key role by identifying unmet needs in industry, seeking government-sponsored technology that might meet those needs, and assisting in the application of this technology.

RTI develops polymers that meet performance criteria such as heat resistance. The Institute also is one of the leading centers for the development and testing of degradable plastics.



Social and economic research at RTI has included studies of pharmaceutical drugs as well as clinical trials of drugs and medical procedures.

SOCIAL POLICY

Whether the goal is reduced drug abuse or increased energy conservation, the policy analyst seeks the most effective way to deploy public resources to achieve social benefits.

Through applied statistics and social science, RTI determines the extent, nature, context and causes of alcohol and drug abuse among groups and populations. RTI evaluates the costs and effectiveness of prevention, intervention and treatment programs; determines relationships between substance abuse and behaviors such as crime; and develops information systems for policy, enforcement and treatment.

Electric utilities promote load management and conservation as ways to hold down utility bills and to, in effect, partially replace construction of new power plants. Identifying the best technologies and the best means to introduce them to customers is the subject of economic, market and technical research at RTI.

By comparing and evaluating education initiatives, RTI identifies

the most effective approaches to a variety of policy issues. Current research includes assistance for children with handicaps, programs for children who face language barriers, interventions to prevent substance abuse, and comprehensive educational development in Egypt.

PUBLIC HEALTH

Public health issues include lifestyle factors that affect exposure to and progress of diseases. Also critical are access to health care, quality of care and adequate resources to cope with large-scale problems such as AIDS. RTI's staff approaches these issues with their skills in epidemiology, survey research, medical research and policy analysis.

Sponsored both by industry and the National Institutes of Health, RTI develops and evaluates new pharmaceuticals, diagnostics and medical procedures. This R&D combines disciplines including chemistry, life sciences, applied statistics, biomedical engineering and software validation.

RTI designs, implements and

evaluates interventions to prevent teenage pregnancy, prevent disease, reduce smoking and manage diabetes. Of particular interest is the role of health education to encourage changes in personal behaviors and social practices.

Research at RTI covers the full range of extended-care services. Recent projects include developing a comprehensive resident assessment system for nursing homes, analyzing the effects of regulation on the quality of care, and evaluating a home-based support service program.

Through large-scale data collection efforts, national and state-level evaluations and policy analysis, RTI examines health insurance, Medicare and Medicaid and alternative health care financing models for cost containment.

RTI researches HIV and other retroviruses via epidemiology, clinical research, seroprevalence studies, evaluations of prevention strategies, needs assessments, and integrated studies of drug abuse and disease prevention.

RTI helps developing nations meet public health goals by building effective institutions and infrastructures for water and sanitation, nutrition, health care delivery, and education.



Her writing sounds intimidating. "Reproductive Toxicity of 4-Vinyl-cyclohexene (VCH) in Mice as Evaluated by the Continuous Breeding Protocol."

But ask Dr. Patricia Fail why she does what she does and you get an answer you might not expect. "Oh, everybody is interested in sex, aren't they?"

However, despite her joking, Dr. Fail's interest is serious. "Some of our work has been with the National Toxicology Program, doing assessments of reproductive competence of mice exposed to compounds thought to be harmful.

"We also measure hormones, the biological markers of endocrine function. Twenty years ago, I developed the first radioimmunoassay (RIA) for determination of luteinizing hormone [a pituitary hormone] in horses. Now we use RIAs routinely to study endocrine problems," says Dr. Fail, manager of RTI's department of reproductive biology.

In other work, the department has focused on contraceptives, specifically compounds that interfere with sperm production.

"Endocrine challenge tests (ECTs) are one method of diagnosing problems such as infertility or finding damage done in biological systems by toxins. We use the ECT in our custom-designed endocrine experiments for drug companies.

"The work is especially gratifying when a drug that you have worked on makes it to the market and begins helping those who need it."

Develops and assesses medicinal chemicals. Performs research in synthetic and biological chemistry, metabolism and toxicology. Work includes pharmaceuticals, abused drugs, polymers and agricultural, industrial and environmental chemicals.

CENTER FOR ORGANIC AND MEDICINAL CHEMISTRY

Designs, synthesizes, and characterizes compounds with potential as medicinal and pharmaceutical agents. Prepares radioisotopically labeled compounds for pharmacological applications, including receptor binding, metabolism and distribution, immunoassay and imaging.

CENTER FOR BIOORGANIC CHEMISTRY

Conducts molecular-level studies on interactions between biological systems and chemicals such as pharmaceuticals, steroids, anti-cancer agents, environmental chemicals, pesticides, personal care products, veterinary drugs, drugs of abuse and industrial chemicals.

CHEMISTRY AND LIFE SCIENCES

Dr. Philip Abraham



After 23 years in the lab, Dr. Philip Abraham still thrills at the basics. "There is something beautiful about a crystal coming out of a solution," he says.

Though it could be said that Dr. Abraham likes chemistry for chemistry's sake, he also values another aspect of his work. "My work at RTI has been very real-life related. I have been trying to get positive results for some negative situations."

For most of the last two decades, Dr. Abraham has worked on projects aimed at increasing the body of knowledge on drugs of abuse. "Some of my work has been to prepare pure compounds for biological researchers to use in their experiments."

Most recently, Dr. Abraham's work has focused on

cocaine. "We are studying how cocaine changes some of the brain's reward processors. We've contributed a large amount of knowledge in this area during the last few years, and our hope is that the increased knowledge may help find a way for addicts to overcome their drug abuse problems."

Dr. Abraham points out that although the work may not produce immediate results in the desired area, there are occasional

bonuses in other areas. "We have discovered that some of the compounds prepared at RTI may be useful for the early detection of Parkinson's disease.

"You never know when a by-product of an experiment may turn out to have some value. It keeps the work fresh and engaging."

CENTER FOR LIFE SCIENCES AND TOXICOLOGY

Conducts research in reproductive and developmental toxicology, neurotoxicology, reproductive behavior and endocrinology, *in vivo* acute to chronic toxicology/oncogenicity, molecular, cellular and genetic toxicology, mammalian genetics/mutagenesis, molecular genetics and

expression vector cloning, and comparative/environmental toxicology. Designs and executes protocols to support development and testing of pharmaceuticals, surgical, industrial, agricultural, environmental, and consumer materials.

DEPARTMENT OF POLYMER SCIENCES

Applies broad capabilities in polymer synthesis and characterization. Addresses physical and chemical aspects of problems and applications involving polymers.

David Nuttall

David Nuttall likes a mystery. In fact, he and his colleagues in RTI's Center for Applied Analytical Systems spend much of their time trying to identify unknowns.

"For many of our projects, we want to find out what a compound is and how much is present," Mr. Nuttall says.

These processes of identification and quantitation may involve several steps. "Often we develop a new analytical method before we can begin to determine the make-up of a compound," Mr. Nuttall says.

Mr. Nuttall's clients include chemical and pharmaceutical companies as well as the National Cancer Institute and other National Institutes of Health. "For NCI we work with drugs in the preclinical and clinical phases after they have been identified as having promise as anticancer agents. We characterize physical and chemical properties of the drugs, and we develop assays for purity."

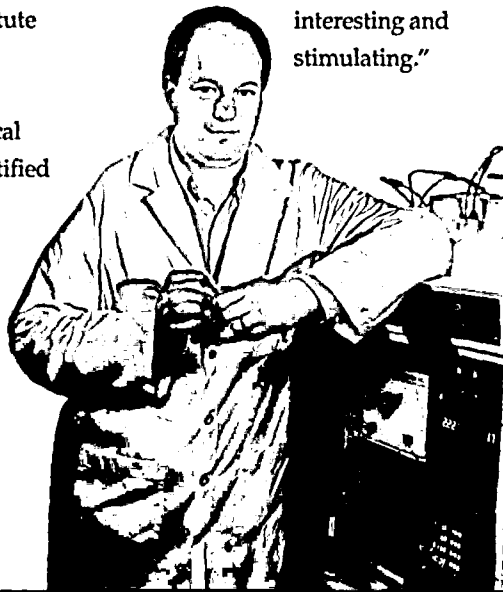
This is part of the overall development process needed to develop new cancer drugs.

Mr. Nuttall's job as chemical investigator takes him into back-

yards and living rooms. For an Environmental Protection Agency project, Mr. Nuttall has collected field samples, which were later analyzed at RTI for volatile organics. "This work demonstrated that concentrations of some compounds of interest to EPA are often higher indoors due to the more insulated homes we have today."

Mr. Nuttall has worked for clients with interests ranging from agriculture to pharmaceuticals to the environment. "One week I might be collecting air samples and then the next week analyzing soil extracts. That

variety makes things interesting and stimulating."



Develops fundamental analytical analysis techniques and applies them in research in pharmaceuticals, pesticides, toxicology, and industrial processes.

ANALYTICAL AND CHEMICAL SCIENCES

Develops and applies techniques to determine trace chemicals in biological, environmental, pharmaceutical, manufacturing, and energy-associated media.

CENTER FOR APPLIED ANALYTICAL SYSTEMS

Develops and applies techniques to separate and analyze chemical and biological components at trace and preparative levels. Major activities are in pharmaceutical sciences, environmental analyses, food analyses, bioanalytical sciences, and toxicology support.

ANALYTICAL AND CHEMICAL SCIENCES

Jeffrey Keever



The equipment occupies most of the spacious room. Yet, Jeffrey Keever and his colleagues use the hulking machines to seek tiny 'fingerprints.'

"Every molecule when ionized has a distinctive fragmentation pattern or fingerprint, by which it can be identified. The mass spectrometry equipment here has a

library of more than 85,000 known compounds, and once the mass spec has ionized an unknown, it can be compared to those known compounds," says Mr. Keever, a research mass spectroscopist.

"One part of our work includes analysis of environmental samples. For example, we perform desorption of filters from ambient air studies and evaluate samples from canisters of ambient air.

"Our work also includes studies for pharmaceutical companies, identifying both constituents of drug compounds and metabolic products of pharmaceuticals."

RTI recently completed a renovation in its Dreyfus laboratories, allowing all seven of its mass spectrometers and ancillary

equipment to be housed in one room.

"The improved facilities and our work in methods development have brought post-doctoral students and visiting scientists to RTI, and that makes for an interesting variety of research and work," Mr. Keever says.

Develops technical information, regulatory strategies, and new technologies to solve environmental problems. Works on environmental measurements, quality assurance, waste minimization and treatment, risk assessment, geosciences, aerosol and contaminant technology, and chemical engineering.

CENTER FOR ENVIRONMENTAL MEASUREMENTS AND QUALITY ASSURANCE

Develops, evaluates, and applies methods for field measurements and analysis of ambient air, indoor air, source emissions, hazardous wastes, and industrial hygiene pollutants. Provides technical assistance to develop, implement, and evaluate quality management systems, data quality objectives, QA

project and program plans, methods development and quality management systems review, technical, performance, and cost quality audits.

CENTER FOR ENVIRONMENTAL ANALYSIS

Conducts engineering and scientific analyses for government and private organizations needing a technical basis for decisions on air and

Though Bill Gutknecht is a chemist, you might find him presenting analytical data in Federal Court in support of a patent infringement case, collecting paint samples in Greensboro for preparation of reference materials or poring over freeze-dried human lungs. That's just the way he likes it.

"I came to RTI from the faculty of the Duke chemistry department, and though I miss teaching at times, I appreciate the research freedom offered at RTI. Within certain limits, I have been able to follow just about every interest for which I could get funding."

The clients that Dr. Gutknecht and his colleagues in the Center for Environmental Measurements and Quality Assurance have worked for cover quite a range—the Environmental Protection Agency; US Fish and Wildlife Service; National



Park Service; US Department of Energy; US Air Force; States of California, New Jersey and North Carolina; pharmaceutical, petroleum and furniture companies, to name a few. Dr. Gutknecht's own special technical interest is "speciation," detecting and measuring specific chemical forms of trace

elements in environmental and biological systems that have potential adverse health effects.

"There just aren't enough hours in the day to work on all the areas I'd like to pursue," Dr. Gutknecht said. "As management duties increase, I have less time to 'think' chemistry. I miss the lab and hands-on problem solving, but I get to work with people who care, and I get to see the application of good chemistry and good analytical methodology."

ENVIRONMENTAL SCIENCES AND ENGINEERING

water quality control, water resource management, and waste management. Conducts research in environmental microbiology; pollution prevention and abatement; risk analysis of pollutants; indoor air strategies; and air, water and soil regulatory impact analyses.

CENTER FOR AEROSOL TECHNOLOGY

Conducts basic and applied research in aerosol science, particularly cleanroom, indoor air quality, environmental, and defense applications. Capabilities include aerosol generation and detection, particle filtration theory, filter testing, mathematical modeling of aerosols, electrostatics, electrohydrodynamics, and enhanced filtration.

CENTER FOR PROCESS RESEARCH

Conducts fundamental chemical engineering studies and mathematical modeling of heterogeneous reactions, gas/solid equilibria, engineering processes, adsorption/reaction processes, surface science, and multicomponent fluid-solid diffusion/reaction processes.

Elizabeth Hill



Research chemical engineer Liz Hill likes to see things clean—very clean.

In fact, Ms. Hill studies clean. "In aerospace, microelectronics, optics and other industries, one particle in the wrong place can ruin a product," Ms. Hill says. Ms. Hill is laboratory manager for RTI's surface cleaning technology consortium, which pools the resources of various companies to investigate new methods for cleaning and measuring contamination.

"We are studying both how to manufacture parts in critically clean environments and also ways to change people's work habits to reduce contamination. For instance, sometimes you have to train people to walk more slowly so that particles don't get as stirred up."

Many different kinds of companies are becoming more concerned with aerosol contamination issues, Ms. Hill says.

"The Clean Air Act is mandating changes in solvent contents and cleaning practices. Chlorofluorocarbons (CFCs) are a good example of that.

"CFCs have until recently served very well as industrial solvents. They are non-toxic, inert and quick drying. But it has been established that CFCs are contributing to the destruction of ozone in the stratosphere, so production has been frozen at the 1986 levels. These solvents will be completely phased out by the year 2000.

"Many companies are trying to be good corporate citizens and quickly eliminate their use of CFCs. That's why a lot of them are coming here. We have the equipment and the expertise to do the evaluations, and we understand the urgency of keeping the line up and getting the parts clean."



On a poster above Dr. Doris Rouse's desk, an astronaut floats in space with the blue sphere of Earth in the background. Across Dr. Rouse's desk passes the research that brings space technology back to this world.

Dr. Rouse heads RTI's Technology Applications Center, the group charged with helping companies solve problems using technology produced in government laboratories. The "spinoff" project is RTI's longest-running, uninterrupted set of contracts.

One of Dr. Rouse's proudest achievements in this work was when her team of researchers found a way to keep people home by applying the knowledge that put them in space. "We were investigating the problem of wandering in Alzheimer's patients. The constant vigil that family members must maintain with Alzheimer's patients drains the caregivers and often causes their health to deteriorate. We were conducting focus groups to see where NASA technology could possibly help. The families were very grateful that we were trying to help them."

As a result of this work, a device will soon be available that will alert caregivers when a person has crossed predetermined boundaries.

"For this job, you're always talking with people who are experts in their fields. You need to stay sharp and have a healthy curiosity. Being able to investigate all these varying topics, I feel like a kid in a candy store."

D

velops and adapts electronic, software and system technologies for

space, medicine, communications and industry. Technical areas include semiconductor materials and devices, ultra-reliable high performance computer systems, computer graphics, software engineering and knowledge-based systems.

CENTER FOR SEMICONDUCTOR RESEARCH

Conducts basic and applied research on electronic materials and fabrication technologies, studies radiation hardness of electronic devices, and develops manufacturing cost/price models.

CENTER FOR DIGITAL SYSTEMS RESEARCH

Develops theoretical concepts, performs systems analysis and systems engineering, performs software engineering, conducts verification and validation, and models cost and effectiveness.

Dr. Charles Finley



"Sometimes I see patients start to cry because they can hear again, or perhaps even for the first time," says biomedical engineer Dr. Charles Finley.

For the past eight years, Dr. Finley and his colleagues in the Neuroscience Program have been at work on cochlear implants to help the profoundly deaf hear. "This kind of work has been going on for 20 years, and we are trying to improve the devices that are available. It's a team effort because our work ranges from basic research about cell activity to listening to patients' descriptions of what they are hearing with different devices. We've been working closely with clinicians at Duke University for the medical applications.

"Some patients receive little to no benefit in understand-

ing speech, but for them the implants perform an alerting function. Other patients can use the implants as an aid to lip reading, and some patients can improve their hearing tremendously."

The work in the center lately has focused on stimulus coding algorithms that simulate sound patterns. "We're trying to develop codes that allow the patients to better discriminate consonant sounds that occur in normal speech. These codes may pro-

vide additional information that is not available on the lips for lip readers.

"By understanding all the underpinnings of the event of hearing, we hope to come up with engineering solutions for biological problems."

CENTER FOR SYSTEMS ENGINEERING

Engineers aerospace and electronics systems, including definition, design, development, testing and evaluation. Experience includes simulation, feasibility studies, software/hardware development, systems integration, risk assessment, experiment definition, and field measurements.

CENTER FOR TECHNOLOGY APPLICATIONS

Conducts interdisciplinary research, design and development to apply advanced technology to industrial processes and manufacturing, medical, and rehabilitation products.

BIOMEDICAL ENGINEERING PROGRAM

Research in clinical and other human studies; development of de-

vices for physiological measurement, clinical research and sensory aids; and analysis and modeling to interpret physiological and environmental data.

NEUROSCIENCE PROGRAM

Capabilities in neurobiology, neurophysiology, electrical engineering, and speech analysis are applied to develop speech processors and auditory devices.

Benjamin Harris



Toxic waste dumps. Substance abuse. Cancer. Retroviruses. It sounds like the modern version of the Four Horsemen of the Apocalypse, but to Ben

Harris, epidemiologic and medical studies assistant director, it is a list of subjects of RTI research projects.

"Even as an undergraduate, I was interested in health-related research, and my work at RTI has allowed me to pursue that interest by studying the health crises that face the Nation. Furthermore, RTI's multidisciplinary approach to research allows the Institute to adjust its direction depending on what crises arise. That makes the work worthwhile and has allowed me to pursue diverse interests ranging from environmental health to endocrinology to AIDS." Harris' most recent research efforts have focused on the Human Immunodeficiency Virus (HIV), which is responsible for AIDS.

For one of the studies, Harris and his colleagues are collecting information on about 1,500 hemophiliacs and their female sex partners. "We are looking at issues

such as time from seroconversion to disease development, what proportion of the population develops the disease and unusual aspects, if any, in the transmission of the disease."

Harris' HIV work has also taken him to the African city of Lagos to observe the collection of blood samples from Nigerian prostitutes for a retrovirus seroprevalence study. Such epidemiological work sent Harris to Washington, DC, in 1983 to study cancer and open RTI's Washington office. "I moved to Washington with one assistant. My department currently consists of 16 in Washington, seven in Maryland and one in London."

Produces statistical information on health care, the environment, and energy management. Conducts clinical trials of medical products, epidemiologic studies of diseases, surveys on pollutants, and statistical analysis of energy use.

**CENTER FOR MEDICAL,
ENVIRONMENTAL AND
ENERGY STATISTICS**

Designs studies and analyzes data for investigations related to medicine, the environment, and energy. Capabilities include designing studies and analyzing data, experimental design, biostatistics, mathematics, computer programming, and health education.

**CENTER FOR EPIDEMIOLOGIC
AND MEDICAL STUDIES**

Coordinates and monitors multicenter clinical trials. Studies safety and efficacy of pharmaceutical products and medical devices. Performs epidemiologic studies of incidence, prevalence, distribution, and risk factors for diseases.

Dr. Vijaya Rao



"At one time, a newborn that weighed 2,500 grams wasn't thought to have much of a chance. Now, you see a lot of 15 hundred grammers survive," says research statistician Dr. Vijaya Rao. Dr. Rao is talking about the kind of clinical research he really likes—analysis of an issue with significant social importance.

"There are many questions that arise from the survival of these low-weight babies. Do they develop normally? Do they suffer handicaps? Will they become independent? The issue is complicated, but I think we do as good a job as any research institute in handling questions like that," Dr. Rao says. Being part of the multi-disciplinary team that examines such problems is what Dr. Rao enjoys. "Much of our work is multicenter clinical studies of a range of medical problems. We have biostatisticians, physicians, computer scientists, epidemiologists, biomedical engineers and a host of others participating.

"Often the only thing the public hears is a statement such as 'drug abuse is up' or 'exercise lowers blood pressure.' But there is a tremendous amount of work that goes on before such statements are made. It sounds like an easy, single statement, but there is much that comes under the umbrella that has to be sorted out."

U

ses economic, sociological, demographic, and psychological methods to assess and recommend policies for governments and companies. Studies issues such as economic development, education, health care, mental illness, homelessness, alcohol and drug abuse, public utilities, income security, and pollution prevention.

CENTER FOR SOCIAL RESEARCH AND POLICY ANALYSIS

Researches social and economic behavior of individuals, groups, and populations. Capabilities include sociology, social psychology, criminology, policy analysis, statistics, economics, public administration, political science, program evaluation, and military issues.

CENTER FOR ECONOMIC RESEARCH

Specializes in economic analysis of public and private policies. Research methods such as benefit-cost analysis, microeconomic modeling, consumer behavior modeling, production and cost modeling, econometric modeling, nonmarket valuation techniques, and sample surveys.

CENTER FOR INTERNATIONAL DEVELOPMENT

Provides research, technical assistance, and training to promote sustainable economic, technical, and social development and understanding. Delivers applied services in economics, urban and regional development, health and family planning, education, demographics, human resource development, information systems, public finance, and environmental policy. Stresses action to increase the capacity of host-country institutions to develop and implement policies for development.

Nancy Dean



A regulatory policy should be grounded with data. Policy is economist Nancy Dean's interest, and she pursues that interest by analyzing data.

"I have a double major in economics and political science with a minor in international relations. The variety of work at RTI was attractive to me and lets me help to address some of society's most pressing problems."

Ms. Dean has recently worked on a benefit analysis study of the change in Food and Drug Administration regulations of nutrition labeling. "The types of information carried on labels are being standardized, and we were looking at what impact this change would have on consumers."

Ms. Dean has also been involved with a US Department of Agriculture profile of the industry producing infant formula. "We were analyzing the impact of the rebates offered in the Women, Infants and Children (WIC) program to determine the pricing effect on non-WIC formula purchasers."

Such topics require a diverse team of researchers, and that makes for interesting work, says Ms. Dean. "The productive atmosphere, the access to so many people who are specialists in their fields, the availability of university collaboration, it adds up to an important product."

SOCIAL SCIENCES AND INTERNATIONAL DEVELOPMENT

Dr. John Paul



Dr. John Paul is working on his hands and knees. Or at least his knees. "Rates of knee replacements have been increasing dramatically in recent years due to technological improvements and other factors, and knee replacements are being done on younger and younger people. The government is interested in knowing more about outcomes from knee replacements. How long will a knee replacement last? What prior medical history or events can be expected to predict a knee replacement? What are the complication rates from the procedure?"

Knee replacements are just one of the medical treatments that Dr. Paul, senior research health analyst, has been studying over the last two years. "We are part of two patient outcome research teams (PORTs), which are sponsored by the Agency for Health Care Policy and Research. PORTs are multidisciplinary and multi-institutional, and evaluate health care issues such as stroke prevention, hip replacements, caesarean sections, and treatments for low back pain.

The PORTs examine cost and utilization outcomes, as well as clinical outcomes and patient preferences, in their assessment of various procedures.

"It's a response to concerns about appropriate and quality treatment, and about the rising cost of medical care in an era of diminishing resources," Dr. Paul says.

RTI's role in the PORTs has been in data collection and analysis, says Dr. Paul. "We're working with extremely large data sets, mostly

from the Medicare system. The challenge is to figure out what data are available and how to use them appropriately for policy purposes."

The work is exciting, Dr. Paul says, because there's the potential of improving the way medical decisions are made, and changing the way the treatments are handled.

"Also, we can take what we're learning now about large data base analysis and apply that in the future to other health care issues."

CENTER FOR RESEARCH IN EDUCATION

Provides education research, program evaluation, policy analysis and development, and technical assistance. Capabilities include special education, adult and higher education, vocational education and rehabilitation, bilingual education,

at-risk students and dropouts, education equity, school administration, health education, and assessment of educational reform.

CENTER FOR POLICY STUDIES

Multidisciplinary staff with capabilities in demography, economics, human resource development, public

policy analysis, public health administration, public management, sociology and statistics. Research methods range from randomized experimental designs and multivariate analyses to qualitative approaches such as comparative case studies.

Dr. Michael Hubbard

Drug abuse, sexual habits, criminal activity—those aren't the kinds of things most people readily discuss. However, Dr. Michael Hubbard specializes in getting survey responses to questions on those sensitive subjects. It's a specialty that's a good fit for a combination statistician and psychologist.

After teaching psychology and working as a statistician, Dr. Hubbard sought a job that took advantage of his dual interests. "I liked the team approach to projects at RTI and saw an opportunity to help gather information on significant social problems."

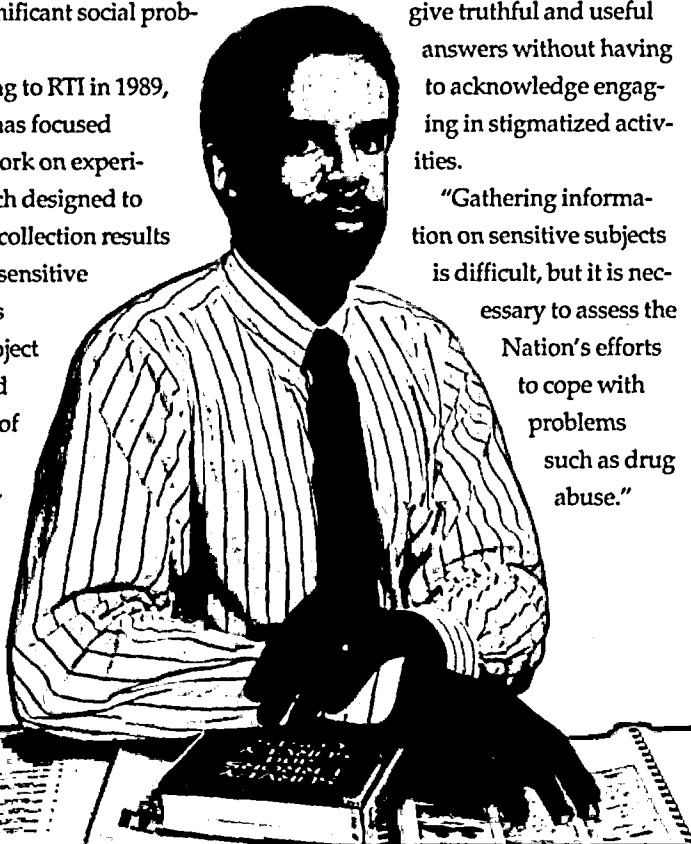
Since coming to RTI in 1989, Dr. Hubbard has focused much of his work on experimental research designed to improve data collection results in surveys on sensitive subjects. He is directing a project to develop and test measures of drug use and sexual activity among adolescents and young adults.

"One problem in any survey is getting respondents to remember accurately the time at which events occurred in the past. That's been part of my work with the adolescent and young adult study—to develop methods to improve that accuracy."

Dr. Hubbard also has helped develop and validate a coding scheme to assess the cognitive difficulties respondents are likely to experience in answering questions about drug use. He has worked on developing a way to ask about HIV-infection risk behaviors in a way that lets people

give truthful and useful answers without having to acknowledge engaging in stigmatized activities.

"Gathering information on sensitive subjects is difficult, but it is necessary to assess the Nation's efforts to cope with problems such as drug abuse."



Designs and conducts scientific sample surveys that target, manages, and analyzes survey data and other scientific data. Collaborates with other research units for research on health, environmental, social, and economic issues.

CENTER FOR RESEARCH IN STATISTICS

Participates in interdisciplinary studies of issues in health, nutrition, the environment, education, energy, and national defense. Develops statistical methodology and accompanying software to design and analyze complex probability-based surveys and randomized experiments, as well as epidemiologic and toxicologic studies.

CENTER FOR SURVEY RESEARCH

Conducts survey research, with primary responsibilities for survey design, data collection and data processing. Designs and manages mail, telephone and personal interview surveys, including computer-



You can't see them. You may not be able to smell them. But research survey specialist Susan Henderson wants to know who was exposed to them and when.

What Ms. Henderson is after are toxic substances such as benzene, dioxin and trichloroethylene (TCE). "We are helping to establish the National Exposure Registry," Ms. Henderson explains.

"The registry is a national data base of people across the country who have been exposed to toxic substances. We are looking at many of the Superfund sites, which are designated by the EPA. Those sites can either be areas where there have been accidental spills or processing areas where substances may have leaked for years.

"We determine if people have been exposed and do a complete health summary of the individuals. We then do yearly follow-ups to update each individual's health information."

Ms. Henderson manages annual follow-ups for the TCE and dioxin subregistry. She is also assistant work order manager for a new data collection effort to establish a benzene subregistry for sites in New York and Minnesota.

"It's never stale here," Ms. Henderson says. "I'm doing something that matters, and I

have the opportunity to examine survey methodology issues and develop new ways of dealing with things. We have to do that to stay competitive."

assisted surveys. Designs and supports software for data entry, editing and cleaning, management, and analysis. Conducts survey methodology research.

CENTER FOR COMPUTER SCIENCE

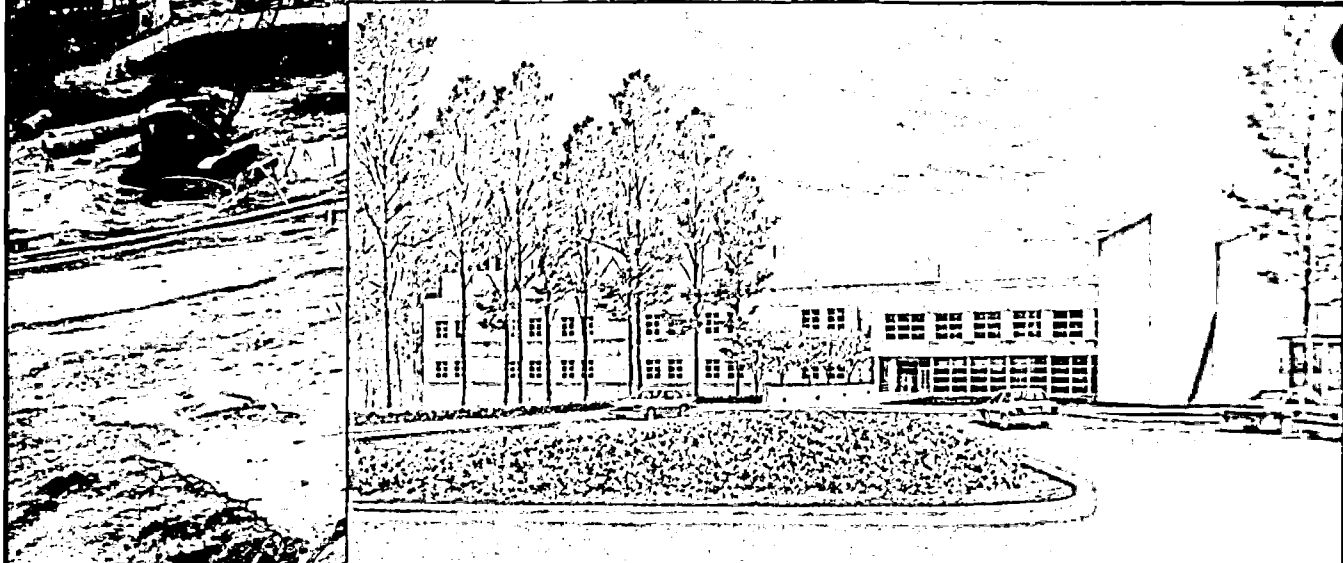
Conducts research in software design, systems analysis, and com-

puter applications. Supports data collection projects, particularly surveys and clinical trials. Staff disciplines include computer science, mathematics, statistics, and operations research.

RAGLAND COMPUTER CENTER

Operates a general-purpose computing center for RTI, and manages

a campus-wide data communications network. Provides PC services, including integration with the computer center.



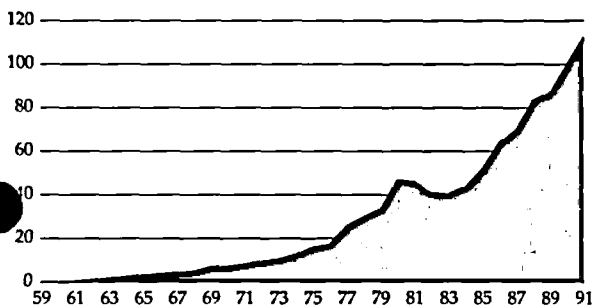
Continued growth has allowed the Institute to begin the much-needed expansion of its laboratory facilities. Construction began in 1991 on RTI's eighteenth building, a 58,560 square-foot structure that will include chemistry laboratories and office space.

1991 OPERATING HIGHLIGHTS

RTI's revenue rose in 1991 to a record \$112.8 million, an annual increase of 12.6%. Continued strength is expected because new contract authorizations in 1991 reached \$151.2 million, a substantial increase over the previous fiscal year.

Research Revenue

Millions of Dollars



RTI's diversity of clients is indicated by the variety of sources of revenue and by the range of industries represented among private-sector clients (see charts).

The US Department of Health and Human Services accounted for 46.8% of RTI's revenue, an exceptional increase from 25.8% only four years ago. The bulk of this work is in response to public health issues such as drug abuse, AIDS, long-term care, cancer, heart disease, and healthy life-styles.

The Environmental Protection Agency remains one of RTI's largest sources of revenue, accounting for 14.1% of the Insti-

tute's activity in 1991. RTI's interest in environmental issues is long-standing, and this commitment is expected to continue.

The private sector continues to be a rapidly expanding part of RTI's activities, accounting for 12.9% of revenue. This work gives

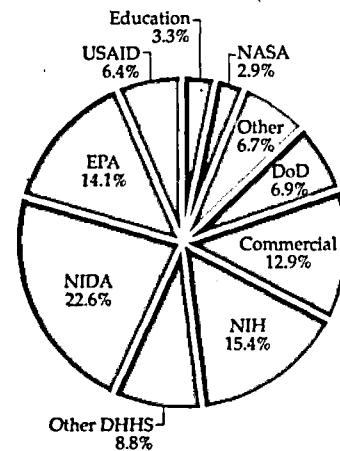
RTI scientists opportunities to apply the knowledge and experience gained in Federally funded research to meet marketplace needs. This fact, and the healthy diversity of the private-sector client base, means further growth can be

expected in this important business segment.

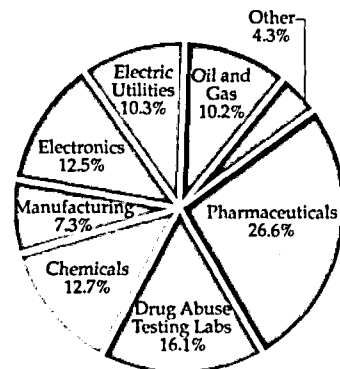
Support from the Department of Defense declined to 6.9% of revenue. Other important sources of revenue include the US Agency for International Development, the US Department of Education, and NASA. A variety of non-Federal sources supplied 6.7% of RTI's revenue.

During 1991, the regular staff grew from 1,409 to 1,435. Offices in the District of Columbia, Virginia, Florida, and overseas continued to expand and now include more than 100 people.

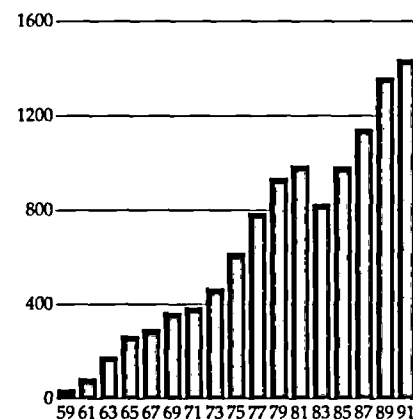
Sources of Revenue



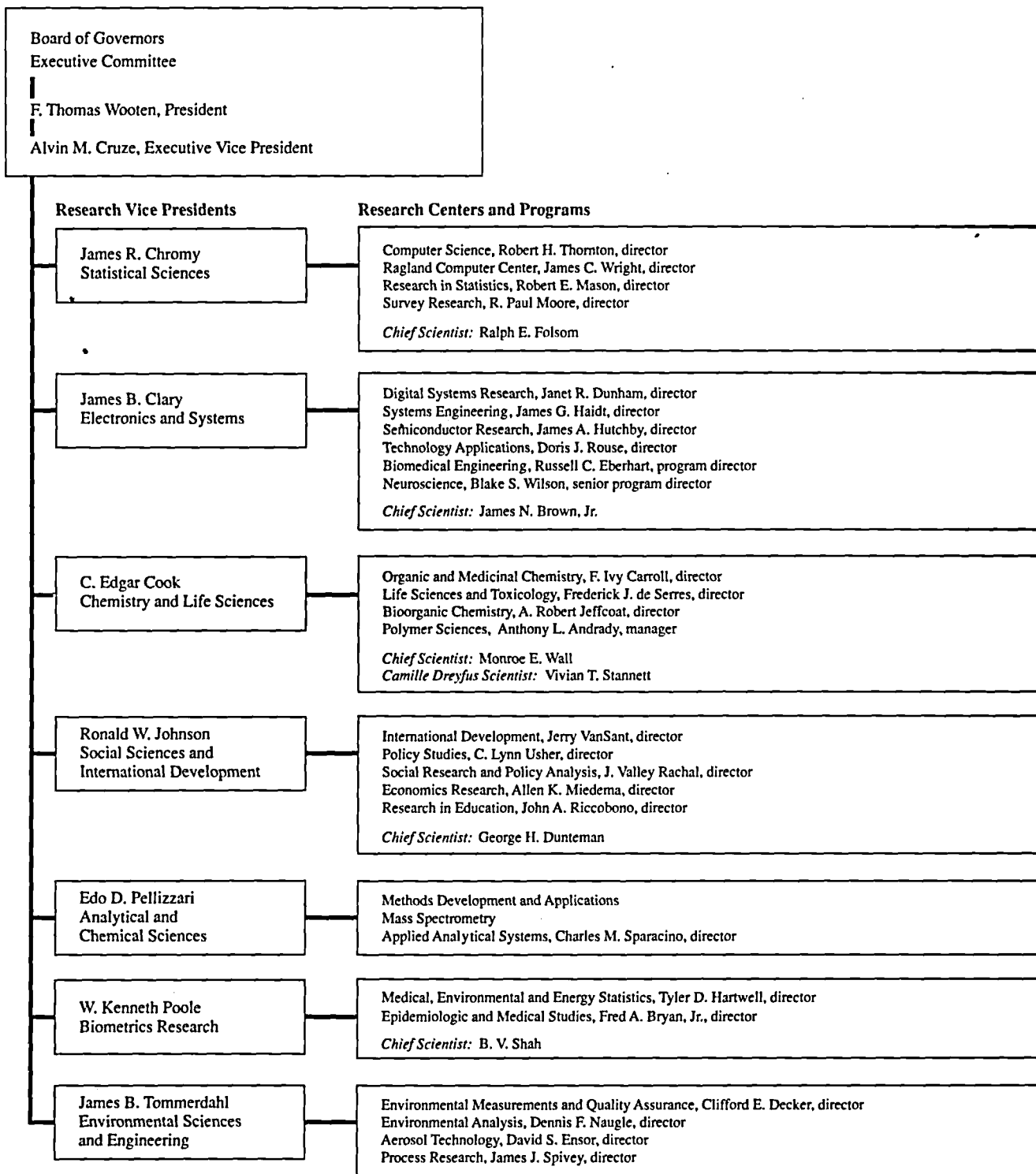
Private-sector Revenue



Staff Growth



RESEARCH ORGANIZATION



GOVERNANCE AND CORPORATE OFFICERS

Board of Governors

Of the 31 Governors: five hold seats by virtue of their positions: the presidents of The University of North Carolina, Duke University, and the Research Triangle Institute, and the chancellors of NC State University and the University of North Carolina at Chapel Hill; four are specified in the Bylaws: George Watts Hill, William C. Friday, George R. Herbert and Marcus E. Hobbs; nine are appointed annually to represent Duke University, The University of North Carolina general administration, NC State University, and UNC-Chapel Hill; and up to 15 Governors are elected from the business and professional communities. A separate category of Lifetime Governor recognizes retired Board members who have made extraordinary contributions to the progress and welfare of RTI. Robert T. Armstrong is the current Lifetime Governor.

Chairman:

George Watts Hill,* Chairman of the Board, Central Carolina Bank and Trust Company, Durham

Vice Chairman:

George R. Herbert,* President Emeritus, Research Triangle Institute

Executive Committee Chairman:

Marcus E. Hobbs,* University Distinguished Service Professor Emeritus of Chemistry, Duke University

John C. Bailar, III, Professor, Epidemiology & Biostatistics, McGill University

Erich Bloch, Distinguished Fellow, Council on Competitiveness, Washington, DC

H. Keith H. Brodie, President, Duke University

Norman L. Christensen, Jr.,* Dean, School of the Environment, Duke University

Ivie L. Clayton,* Business Consultant, Raleigh

Pedro Cuatrecasas, President, Pharmaceutical Research Division, Warner-Lambert Co., Ann Arbor, Michigan

Raymond H. Dawson,* Senior Vice President and Vice President for Academic Affairs, The University of North Carolina

William C. Friday, President, William R. Kenan, Jr. Fund, Chapel Hill

Pamela B. Gann, Dean, School of Law, Duke University

Steve C. Griffith, Jr., Executive Vice President and General Counsel, Duke Power Company, Charlotte

Paul Hardin, Chancellor, University of North Carolina at Chapel Hill

Margaret T. Harper,* President, The Stevens Agency, Southport

Franklin D. Hart,* Provost and Vice Chancellor, North Carolina State University

H. Garland Hershey,* Vice Chancellor for Health Affairs, University of North Carolina at Chapel Hill

William G. Howard, Jr., Consultant, Scottsdale, Arizona

Earl Johnson, Jr.,* President, Southern Industrial Constructors, Inc., Raleigh

William L. Klarman,* Interim Vice Chancellor for Research and Extension, North Carolina State University

Matthew Kuhn, President, MCNC, Research Triangle Park

William F. Little,* Interim Provost and Vice Chancellor for Academic Affairs, University of North Carolina at Chapel Hill

Eugene J. McDonald, President, Duke Management Company

Larry K. Monteith, Chancellor, North Carolina State University

Charles E. Putman,* Executive Vice President for Administration, Duke University

Thomas A. Rose, President, Blue Cross and Blue Shield of North Carolina, Durham

C. D. Spangler, Jr., President, The University of North Carolina

Thomas J. Troup, Vice Chairman, Burr-Brown Corporation, Tucson, Arizona

Charles B. Wade, Jr., Winston-Salem

F. Thomas Wooten,* President, Research Triangle Institute

Phail Wynn, Jr., President, Durham Technical Community College, Durham
*Member, Executive Committee

Members of the Corporation

The Members are the equivalent of RTI shareholders. As such, they elect the Governors who represent the business and professional communities. Of the nine Members of the Corporation: four are the chairmen and presidents of The University of North Carolina and Duke University; one is George Watts Hill, a lifetime Member of the Corporation; four are elected annually, two from and by the Duke University Board of Trustees, and two from and by the Board of Governors of The University of North Carolina.

Members of the Corporation representing Duke University are: P. Jackson Baugh, Nicholasville, Kentucky; H. Keith H. Brodie, Durham; Nathan T. Garrett, Durham; Thad B. Wester, Raleigh

Members of the Corporation representing The University of North Carolina are: Samuel H. Poole, Raleigh; T. Henry Redding, Asheboro; Hon. Robert W. Scott, Haw River; C.D. Spangler, Jr., Chapel Hill

Corporate Officers

RTI officers, including the research vice presidents listed on page 22, are elected by the Board of Governors.

F. Thomas Wooten, President
Alvin M. Cruze, Executive Vice President
William H. Perkins, Jr., Financial Vice President
Suzanne P. Nash, Corporate Secretary
Carolyn J. Harris, Assistant Corporate Secretary

AN OVERVIEW OF RTI

Research Triangle Institute (RTI) is a not-for-profit contract research organization located in the center of North Carolina's Research Triangle Park. RTI was established in 1958 by the University of North Carolina at Chapel Hill, Duke University, and NC State University.

RTI conducts applied and basic research in the United States and abroad for clients in government, industry, and public service.

Organization and Staff

RTI's organization supports the formation of multidisciplinary teams to address complex research issues.

The staff of more than 1,500 includes approximately 60 percent professionally trained research personnel. Of these, nearly two-thirds have advanced degrees. Their backgrounds include more than 115 degree fields.

Major areas of training and experience include:

Social Sciences: economics, econometrics, benefit-cost analysis, evaluation research, urban and regional planning, international development, health services and health policy research, agricultural development, sociology, psychology, social psychology, education, business administration, public administration, municipal financial management, criminology, law, political science, and the humanities.

Survey Research: sample design and selection, survey planning and execution, data collection and management, and research and development on survey methodology.

Mathematics, Statistics, and Computer Sciences: data management and analysis, statistical methods development, statistical analysis, biostatistics, clinical trials, epidemiology, computer-aided engineering, CAD/CAM, systems software, software verification, computer security, numerical modeling, and operations research.

Environmental Sciences and Engineering: environmental controls and engineering, environmental chemistry, environmental health, industrial hygiene, hazardous materials management, hydrogeological and earth and mineral sciences, meteorology, and oceanography.

Chemical and Biological Sciences: analytical, organic, inorganic, physical, polymer, and medicinal chemistry; toxicology, pharmacology, genetics, neuroscience, biology, biochemistry, and microbiology.

Engineering and Physics: electrical, electronics, systems, computer, semiconductors, chemical, biochemical, energy, industrial, mechanical, manufacturing, materials, biomedical, aerosol, civil, petroleum, nuclear, aeronautical, and transportation engineering.

University Affiliations

RTI was created as the focal point for growth in North Carolina's Research Triangle Park, an industrial and governmental scientific center built around the resources of the area's three major research universities.

RTI's capabilities are greatly expanded by frequent collaboration with university scientists. Additional relationships include joint staff appointments, cooperative research programs, and other professional contact.

Laboratory and Office Facilities

RTI's Research Triangle Park campus includes 454,000 square feet of laboratory,

computer, and related facilities for all RTI programs. RTI also maintains research offices in Washington, DC; Newport News, VA; Cocoa Beach, FL; and other locations in the US and abroad.

Computer Facilities

In-house facilities for data management, statistics, modeling, simulation, software R&D, computer-aided engineering, electronics, and laboratory management include microcomputers, two computer centers, and daily traffic with national and regional scientific networks.

Library Facilities

The RTI Technical Information Center provides on-line computerized literature searches via data bases relevant to RTI research programs. The Center maintains subscriptions to more than 1,000 professional periodicals. Specialized libraries are maintained in RTI research buildings.

RTI staff have full access to the combined libraries of the nearby universities, which have been cross-cataloged and shared since 1934. Access is facilitated by computerized catalog links and daily track service.





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192-21K

STATISTICAL SCIENCES, PLAGIANDI

DIGITAL SYSTEMS, RESEARCH

NEUROSCIENCE, CHEMISTRY AND

POLYMER SCIENCES, SOCIAL SC

POLICY ANALYSIS, ECONOMICS

MASS SPECTROMETRY, APPLIED

AND MEDICAL STUDIES, ENVIR

ANALYSIS, AEROSOL TECHNOLO

IN STATISTICS, SURVEY RE

BIOMEDICAL ENGINEERING, NEUR

BIOORGANIC CHEMISTRY, POLYM

ECONOMIC RESEARCH, SOCIAL

ANALYTICAL SYSTEMS, BIOMETRI

ENVIRONMENTAL SCIENCES AND

TECHNOLOGY, PROCESS RESEAR

SYSTEMS, DIGITAL SYSTEMS RESI

NEUROSCIENCE, CHEMISTRY AND