1994

RTI

A REPUTATION OF ACHIEVEMENT

1994 ANNUAL REPORT

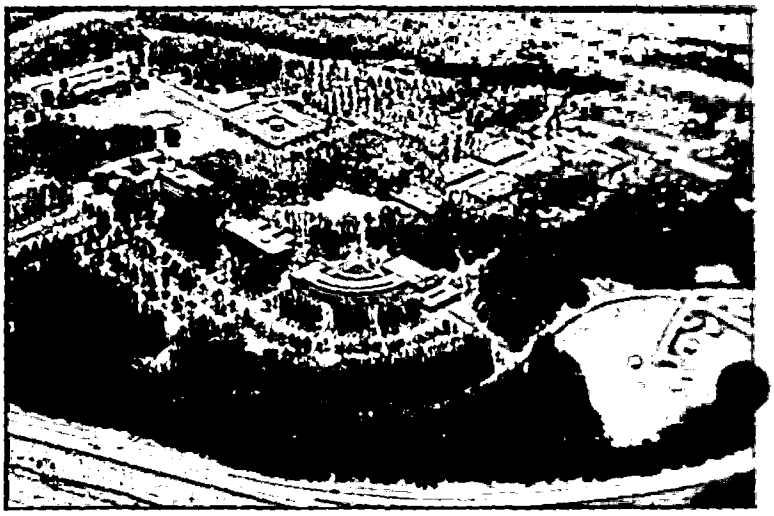
RESEARCH TRIANGLE INSTITUTE

Introduction

Above all other factors, the success of a research institution depends upon the quality of its staff and their reputation for scientific achievement. That reputation takes on vital importance in times such as today when the U.S. research community must answer questions about its cost, its ethics, and, most of all, its relevance.

For 36 years, RTI's staff have focused on priorities that are consistent with their mission, which is to improve the human condition through applied research and technical services that meet the highest standards of professional performance.

Today those priorities are public health, medical research, environmental protection, advanced technologies, and public policy.



RTI's reputation for excellence in each of these areas is evidenced by the accomplishments highlighted in this annual report. We are proud that our work helps our clients accomplish their own missions.

Tom Wooten, President
December 1994

Dedication

George R. Herbert, President: 1958-1989
Vice Chairman and President Emeritus: 1989-1995

George R. Herbert, founding president of Research Triangle Institute, died January 14, 1995. He was 72. He arrived in North Carolina at the end of 1958 as the first employee of the first science organization in the fledgling Research Triangle Park. With considerable help from university, business, and government leaders, he set out to build a scientifically diverse research institute as the Park's centerpiece. The accomplishments described in this annual report stand as a tribute to his vision, his leadership, and his commitment to excellence.

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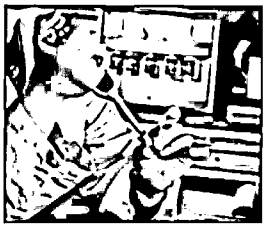

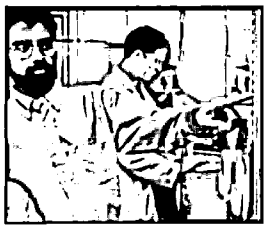

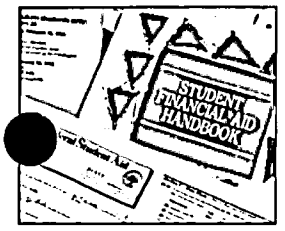

For more information, please access RTI's World Wide Web pages at http://www.rti.org. Or, contact RTI's communications manager at:
Internet crm@rti.org
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Fax 919-541-6515

Public Health

Public health research at RTI focuses on identifying the most cost-effective approaches to preventing and treating problems arising from drug abuse, chronic disease, infectious disease, aging, violence, and other issues in human health. This theme appears throughout RTI and involves staff from many different research disciplines.

Drug abuse and the AIDS epidemic have been dominant topics for the past decade. In recent years, topics have included aging and fertility. In 1994, RTI's emerging program in community-based, prevention-oriented interventions matured, adding large new efforts in early childhood intervention to existing work on diabetes, mental health, violence, and HIV.

RTI also studies policy issues associated with public health and medicine, such as access to care, financing, and cost containment.

DRUG ABUSE

In 1994, RTI completed the Washington, DC, Metropolitan Area Drug Studies, providing a comprehensive picture of drug abuse in the nation's capital. Results were presented at the 1994 meeting of the American Public Health Association. Also in 1994, RTI conducted the annual National Household Survey on Drug Abuse, the primary means of measuring drug abuse in the U.S. RTI has conducted this survey six times since 1988 and for

Outreach staff from two North Carolina counties are trained by RTI's Kathy Rourke (front left) and Randy Lucas (right rear) to help drug users avoid HIV and to collect data needed to plan future programs.

Community-Based Randomized Field Experiments

Because they provide opportunities to do statistically rigorous research in the context of real-world programs in local communities, randomized field experiments are increasingly used to evaluate the effectiveness of new social programs.

RTI is conducting this type of research on issues such as violence prevention, AIDS outreach, drug-abuse treatment, and employment.

In 1994, RTI and community-based organizations in Durham, NC, began an outreach effort to prevent violence among African-American male adolescents. The program emphasizes mentoring and work experience. One goal is to increase youths' attachment to the community and appreciation for African-American culture through mentoring and guidance. Another aim is to enhance job skills and employment opportunities.

In another study just getting under way in two North Carolina counties, RTI researchers are trying to get drug users to reduce their needle and crack use and to enter drug treatment to reduce the spread of AIDS.

RTI also is conducting a randomized field experiment to evaluate the effectiveness of providing vocational services to people who are undergoing drug-abuse treatment. Preliminary results show that two-thirds of the people entering treatment are without jobs and that the type of vocational service needed varies widely.

the current survey has developed a method to use the survey's results to make localized estimates of drug use. RTI will conduct the survey annually through 1996.

For more than 20 years, RTI's Treatment Outcome studies have demonstrated the effectiveness of drug abuse treatment and pointed the way to the most cost-effective approaches. The NIDA Center for Community-Based Treatment Research Methods brings together RTI and North Carolina universities in a program of training and research that applies the results of treatment research funded by NIDA and the Substance Abuse and Mental Health Services Administration.

From basic biochemical research to discovery of new pharmaceuticals, RTI's programs in pharmacology and medicinal chemistry also contribute to the fight against drug abuse.

AIDS EPIDEMIC

In 1994, RTI renewed its commitment to epidemiologic research on HIV by establishing a new 5-year program with the National Cancer Institute in support of international research on the spread of AIDS. Also in 1994, RTI's chemistry researchers began a new program in support of pharmaceutical development, providing the National Institute on Allergy and Infectious Diseases with analysis of candidate drugs for the next generation of AIDS treatments.

Behavioral Clinical Trials

Behavioral clinical trials emphasize developing personal responsibility to prevent or cope with threats to public health. These studies not only allow systematic comparisons of alternative approaches, but they also provide opportunities for service providers to gain valuable experience that accelerates development of improved public health services.

RTI is testing an HIV prevention program in seven cities, comparing it with a simpler approach to providing such information. A statistical comparison between the outcomes of the two approaches will show whether the enhanced prevention program is effective.

Elementary and junior high students in seven cities are participating in a curriculum designed to prevent violence, drug abuse, sexual activity, and associated problems of disease and unwanted pregnancy.

In another study, RTI is collecting data on different approaches in 11 cities to provide mental health services to HIV/AIDS patients. Because there is little experience with these services, RTI's study is designed to accelerate the development of effective programs.

RTI is conducting similar studies on managing diabetes and on treating drug abuse.

Discussion group in an HIV prevention program.

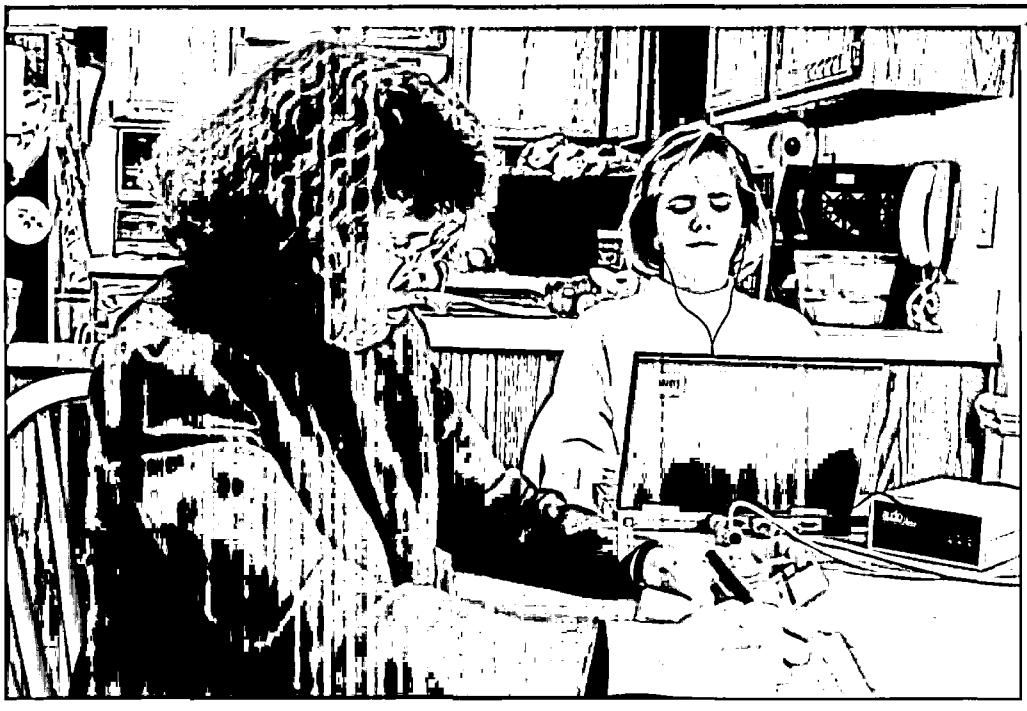
FERTILITY

The National Survey of Family Growth, which RTI will conduct in 1995, provides basic information for policy decisions on aspects of reproductive health ranging from prevention of teenage pregnancies to assessing needs for infertility research.

In studies for private foundations and for NIH, RTI conducts in-depth longitudinal studies of behaviorial issues in contraceptive use and their policy implications.

AGING

RTI addresses the quality and costs of long-term care via a combination of policy research and development of practical solutions. Current policy studies focus on assisted living for the frail elderly, use of mammography among Medicare recipients, improving the quality of nursing home care, evaluating the effects of specialized care units in nursing homes for people with Alzheimer's disease, the effectiveness of congregate housing with



Ellen Stutts, a regional supervisor for data collection in the National Survey of Family Growth, conducts a field demonstration of ACASI.

Accurate Answers to Personal Questions

The National Survey of Family Growth provides data that help determine policies on issues such as preventing teenage pregnancies, coping with infertility, and providing child care.

Yet the survey seeks the most personal information from more than 10,000 women between the ages of 15 and 44. To help get accurate answers, RTI has integrated two "firsts" into the current survey, which has been conducted four other times since 1973 by the National Center for Health Statistics.

This is the first time Computer-Assisted Personal Interviewing (CAPI) has been used in the survey. Moreover, this will be the first national CAPI survey to include Audio-Computer-Assisted Self-Interviewing (ACASI), in which respondents answer questions privately. Through earphones, the computer plays recorded question-and-answer choices, and the individual responds on the computer's keyboard. Based on the answer, the computer moves on to the next appropriate question.

Large survey projects ongoing at RTI include the National Household Survey on Drug Abuse, the National Personal Transportation Survey, and the Worldwide Survey of Health Behaviors among U.S. Military Personnel.

Drug-Abuse Treatment Research

Research on drug-abuse treatment at RTI is a comprehensive program combining community-based experiments, outcomes research, methods improvement, and professional training.

This program repeatedly has shown that treatment dollars effectively and efficiently reduce drug abuse and the problems associated with it. The program also contributes to maximizing the accessibility and quality of treatment.

The Drug-Abuse Treatment Outcome Family of Studies includes studies of characteristics, treatments, and outcomes among adolescents and adults. In 1994, RTI completed a retrospective followup study demonstrating the positive effects of treatment to reduce cocaine abuse. Another result from these studies shows that the service needs of people are increasing at a time when services provided are decreasing.

Applied research conducted in 1994 included development of performance outcome measures for treatment programs, intended to support a quality assurance program for treatment.

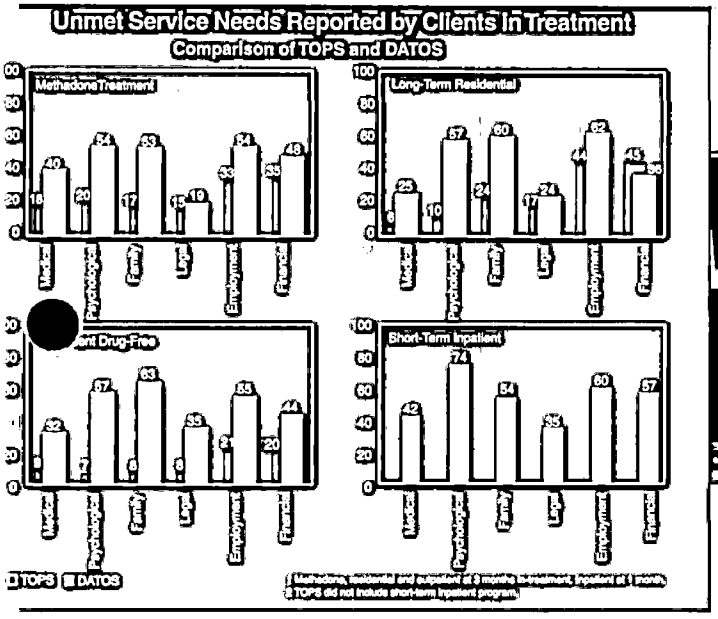
To investigate how drug abuse develops, RTI is conducting followup interviews with young adults who were involved as elementary school students in an alcohol and drug prevention program RTI helped provide 10 years →

supportive services in public housing for the elderly, and the effect of regulation on the quality of care in domiciliary care or board-and-care homes.

METABOLISM RESEARCH

RTI conducts metabolism research to discover how the body processes chemicals such as abused drugs, environmental chemicals, and pharmaceuticals. This research leads to a better understanding of how chemicals exert beneficial and/or harmful effects and is crucial in development of new pharmaceuticals.

In 1994, RTI expanded its metabolism research on large molecules such as peptides, which are increasingly sought as pharmaceuticals. RTI combines knowledge in biology and chemistry to develop catalytic antibodies, which can promote useful reactions. For example, RTI is developing catalytic antibodies that can detoxify harmful chemicals, including the recent creation of a catalytic antibody for cyanide removal. △



As needs for services have increased, availability of services has declined.

ago in Wake County, NC. In addition, RTI is conducting a statewide assessment of needs for treatment.

An important aspect of outreach is the National Institute on Drug Abuse Center for Community-Based Treatment Research Methods, through which RTI not only advances the methods used in treatment research but also participates in training researchers and practitioners in the field. The Center emphasizes collaborative research and training at universities throughout North Carolina.

Developing the resident assessment instrument for long-term care required a multidisciplinary research team including (L-R seated) Marianne Nennstiel, Charles Phillips, PhD, Lynn LeMaster, (standing) Kirk Pate, Steven Garfinkel, PhD, Angela Greene, Janet Griffith, PhD, Edward Norton, Catherine Hawes, PhD, Rebecca Green.

Improving Long-Term Care

The quality of long-term care for the elderly has been profoundly affected by a resident assessment instrument (RAI) that is used by virtually all U.S. nursing homes to identify the needs, strengths, and preferences of residents and to develop individualized resident care plans. RTI led the team that developed the RAI, which is sometimes referred to as the MDS or Minimum Data Set, for the Health Care Financing Administration of the U.S. Department of Health and Human Services. It has been in use nationwide since early 1991.

RTI is evaluating the effects of the new system on the quality of care in nursing homes. Preliminary results show significant improvements in the process of care in nursing homes, as well as in resident outcomes. For example, residents now receive more comprehensive care plans that address the problems and care needs identified by the assessment system. Hospitalizations have been reduced, and use of the RAI seems to be associated with reductions in decline and better maintenance of function among residents in areas such as cognition, physical function in the activities of daily living, continence, mood, and psychosocial well-being.

The RAI has been translated into more than 11 languages, and countries in Europe and Asia are testing it for possible use.

Medical Research

Researchers at RTI conduct a combination of applied and basic research to discover new pharmaceuticals, develop auditory prostheses, and assess the economic and medical viability of new treatments.

DRUG DISCOVERY

Drug discovery at RTI traces its roots to the earliest days of the National Cancer Institute's search for new pharmaceuticals from plant extracts. RTI has contributed to this "natural products" search by discovering the cancer drugs taxol and camptothecin.

While the natural products program remains active, drug discovery has grown to include methods that expand the range of possibilities and accelerate the search for candidate drugs. RTI uses computerized drug design to create compounds with desired biological effects. An emerging laboratory method called combinatorial chemistry

Alcohol and the Immune System

Heavy alcohol use by a pregnant woman can cause a set of severe problems called fetal alcohol syndrome. It is also known that lower levels of alcohol use can cause more subtle problems, one of which is a weakened immune system. Children who were exposed to alcohol *in utero* appear to have increased risk of both infectious disease and cancer. The "T-lymphocyte" arm of the immune system is associated with both of these risks, and previous research indicates that alcohol might impair its function in some way.

RTI researchers are using a mouse model to mimic both chronic and binge drinking by pregnant women. Working under a new National Institutes of Health grant, RTI will examine effects of prenatal alcohol exposure more extensively than in previous studies. Two important aspects of the study are the analysis of multiple T-lymphocyte subsets and analysis of immune system development during that portion of mouse development that parallels the third trimester of human gestation. In the mouse, this occurs in the first 10 days *after* birth, and preliminary studies at RTI have demonstrated the feasibility of alcohol exposure studies during this period.

The results will help devise approaches to counteract alcohol-induced immune deficiencies and prevent life-threatening and costly illnesses. In addition, the study will establish an approach that might be applied in studying other agents that impair the immune system.

Patricia Basta, PhD, leads a new study on how alcohol affects the developing f

rapidly creates large numbers of compounds that are potentially active. Combined with RTI's life sciences ability to develop rapid assays for desired biological effects, these methods are yielding an increasing number of success stories.

PHARMACEUTICAL DEVELOPMENT

Where research requires sophisticated analytical techniques and development of new methods, both industry and government turn to RTI. Chemical analysis is required to ensure the quality of dosage forms used in research and to analyze blood and tissue samples for drugs and their metabolites.

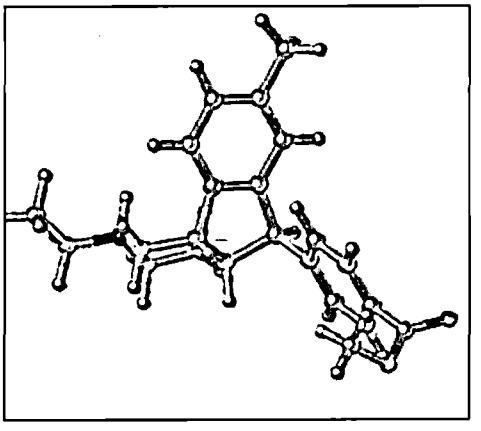
RTI started a new project in 1994 to provide such support to NIH for research on the frontier of anti-viral and anti-infective development.

Members of the team working on the new male contraceptive compounds are Betty McTaggart, Patricia Fail, PhD, Stephanie Anderson, Joseph Jump, PhD, David Lee, PhD, Edgar Cook, PhD, and M.C. Wani, PhD.

Discovering a Male Contraceptive

At the 1994 meeting of the American Chemical Society, RTI scientists described their discovery of a candidate compound for a male contraceptive drug. The compound appears to avoid some of the problems that have halted development of other candidate compounds. For example, it is nonhormonal, while hormonal activity is a frequent source of side effects. In animal tests, the compound made males infertile without interfering with mating behavior.

The discovery results from teamwork combining specialists in drug design, synthetic chemistry, metabolism, and endocrinology. One key to this success story was development of a rapid bioassay, with which RTI's team was able to screen large numbers of candidate compounds.

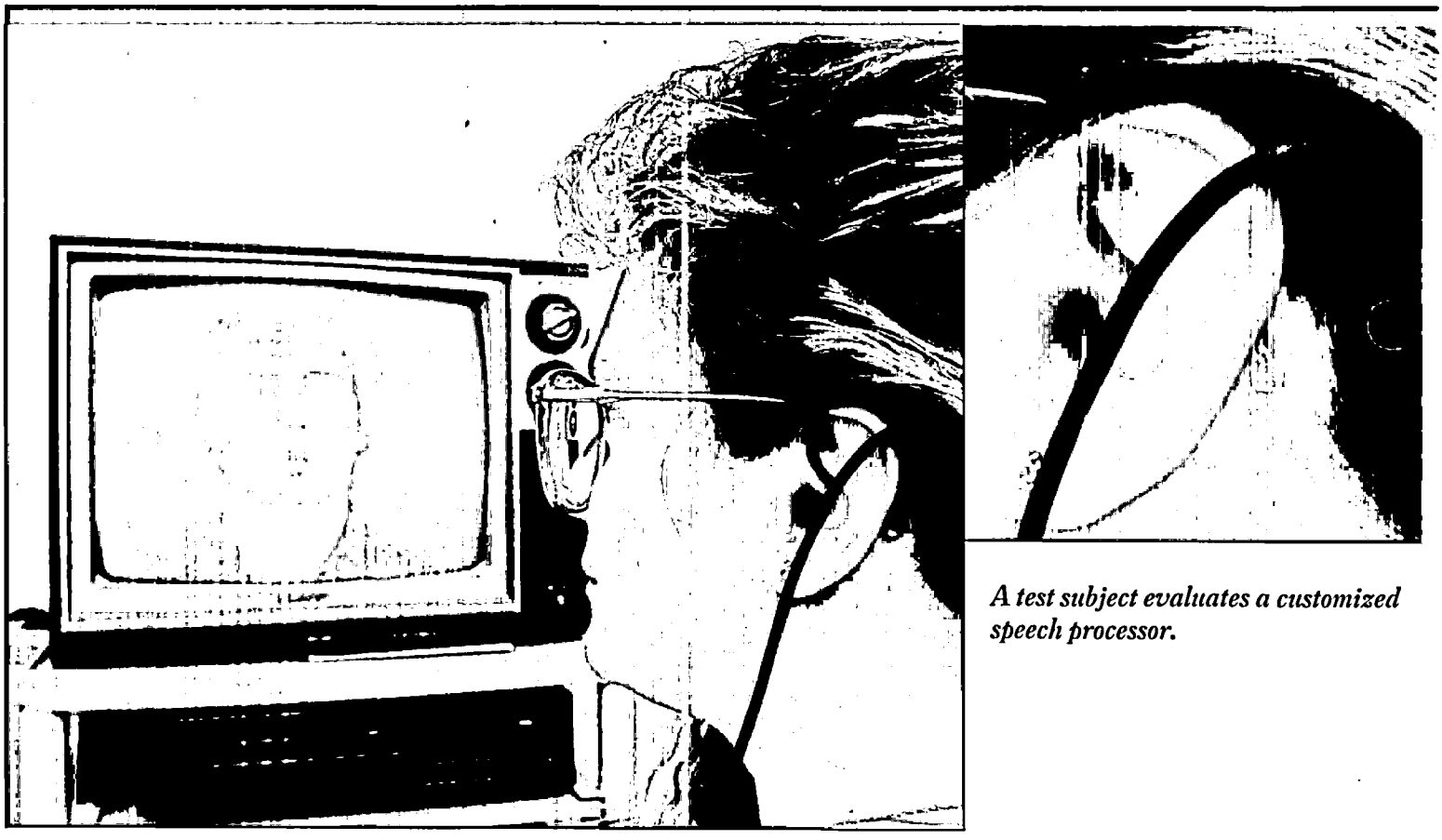


One of the RTI contraceptive compounds.

MEDICAL STATISTICS

RTI conducts data collection and statistical analysis for international studies of HIV. One of these, the International Registry of HIV-Exposed Twins, has yielded the finding that a substantial portion of HIV transmission from mother to infant occurs during birth, rather than *in utero*. In 1994, the National Cancer Institute extended RTI's participation in such research for an additional five years.

In an ongoing multicenter study for the National Cancer Institute, RTI is assessing risk factors among patients with brain tumors. The results, expected in 1997, should identify possible causes of brain tumors and could lead to preventive measures.



A test subject evaluates a customized speech processor.

Advanced Cochlear Implants

Wearable versions of advanced cochlear implants soon will be tested by profoundly deaf patients of the RTI/Duke University Medical Center Cochlear Implant Laboratory. These tests will reveal the full potential of implants that use speech processors developed at RTI.

One of the strongest messages emerging from implant research at RTI and Duke is that patients benefit significantly from a high degree of customization in speech processor design and fitting.

RTI is developing computer-aided fitting systems capable of guiding audiologists toward the optimum result for each patient.

Work also is under way to apply RTI's cochlear implant approach to a new generation of acoustic hearing aids.

PHARMACOECONOMICS

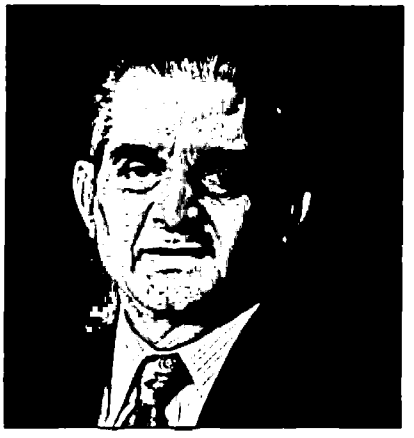
As new and more costly drugs appear in the market, insurers and patients have started to ask "is it worth it?" In 1994, RTI emerged as an important provider of cost-effectiveness analyses of new drugs for pharmaceutical companies. In performing these analyses, RTI is using MedTREE, a proprietary decision-analysis software package. In addition, RTI has developed computer-interactive interviewing software to gather data on and then estimate both individuals' quality of life while sick and their willingness to pay for improved health outcomes. ▲

Hernan Navarro, PhD, is lead toxicologist in detecting chemically induced alterations in heart function.

Heart Function in Newborns

Toxicologists and biomedical engineers at RTI have collaborated to develop a non-invasive method to measure heart function in adult and neonatal rats. This provides a rapid, yet sensitive, method to detect chemically induced alterations in central-nervous-system control of the heart and/or structural defects. The system went into use in 1994 in research on side effects of an anti-cancer drug and on *in utero* effects of a pesticide. In the future, this method might be applied to replace invasive methods used to evaluate heart function in infants and children suspected of having cardiac abnormalities.

Monroe Wall, PhD



Mansukh Wani, PhD

Awards for Pharmaceutical Pioneers

The discoverers of taxol and camptothecin, two of the most important new cancer drugs, have received many important honors for their achievements in drug discovery. Monroe E. Wall, PhD, and Mansukh C. Wani, PhD, received the 1994 Bruce F. Cain award from the American Association for Cancer Research. Also in 1994, they joined a select group of internationally known health researchers who have received the Durham, NC, City of Medicine Awards. Dr. Wall has received four previous national or international awards for natural products research conducted at RTI.

Wall, Wani, and their colleagues at RTI were early pioneers in the systematic search for plant extracts and other compounds from nature that can fight disease. Today they are leaders in research on natural products.

Natural products research provided the starting point for a diverse program of drug discovery at RTI, which now encompasses computer-aided drug design, combinatorial chemistry, and rapid bioassays for screening candidate compounds.

In 1994 the drug discovery program achieved notable successes with the licensing of two new compounds and the discovery of a candidate compound for a male contraceptive.

Environmental Protection

Environmental protection, as researched at RTI, seeks the greatest benefit for human health and the ecology with the least interference with the private economy. This cost-benefit concern has led RTI to become a leader in:

- ensuring accurate measurements of pollutants,
- determining how much pollution people and animals actually ingest,
- learning how different chemicals affect health,
- developing technologies that cost-effectively avoid pollution,
- finding "win-win" approaches that prevent pollution while improving industrial processes, and
- assessing the economic impacts of environmental initiatives.

POLLUTION PREVENTION

Instead of treating waste and emissions from manufacturing processes with expensive add-on equipment, pollution prevention emphasizes changes in the manufacturing process that prevent waste from being generated. RTI assesses new technology and process changes to find those that offer practical opportunities for significant benefits.

Indoor Air Quality Research

The photograph shows engineer Erick Myers preparing an experiment into the growth of microbiological organisms on air duct construction materials in RTI's Dynamic Microbiological Test Chamber. Conditions in the recently completed chamber can be controlled to mimic those encountered in building environments and can be used to evaluate growth, measure emissions, and evaluate air cleaning and contamination control efforts.

The chamber is among the specialized apparatus used in RTI's multidisciplinary indoor air quality research program, in which engineers and microbiologists work together to solve the complicated problems encountered in the field. Much of this research concentrates on particle and gas-phase contamination, indoor air quality modeling, and development and evaluation of airborne contamination samplers.

RTI also conducts research into the measurement and evaluation of indoor lead, other metals, asbestos, and volatile organic compounds.

These programs are an integral part of multidisciplinary research on exposure assessment and indoor air quality experiments conducted at RTI.

For example, RTI's solvent alternative guide helps industries choose chemicals to avoid toxic emissions. Such work requires input from RTI engineers, chemists, economists, and statisticians.

ENVIRONMENTAL TECHNOLOGY

Coal remains among the most important long-term energy resources in the U.S., and new technology is needed to cost-effectively avoid its well-known environmental impacts. In 1994, RTI patented a "direct sulfur recovery process" that can be used with a new type of power plant to remove sulfur — a primary component of acid precipitation — and to reduce greenhouse gases by producing electricity more efficiently. The technology is being demonstrated at a pilot scale at the U.S. Department of Energy's Morgantown Energy Technology Center.

Electric motors of 20 horsepower or more consume roughly half of the electric energy produced in the U.S. As a result, even a small increase in their efficiency could significantly reduce pollution from electric-power generation. With funding from EPA, RTI has developed a new technology that accomplishes this goal by using a fuzzy logic controller to optimize a motor's output according to the work it is called upon to do.

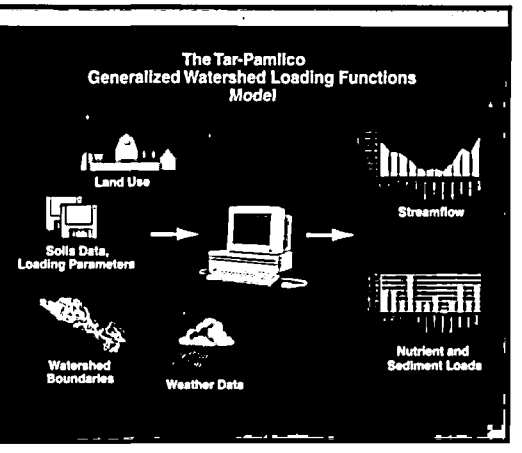
RTI's team for developing microenvironmental models includes statistitians such as Andy Clayton, survey specialists such as Harvey Zelon, chemists such as Edo Pellizzari, PhD, and Kent Thomas, and environmental engineers such as Charles Rodes, PhD.

Exposure Assessment

With all science knows about pollutants and their health effects, two critical factors remain incompletely understood: Which pollutants are most likely to find their way into the human body and cause harm? And by what pathways do they enter the body?

In 1994, RTI began work in a three-year cooperative agreement with the Environmental Protection Agency that combines RTI capabilities in analytical chemistry, statistics, and exposure assessment. RTI will develop, refine, and test microenvironmental models for human exposure to toxic chemicals. The primary purpose is to find the best way to conduct a national human exposure assessment survey, and the study also will advance the science of risk assessment by providing a direct measure of people's exposure to toxic chemicals.

This work will set the stage for a long-term study, called the National Human Exposure Assessment Survey, of the status and trends of human exposure to toxic chemicals in the environment.



Computer models help plan protection for valuable estuaries.

Healthy Estuaries in North Carolina

RTI has supported the N.C. Division of Environmental Management by developing computer-based tools to help assess alternate policies for controlling nitrogen and phosphorus inputs into the Tar-Pamlico River Basin. Nitrogen and phosphorus are associated with excessive algal growth, low dissolved oxygen, and fish disease, and the Tar-Pamlico Basin contains some of the state's most valuable estuaries.

RTI developed a mathematical model of nutrient loadings from wastewater treatment plants and both urban and agricultural land uses. RTI then applied the model, and Geographic Information System tools, to all 15 watersheds in the Basin. Finally, RTI researched the cost-effectiveness of agricultural practices for controlling nutrient runoff.

HEALTH EFFECTS

Chemicals in the environment often affect human health in unpredictable ways. RTI conducts toxicology research to identify the potential health effects of chemicals that are in the ambient environment, in the workplace, and in food and pharmaceutical products.

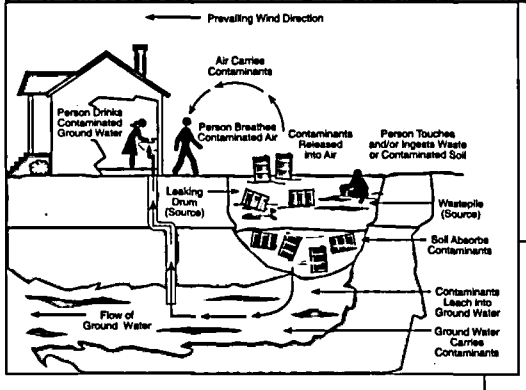
Toxicology researchers at RTI place particular emphasis on developing and using new approaches that increase the sensitivity of toxicology assays, reduce the cost, and reduce dependence on laboratory animals.

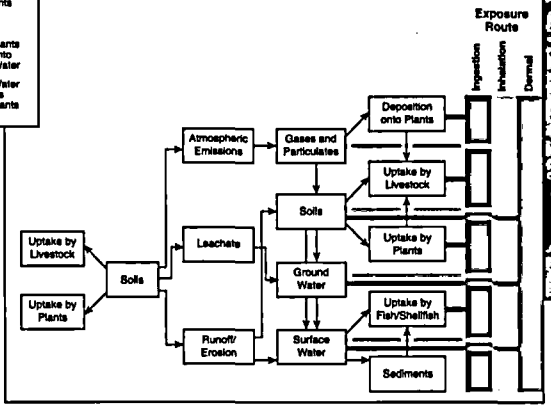
EXPOSURE ASSESSMENT

No matter how toxic, a chemical cannot affect human health unless it enters people's metabolism via a route such as inhaling, eating, drinking, or absorption through the skin. RTI has a 20-year history of pioneering work to determine how pollutants in the environment actually affect human health. RTI has developed the methods used to accurately measure the pollutants we ingest, proving a crucial link between measurements of ambient pollutants and determinations of chronic effects on health.

In 1994, this program grew to include new research on the magnitude, extent, and causes of human exposure to important environmental agents. Based on this knowledge about the effects on individuals, both citizens and officials can make more informed decisions about environmental health risks.

By capturing and analyzing the breath of animals that have been exposed to chemicals, scientists at RTI have





Multiple exposure pathways include ingestion, dermal contact, inhalation, and migration into ground water pathways.

Groundbreaking Tool for Risk Analysis

RTI developed a multipathway risk analysis methodology for EPA that has been recognized as a "groundbreaking risk tool" (*Risk Policy Report*, 1(2):6-7, October 7, 1994). Using this tool, RTI has prepared risk assessments for listing determinations of hazardous waste and for site-specific decisions.

Multipathway risk analysis examines multiple exposure pathways and gives a more robust picture of potential releases of hazardous materials. In addition, this methodology estimates risks not only for the general population, but also for special subpopulations.

Life-Cycle Analysis

RTI is becoming a leader in applying life-cycle analysis to making sound environmental decisions. In 1994, RTI began a new effort, jointly funded by EPA and the U.S. Department of Energy, to apply life-cycle concepts to efficient solid waste management.

Virtually every community in the U.S. has taken initiatives to conserve landfill space and to protect the environment through activities such as recycling and banning certain materials from landfills. Even so, there are questions as to whether the environment actually benefits from each type of initiative. →

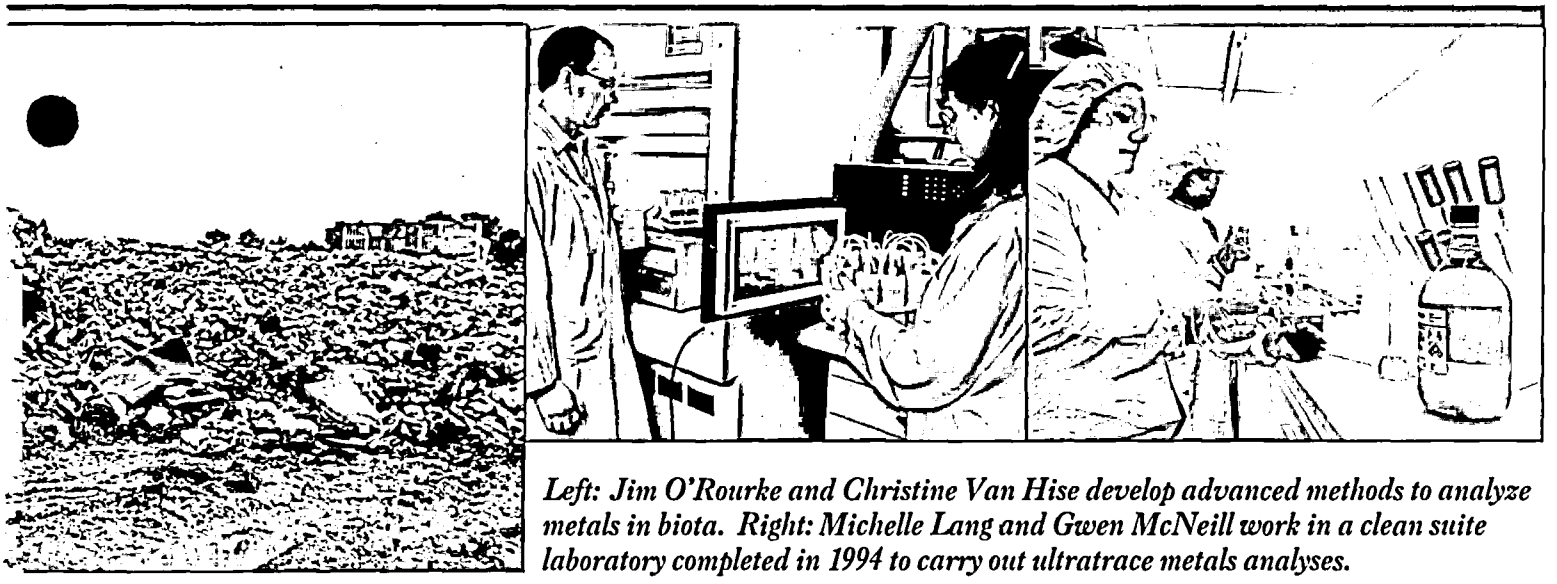
developed ways to use breath samples to assess exposure to pollutants. Last year, they carried this method an important step further: Now they can use expired breath to assess how chemical exposure has altered the body's metabolic machinery, providing insight on how and why a chemical affects health.

Food is a major source of our intake of potentially harmful chemicals. But it also is difficult to analyze because each food and each chemical present a unique analytical challenge. To overcome this difficulty, RTI has developed an approach that combines foods from a person's diet — sample "plates" — with highly sensitive analytical methods.

INDOOR AIR QUALITY

Wood products, furniture, electronic equipment — these and other items in our homes and workplaces — emit gaseous pollutants that we inhale. But which products or materials are most important in this process? RTI has developed the sample collection and analytical methods to answer these questions. Using specially built enclosures, scientists here provide definitive answers on products ranging from carpets to copiers.

Asbestos remains an important indoor air quality issue, and RTI contributes to identifying problem locations by developing analytical methods and helping assure quality of measurements. In 1994, EPA officially adopted a method RTI has developed for determining asbestos in bulk building materials, including



Left: Jim O'Rourke and Christine Van Hise develop advanced methods to analyze metals in biota. Right: Michelle Lang and Gwen McNeill work in a clean suite laboratory completed in 1994 to carry out ultratrace metals analyses.

Working in cooperation with university, private-sector, and stakeholder groups, RTI will develop a management decision tool to help communities identify cost-effective options that provide real environmental benefit.

The work will be completed in 1997. Current efforts focus on collecting data, evaluating life-cycle models, and establishing mechanisms for communications and technology transfer.

Ultratrace Environmental Analysis

RTI has developed a broad capability in trace metals research and analytical methods development over the past 20 years. Research accomplishments in 1994 include a new method to differentiate between forms of mercury in combustion emissions; a sample preparation method for ultratrace determination of 20 metals in tissues, sediments and foods; and a tissue sample preparation method for copper in pharmacokinetic studies.

Also in 1994, RTI completed a suite of cleanrooms for analyzing parts-per-trillion (ppt) concentrations of metals in environmental samples. Some hazardous metals such as lead and mercury not only are toxic at low levels, they also tend to "bioconcentrate." These metals might start as ppt concentrations in the ambient environment, but by the time they reach foods we eat they could be concentrated by a factor of a million.

Analysis at the starting point, in ppt concentrations, is required for fundamental research. Unfortunately, metals in the air, and even from the surfaces of lab furniture, can contaminate ultratrace analysis. To avoid contaminating samples, RTI's new cleanroom suite combines air filtration with comprehensive use of plastic materials and coatings for laboratory components.

analysis by polarized light, x-ray diffraction, and transmission electron microscopy. Laboratories in the U.S., Canada, and Europe are using this method.

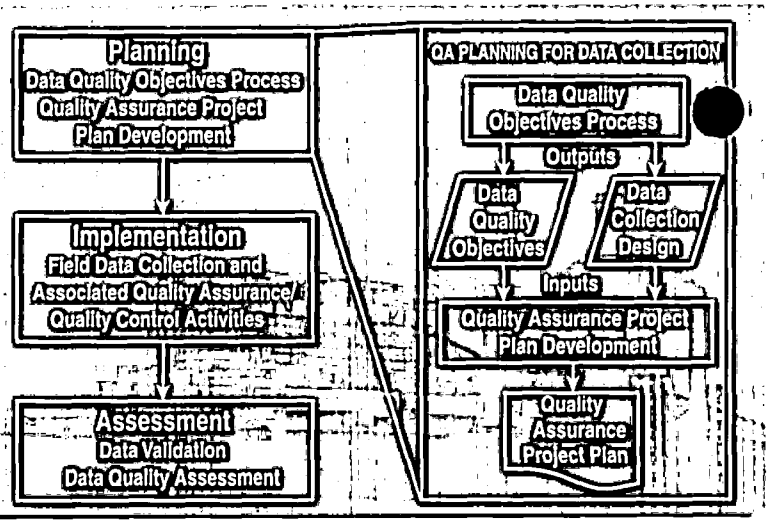
Also in 1994, RTI completed a rapid, sensitive, and quantitative field test method for lead in paint, soil, and dust. This, too, is now an approved EPA method.

ENVIRONMENTAL ECONOMICS AND MANAGEMENT

The need to make choices permeates questions related to environmental quality. Governments make choices in policy, while firms choose the technologies they employ. RTI economists evaluate choices at both the public and private levels. They estimate the economic effects of alternative regulations and market-type approaches to environmental quality management to help governments make choices in environmental policy. They also examine how firms can make better decisions in selecting production methods and managing the release of residuals into the environment. This information helps in understanding why some firms lead and others follow in employing the latest methods for addressing environmental concerns.

For example, the pulp and paper industry is a significant source of pollution and a significant component of the nation's economy. RTI has conducted an extensive economic analysis of the likely impact on society of higher pulp and paper production costs due to the need to address air- and water-pollution problems. This analysis addresses effects on paper products' prices and sales, international trade, and the viability of pulp and paper mills.

Susan Lewis, PhD, leads a team that uses genetically engineered mice to assess damage to reproductive cells.



Quality assurance planning and the data life cycle.

Genetically Engineered Mice

Genetics researchers at RTI are participating in an effort to develop ways to use genetic engineering to identify chemical risks to reproductive health.

Molecular biologists at the National Institute of Environmental Health Sciences have inserted a bacterial gene into the DNA of laboratory mice. Toxicologists at RTI expose these mice to chemicals that are suspected of causing genetic damage that parents can pass on to offspring. Then, RTI's genetics team samples reproductive cells from the mice, extracts the bacterial DNA, and puts it back into bacteria. If the genes have been damaged, the bacteria will grow differently than they will if the genes are unaffected.

Existing research methods require breeding new generations of test animals from those that are exposed to chemicals. If the new genetically engineered method works, it will provide a direct window on DNA damage in reprodutive cells and would reduce the numbers of animals and amount of time needed for such studies.

Environmental Decisions

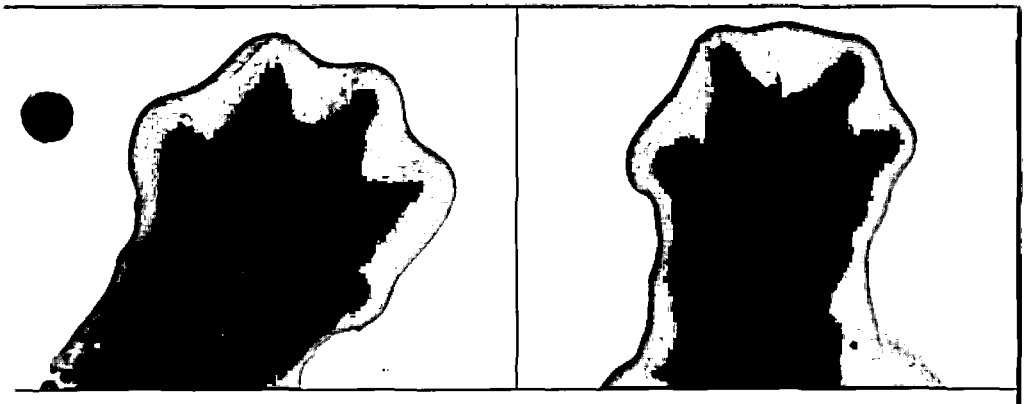
Errors in environmental data can lead to decisions that fail to cost-effectively address threats to ecological and human health.

To help prevent such problems, RTI's "quality assurance" staff have been closely involved with EPA's work in environmental sampling, laboratory analysis, and data management.

Now, RTI is applying these experiences to help EPA's various programs improve their decision-making through better planning. Working with the Agency's Quality Assurance Management staff, RTI's work is to build bridges between the needs of decision-makers and the technical methods that produce the data that support key decisions.

In another project, RTI has joined with EPA to explore ways to support sustainable development in communities that have high population densities, a historically industrial-based economy, and a high share of disadvantaged populations. Such communities frequently have degraded environments. They need to find ways to improve the environment that will contribute to the economic growth in the community. RTI will work with local residents in three New Jersey counties to develop policy options and practices that can be transferred to other industrial communities.

Another important issue is the relative benefits and costs of industry's adoption of new technology to control environmental and health risks and the factors that lead to technology adoption. For the Food and Drug Administration, RTI is investigating the diffusion of risk management approaches and technology as strategies for managing food safety risks, as well as the benefits, costs, and incentives to industry of adoption. ▲



Considering the Embryo

Studying the embryos of test animals soon after exposure during pregnancy has shown that toxic effects often show up in stark relief in the physical structure and the biochemical pathways of the embryo, even though the effects might be absent or subtle at birth. This evidence of damage can reveal impacts that conventional tests, which evaluate effects near birth, might miss and potentially can be used to conduct toxicology research using low doses of chemicals that closely simulate how people are exposed in their workplaces and their homes.

For example, an exposure considered non-toxic by conventional tests produces deformed paws in embryos (see photos: normal paw on the left, abnormal paw on the right with only four digits). Because these abnormalities apparently are corrected as the embryo develops, conventional methods would not detect a toxic effect.

RTI's specialists in developmental toxicology have received a grant from the National Institutes of Health to explore this potentially sensitive method and the implications of the toxic effects it uncovers.

R.K.M. Jayanty, PhD

Association Honors RTI Scientist

R.K.M. Jayanty, PhD, has been named a fellow of the Air and Waste Management Association, becoming the 40th person so honored in the Association's 87-year history.

"For the past 20 years, Jayanty has been a valuable contributor to the measurement of toxic air pollutants," the Association said. The Association also called his 15 years of research on the stability of trace organic compounds in a variety of media "unique and valuable to the scientific community throughout the world."

In 1991, the Association awarded Dr. Jayanty its highest technical award, the Frank A. Chambers Award, for his contributions to the field of air pollution measurements.

Advanced Technology

Technology-related engineering at RTI brings concepts out of the laboratory and uses them to solve problems for government and industry. This is accomplished by understanding their needs and providing R&D and the marketplace know-how to realize the promises of advanced technologies.

Aerospace technologies, new materials, applications of information-age technologies, and new special-purpose electronic systems are the primary themes for contract R&D in RTI's technology-related programs. Technology transfer is a formal part of these programs, as RTI's market-driven approach to technology transfer increasingly has been adopted by federal agencies and laboratories.

Engineers Jennifer Hills, Rama Venkatasubramanian, PhD, Tom Colpitts and Brooks O'Quinn set up a new chemical vapor deposition system in 1994 for developing thermoelectric materials.

Engineers Steve Ammons, Bob Hendry, and Ron Rudder, PhD, lead development projects in the materials research laboratory at RTI.

Bringing Low-Cost Diamond Technology to Market

In 1994, an industry-government-RTI team came together to develop commercial use of a low-cost diamond-film technology based on research RTI originally conducted for the U.S. Department of Defense.

A year earlier, 3M Company and RTI teamed up to demonstrate the potential of the process, which RTI had developed at laboratory scale.

In 1994, a "dual-use" consortium was formed to realize both the commercial and military uses of this technology. As RTI and 3M are scaling up the technology and building a prototype process reactor, ASTeX Corp. is preparing to manufacture the process equipment. The Naval Research Laboratory is collaborating with RTI and 3M to model, characterize, and guide the process development. Meanwhile, Honeywell, Inc., is developing the process control instrumentation. The Advanced Research Projects Agency and the Ballistic Missile Defense Organization are providing funding and technical support based on the potential military applications.

Together, this team plans to bring to market a process that could open up many new uses for synthetic diamond films and coatings by substantially lowering the production cost.

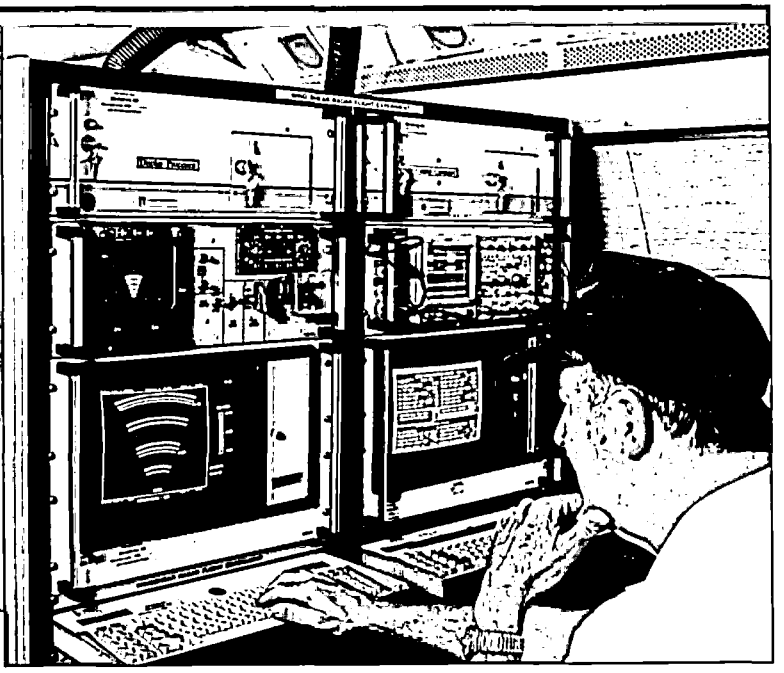
AEROSPACE TECHNOLOGIES

New technologies offer improvements in safety and in affordability of air travel and space flight. RTI's engineers team with counterparts at NASA to develop applications that protect airliners from weather phenomena such as wind shear (see "Warnings of Deadly Turbulence" on this page).

For enhanced safety of both government and commercial space launches, other RTI engineers have developed an automated expert system that accelerates safety-related decisions during launch.

RTI is playing a central role in assembling a consortium for a "renaissance in general aviation" through research, systems engineering, and technology transfer. In 1994, RTI helped assemble a large consortium of companies, universities, independent laboratories, and government laboratories. The consortium's goals include reducing the cost and increasing the ease of use of general aviation aircraft and flight support systems.

RTI takes a market-driven approach to technology transfer. The members of the team include: Laura Schoppe, Gary Hughes, Doris Rouse, PhD, Steve Mangum, Molly Dix, and Dan Winfield.



Lead engineer Les Britt, PhD, is shown with a test rig during inflight trials of the wind shear warning system.

Bringing Federal Technology to the Marketplace

RTI's longest-running project, now in its 27th year, has an outstanding track record in moving technology out of federal laboratories and into commercial and industrial use. In January 1995, the project was extended for another five years.

In 1994, RTI expanded its role in the transfer of technologies from federal laboratories to U.S. industry. As a leader in market-driven technology transfer, RTI has developed and successfully implemented methods for defining industry and public-sector needs, and identifying federal laboratory technologies that could be adapted to meet those needs, often drawing from several sources. For example, RTI's technology transfer program led to the use of NASA electro-optics technologies for a commercial device to assist people with severe visual impairment caused by macular degeneration.

Also in 1994, RTI began new programs to assist the U.S. Army and the U.S. Department of Energy in the transfer of their technologies to U.S. industry.

Warnings of Deadly Turbulence

In 1994, the first on-board systems giving advance warning of wind shear were installed on commercial airliners. The technology, developed by a team led by NASA and RTI engineers, warns pilots of this weather phenomenon before their aircraft are within its deadly grasp.

Earlier in 1994, the engineering team had moved on to address other problems, including wake vortex. Doppler radar and lidar (laser-based system similar to radar) could warn pilots of turbulence created by other airplanes, especially during landing or takeoff.

An even more ambitious project started in 1994. This radar-based project involves development of a ground-imaging display, which would ensure that pilots have a clear picture of their aircraft's location during landing in any weather.

MATERIALS

RTI's research focuses on market-driven development of new materials and new processes to produce and u those materials. In 1994, RTI's semiconductor materials research expanded its activities to include coating technology, in addition to electronic technologies. This has resulted in market-driven development work with industry in applications of patented synthetic-diamond technology. The new focus complements existing teamwork with industry on thin-film transistors for liquid-crystal displays, applications of germanium for night-vision technology, new gallium-arsenide-based transistor technologies, applications of high-efficiency solar cells both in space and on earth, new thermoelectric materials for high-efficiency cooling, and thermophotovoltaic devices for direct conversion of heat into electric power.

Sgt. Pike, an instructor in tank maintenance, evaluates the prototype virtual reality system for maintenance training.

Virtual Reality: A Practical Tool for Training

In a project started and completed within 1994, RTI's Virtual Reality (VR) team provided the first demonstration of VR within a robust PC-based training system at a cost low enough for practical classroom use.

Students are already trying out prototypes of the system, which provides a course for National Guard tank mechanics in diagnosing and repairing the M1A1 Abrams Tank.

The Maintenance Training Simulator for the National Guard (MTS-NG) uses VR as the interface between the trainee and an instructional system, extending training opportunities to personnel at sites that lack access to real tanks. The system operates on a low-cost computer platform, significantly reduces the hours needed for training, and provides improvements in flexibility.

At the end of 1994, RTI's team was awarded an ambitious new project to enhance and extend the approach developed for the MTS-NG for a more complex training system for the next generation of armored vehicles.

This work has proven that virtual reality can be a cost-effective and flexible training tool for many military and civilian applications.

Tassos Markas, PhD, (left) and Eric Edwards are working on a set of CAD tools for designing fault-secure ingrated circuits.

Technology for Designing Fault-Secure Circuits

Digital systems applications such as flight control, distributed industrial control, and secure communications must have on-line error detection capability with a high degree of confidence.

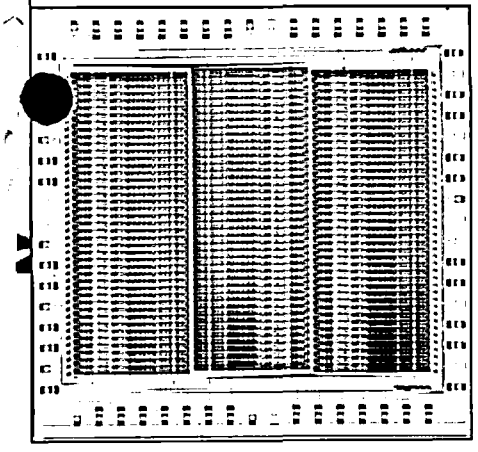
In a flight control system, error detection might trigger a reconfiguration of the system to maintain performance. In a secure communications system, an error might trigger shutdown to preserve the integrity of information.

RTI, under the sponsorship of the U.S. Department of Defense, has been developing a circuit design technique called Differential Cascade Voltage Switch (DCVS) logic. →

INFORMATION TECHNOLOGIES

RTI develops ways to process and present information so that people can use it faster and better. Automated computer-aided engineering systems play a key role in codesigning application-specific hardware for signal processing, but there are gaps in the automation. RTI is improving the productivity of design engineers by developing a seamless environment combining algorithm design and integrated circuit design.

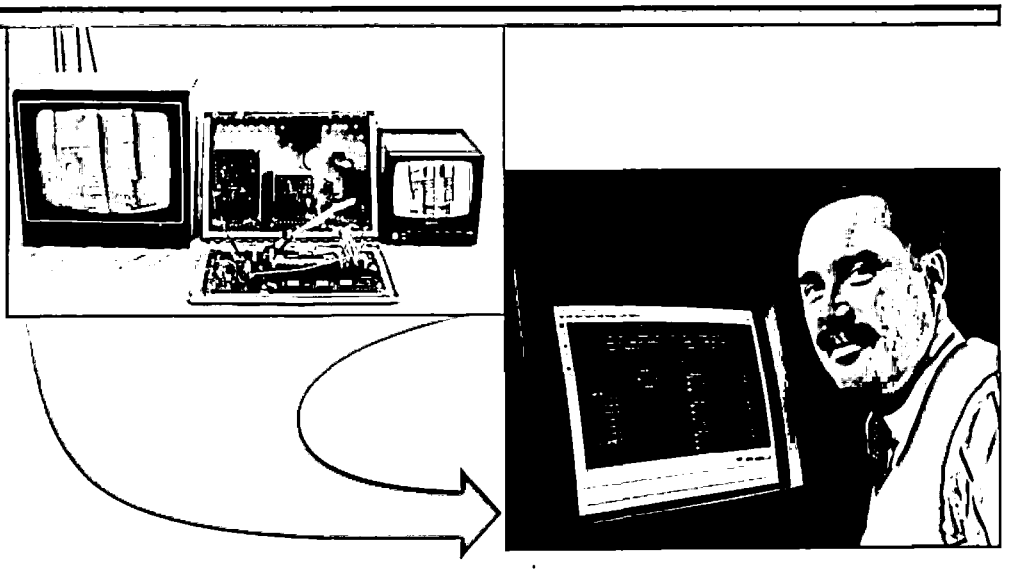
Virtual reality (VR) offers exciting opportunities for information and training systems, if the marketplace is able to use the most advanced technology. In 1994, RTI brought such technology to bear in creating one of the most complex VR models ever built. It is being used to help with fund raising to restore a historic church destroyed during World War II. The model used innovative approaches to update an unusually complex set of images. Also in 1994, RTI completed a military training system that operates on inexpensive personal computers. ▲



This approach allows immediate on-line error detection for 100% of individual faults from a prescribed transistor-level fault model.

Analytical work at RTI has proven the technology's error-detection capabilities, which were demonstrated in actual chips in 1994.

In 1995, RTI will complete a set of CAD tools that enables users to automate the design of DCVS circuits.



Geoff Frank, PhD, RTI Principal Scientist for Digital Systems Engineering, demonstrates a virtual test bench that reduces the need for costly hardware-based prototypes.

A New Design for Signal Processing

Designing software and hardware for signal processing applications such as CAT scans involves a complex process. It includes specifying performance requirements, choosing software algorithms, integrating them with computer architecture, creating prototypes, and evaluating their performance.

To reduce the time and cost of this process, RTI is working with Virginia Polytechnic Institute on a project within a larger program called Rapid Prototyping of Application-Specific Signal Processors (RASSP). The Advanced Research Projects Agency is funding RASSP.

RTI's RASSP environment will include "virtual test benches" for building and evaluating prototypes within a computer-aided design system. RASSP emphasizes co-design of software and hardware for each new application. And it includes the ability to access libraries of existing software algorithms and translate them for use on the appropriate computer architecture. Finally, RASSP includes tools to coordinate and manage design as a single seamless process, rather than as a series of discrete steps.

In 1994, RTI demonstrated the ability to bring software algorithms into the process. Overall accomplishments by the team include demonstrating spreadsheets as process management tools and creating virtual test benches for radar applications. Goals for 1995 include generating performance models for prototype designs.

A key RTI goal for 1995 is to establish paths to commercializing the RASSP results.

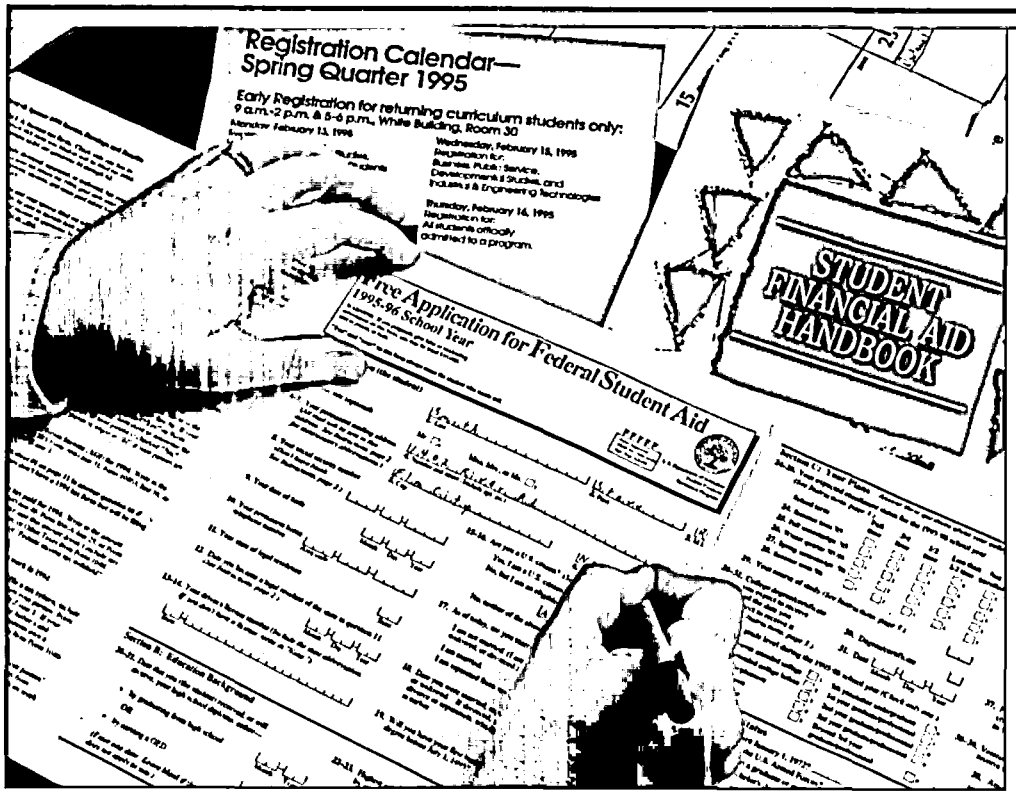
Public Policy

Through analysis, demonstration projects, evaluations, and technical assistance, RTI translates research into effective policies that make positive differences in people's lives. RTI staff are at work in developing countries, in education, and in public utilities, as well as in public health (page 2) and environmental protection (page 10).

PUBLIC UTILITIES

Research for electric and gas utility companies includes evaluation of utility-sponsored programs that affect industrial, commercial, and residential users of energy. For example, within the industrial sector, electric utilities are seeking to promote the use of electrotechnologies, such as microwave drying or ultraviolet curing, in industrial processes. Such technologies can help customers meet stringent environmental control standards, improve process control, and/or improve product quality. RTI helps utilities evaluate efforts to promote electrotechnologies and determine the cost-effectiveness of these efforts.

In 1994, RTI began a project to estimate the potential energy savings from installation of energy conservation measures among the largest industrial customers in a region of New York State. RTI is also comparing energy



The NPSAS survey helps set policy on financial aid for postsecondary education.

How to Pay for Higher Education

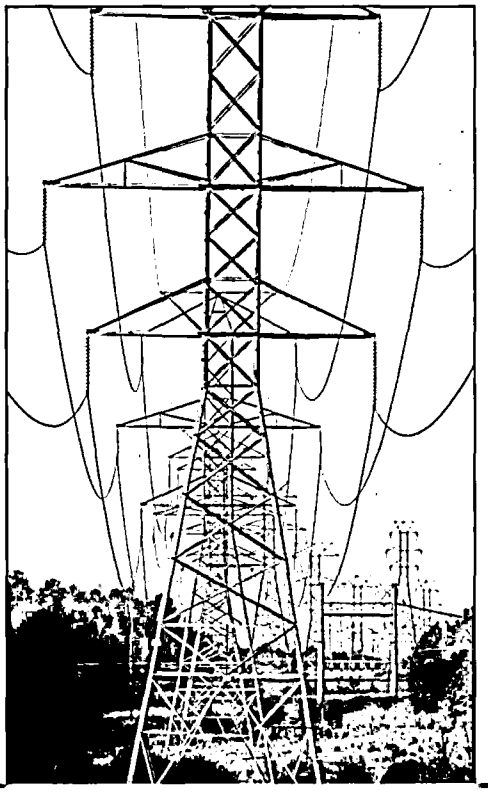
The National Postsecondary Student Aid Study (NPSAS) provides answers to policy-related questions about the costs of higher education, how students and their families pay for it, changes in the types of students applying for and receiving financial aid, and the impacts of costs and aid on students, families, and schools. NPSAS examines all sectors of postsecondary education, from vocational/occupational programs through graduate and other post-baccalaureate education. This periodic study is sponsored by the National Center for Education Statistics of the U.S. Department of Education. In 1994 RTI initiated the 1996 round of NPSAS, which is the fourth in the series. NPSAS:96 will use advanced data-collection technologies, including electronic data transfer, computer-assisted record abstraction, and computer-assisted telephone interviewing. These approaches reduce respondent burden, accelerate data-collection activities, and enhance the quality of collected information.

A large pilot study, initiated in December 1994, will test the systems and procedure planned for the main study, which will be conducted during the 1995-96 school year.

In addition to its basic purpose, the NPSAS:96 will also provide baseline data for a longitudinal study of 16,000 students who begin postsecondary education during the 1995-96 school year.

installation rates for conservation measures, as well as electricity savings between groups of large industrial customers — those who have had an energy audit and those who have not.

Also in 1994, RTI completed a project to measure residential customers' willingness to pay for utility-sponsored investments in renewable energy sources and other "green products." RTI also released MarketTrek 2.0, a market penetration forecasting software tool sponsored by the Electric Power Research Institute.



EDUCATION

RTI provides information necessary for sound policy decisions on special-needs populations, drug-free schools efforts, and school-to-work transitions.

In 1994, RTI staff provided information on the effectiveness of state and local literacy programs, uses of distance-learning technology to extend the

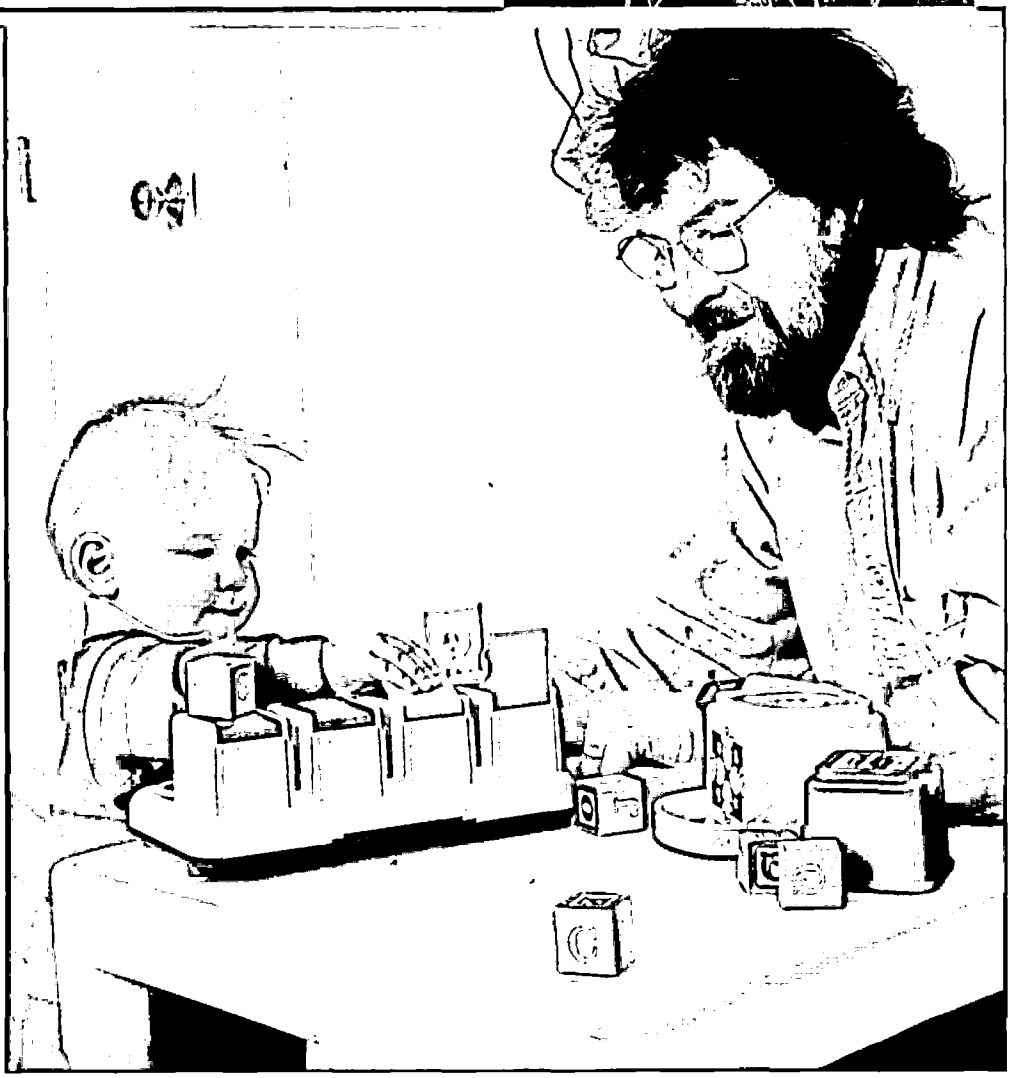
Child Development BEGINs

RTI and the Centers for Disease Control Prevention are testing the effectiveness of a family and early childhood program that emphasizes developmental activities and family interactions. The research will help determine whether early intervention can be successful in preventing developmental problems that cause some children to fall behind their peers.

More than 5,000 families across the country will participate, receiving weekly visits that focus on parent/child interaction, child development, and community services the family might need. Also, from one to three years of age, the children will attend child development centers.

A crucial component of the study is a randomized comparison group that will be studied at the same time as the intervention group. In addition, RTI will conduct economic analyses that will allow evaluation of benefits and costs of services.

Called Bringing Early Growth and Development Into Neighborhoods (BEGIN), the project will enroll its initial families in 1996 and will continue into the year 2003.



BEGIN emphasizes developmental activities in the home and in child-development centers.

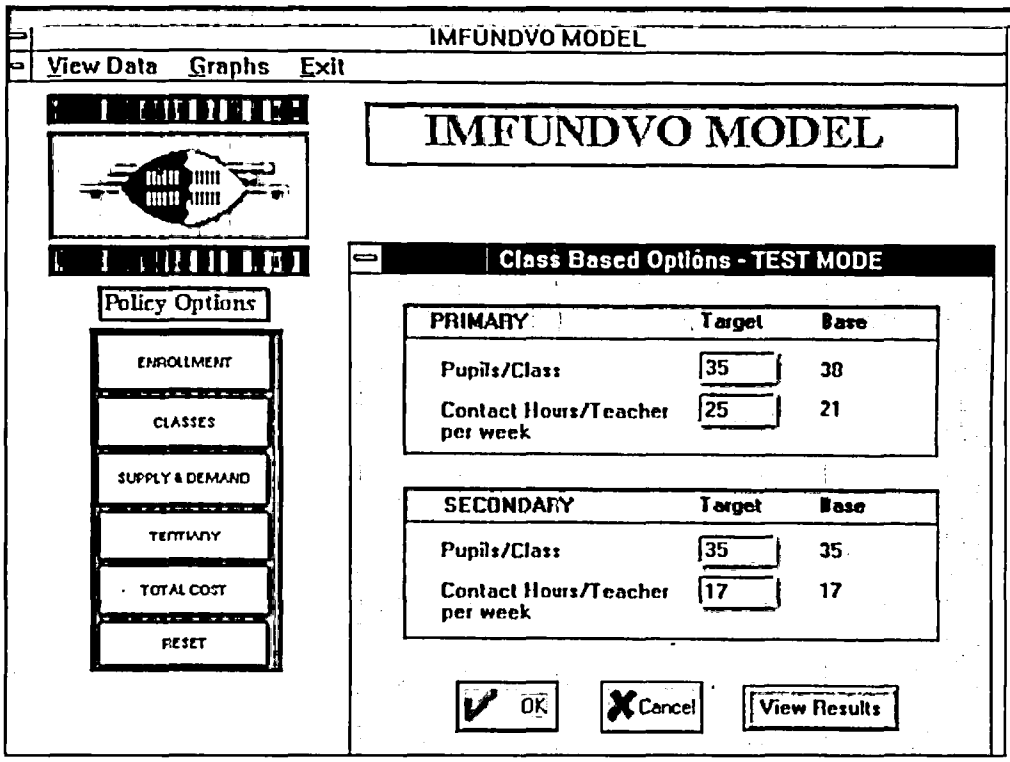
reach of adult education, "Even-Start" programs that combine educational help for both parents and children, and on adult education in public housing.

Performance indicators and systems for using them grew in importance in 1994 as a means to hold government accountable, in response to the Government Performance and Results Act and the Reinventing Government Initiative. RTI is providing analysis on indicators for topics such as vocational education, special education, adult education, and drug-free schools programs. The purpose is to ensure the quality of educational opportunity throughout the nation.

RTI is conducting a longitudinal survey involving 10,000 respondents to help the U.S. Department of Education examine the performance of the state-federal Vocational Rehabilitation Services Program in assisting persons with disabilities achieve sustainable improvements in outcomes such as employment and earnings. Policy makers at local, state, and federal levels will use the information to make decisions on improving the program.

HEALTH CARE ACCESS AND FINANCE

Availability of, and access to, health care are closely related to issues of cost and financing. RTI evaluates the impacts and effectiveness of state initiatives on health-care reform, including Medicaid-managed care waiver programs.



The government of Swaziland has begun implementing politically sensitive changes, having used quantitative results from RTI in discussions among stakeholders about major sources of waste in the country's educational system. Microcomputer-based decision tools developed at RTI help leaders evaluate the information and make difficult choices.

Policy Reform for a Changing World

Developing countries are striving to promote democracy, provide economic opportunity, and address urgent social needs. Through analysis and technical assistance, RTI staff work with leaders in these countries to reform policy and implement change.

RTI staff members are active in countries on four continents and in topics such as education, health and population, environment, urban services, and financial management. Their work emphasizes a combination of quantitative analysis, clear presentation of information to decision-makers, and mediation through dialogue among stakeholders. These efforts effectively transfer knowledge and experience, not only to make immediate decisions, but also to enhance the capabilities of governments in emerging democracies.

Education. RTI emphasizes innovative policy options such as stimulating the discussion of private solutions to public problems and of parents' and local governments' roles in education management.

As South Africa began reforming its educational system, RTI compiled the first unified, complete database on the system, tied to a computer-based tool to make cost projections of proposed reforms. RTI has carried out dozens of seminars and meetings that created inclusiveness among the parties concerned with reform.→

RTI is studying the information needs of Medicare, Medicaid, and private insurance beneficiaries when making choices among competing health plans.

Also in 1994, RTI began new projects on the impacts of health reform initiatives on health-care professions, labor needs for health-care professionals, and utilization of nonphysician providers for primary care.

RTI is at work in Robeson County, NC, to develop an understanding of the sociocultural barriers to maternal and child health-care access and to create and implement new approaches to enhance access to care. The effort emphasizes teamwork with community organizations and is sponsored by the Robert Wood Johnson and Kaiser Family Foundations.

DEVELOPING COUNTRIES

Reliable information organized and presented for decision-makers, combined with an inclusive dialogue with stakeholders, leads to policy reform and implemented change, integrated into a program that strengthens government in emerging democracies. These are the themes of policy analysis and technical assistance RTI provides in developing countries. The work ranges over four continents and includes topics in key policy areas such as education, health and population, environmental protection, and urban services. ▲

RTI's work continues, with activities such as developing university financing formulas and modeling the requirements for teachers.

Even as the crisis in Haiti was unfolding, RTI staff proposed an approach to reconstruct the country's educational system. By November 1994, RTI was at work in Haiti providing technical support and mediation for development of a national plan to improve education.

Health and Population. RTI made presentations to Bangladesh's prime minister on family planning accomplishments, challenges, and financial requirements in that country. These influential presentations have led to plans for expanded efforts over the next five years.

In Bolivia, RTI staff have worked for more than 10 years on population and health issues, becoming key advisors. In 1994, RTI analyzed policy issues in reforming health, family planning, education, and social welfare services. Results and recommendations were presented to Bolivia's president and cabinet, as well as to donor nations via the World Bank.

After two decades of civil strife and famine, Ethiopia has a new government that is taking bold initiatives to address severe economic, social, and environmental problems. RTI staff now are providing technical assistance, particularly on health and population issues, to the Office of the Prime Minister.

Environment. In 1994, RTI completed a PC-based decision-support system for Bulgaria, Slovakia, Hungary, Romania, and Poland to help those countries restore one of their most valued natural resources: the Danube River. Using the system, officials can test and evaluate combinations of strategies. The system incorporates factors such as stream quality, effluent quality, mathematical models, and cost/benefit analysis. It is a superior system because it gives user-friendly access to modeling that uses such a broad range of data.

In 1994, RTI provided a course in "Environmental Management: Tools and Practices" for officials from 17 cities in Russia. The course covered the legal, technical, social, and political aspects of environmental management in the U.S., giving the participants a model they can adapt to their own national and local needs.

Urban Services and Finance. Since 1987, RTI has assisted Indonesia with a national policy agenda to decentralize responsibility for urban services. One of the most important goals is to increase the revenues local governments collect themselves. Since 1987, such revenues have increased by two-thirds through transfer of some revenue sources from the central government to local governments and through management improvements that result in more efficient local revenue collection.

In Eastern Europe and the former Soviet Union, RTI is working at both the national and local levels to restructure public services for a decentralized, market-oriented economy. In Slovakia, for example, RTI staff have helped the central government design the process for breaking up the state-run water and sewer monopoly and create locally managed authorities.

Operating Highlights

During the 1994 fiscal year, RTI staff improved their competitive position with a successful effort to reduce costs. They achieved a 9.5% reduction in the research overhead costs charged to clients and held administrative costs flat. A further decline in both research and administrative overhead costs is planned for 1995.

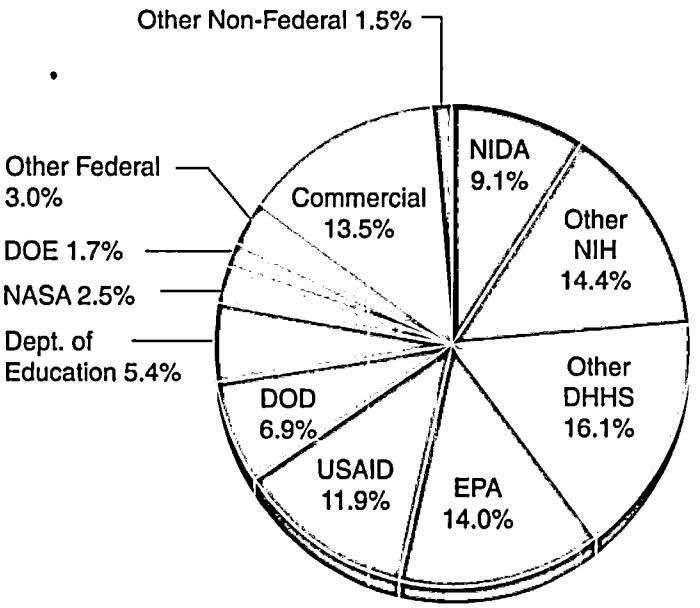
This cost reduction was an important factor in winning $142.3 million of new funding for research in 1994, 8.6% more than in the previous fiscal year.

Revenue during 1994 was $126.3 million, 4.3% ahead of the previous year.

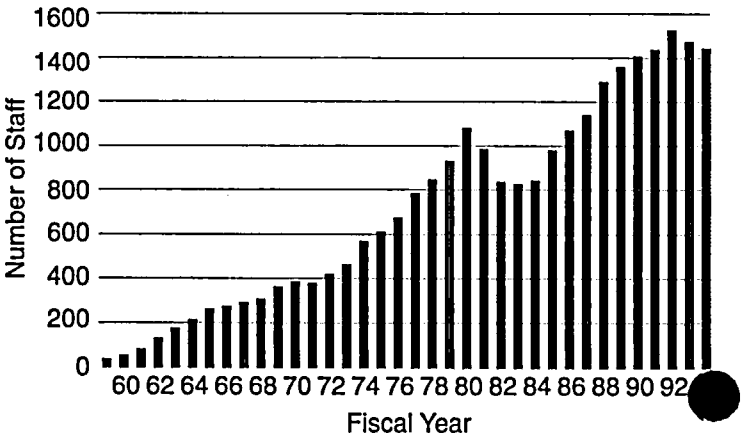
At the end of the fiscal year, on September 30, RTI's regular staff included 1,442 people, compared with 1,472 a year earlier. Almost three-quarters of RTI's staff are professionals and technicians working in research, development, and technical services.

Public health and medical research for the U.S. Department of Health and Human Services remained the largest category of research activity at RTI. DHHS revenues for 1994 were $49.9 million, or 2.2% higher than in the previous year.

RTI experienced substantial growth in policy-related research and technical services for a wide variety of federal agencies, companies, and state



1994 Revenue



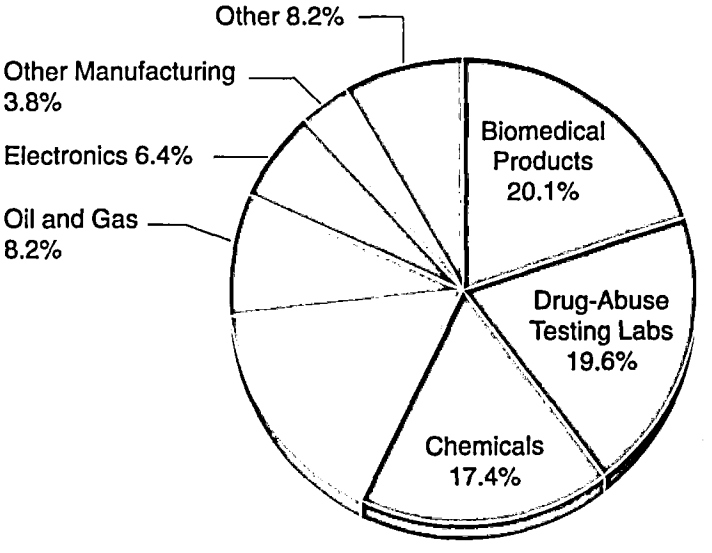
RTI Staff

and local governments. The most rapid growth was in work for the U.S. Agency for International Development, which accounted for $14.9 million of revenue (up 55% from the previous year) and for the U.S. Department of Education ($6.8 million, up 19%).

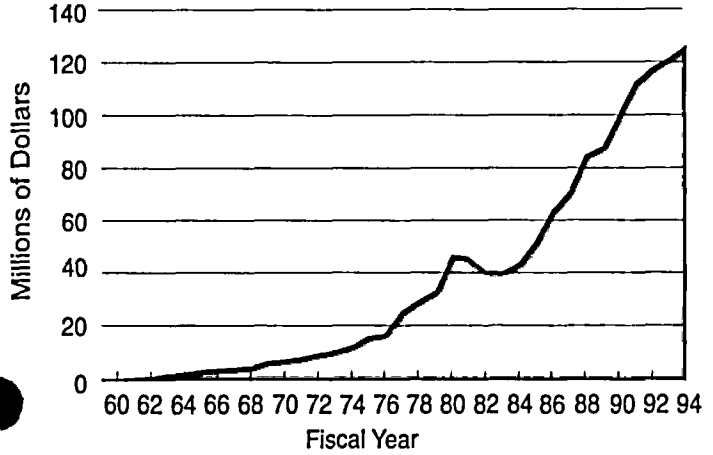
Research and technical services for environmental protection continues to be among the highest priorities at RTI. The Environmental Protection Agency provided $17.6 million of RTI's funding in 1994, down 12% from the previous year. RTI also conducts environmental technology R&D for the U.S. Department of Energy, which accounted for 1.7% of RTI's revenue in 1994.

Work for organizations such as the U.S. Department of Defense and NASA focuses primarily on advanced technologies and accounted for $11.9 million of revenue in 1994, a 2.6% increase over the previous year.

RTI's services to industry closely reflect the mix of priorities and topics within the federally funded research. Revenue from the private sector remained essentially flat compared with the previous year, at $17.1 million. This work is for companies in industries such as biomedical products, electricity generating, chemicals, electronics, manufacturing, and service industries.



1994 Industry Revenue



RTI Revenue

Research Organization

Board of Governors

Executive Committee

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Governance and Corporate Officers

BOARD OF GOVERNORS

Of the 29 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; two are specified in the Bylaws: William C. Friday 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; up to 15 Governors are selected from the business and scientific communities.

Chairman:
Earl Johnson, Jr.,* Chairman,
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Executive Committee Chairman:
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Nancy Birdsall, Executive Vice President InterAmerican Development Bank, Washington, DC

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

[redacted]rman L. Christensen, Jr.,* Dean, School of the Environment, Duke University

Ivie L. Clayton,* Business Consultant, Raleigh

Pedro Cuatrecasas, President, Parke-Davis Pharmaceutical Research, Ann Arbor, Michigan

Earl H. Dowell, J.A. Jones Professor and Dean, School of Engineering, Duke University

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Eugene J. McDonald, President, Duke Management Company

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Charles E. Putman,* Senior Vice President for Research Administration and Policy, Duke University

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Phillip J. Stiles,* Provost and Vice Chancellor, North Carolina State University

Gail R. Wilensky, Senior Fellow, Project Hope, Bethesda, Maryland

F. Thomas Wooten,* President, Research Triangle Institute

Phail Wynn, Jr., President, Durham Technical Community College, Durham

Members of the Corporation
The Members are the equivalent of RTI shareholders. As such, they elect the Governors who represent the business and scientific communities.

The Members of the Corporation include: the chairmen and presidents of The University of North Carolina and Duke University and representatives elected annually from and by the Duke University Board of Trustees and the Board of Governors of The University of North Carolina.

Members of the Corporation representing Duke University are: John A. Forlines, Jr., Granite Falls; Nannerl O. Keohane, Durham; Thad B. Wester, Raleigh.

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

Corporate Officers
RTI officers, including the research vice presidents listed on page 26, are elected by the Board of Governors.

F. Thomas Wooten, President

Alvin M. Cruze, Executive Vice President

William H. Perkins, Jr., Vice President, Finance

Rick C. Sisson, Treasurer

Walton J. O'Neal, Controller

Woody H. Yates, Assistant Treasurer

Suzanne P. Nash, Corporate Secretary

Carolyn J. Harris, Assistant Corporate Secretary

** Member, Executive Committee*

Research Programs

RESEARCH TRIANGLE INSTITUTE

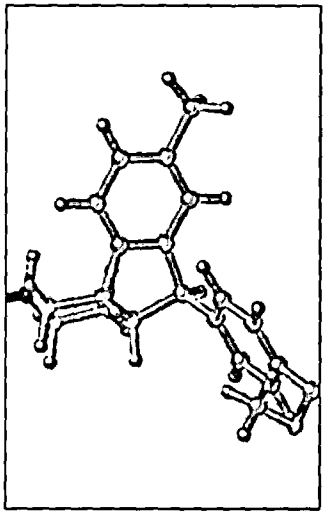
Research Triangle Institute is an independent research institute that serves government and industry clients in the U.S. and abroad. With a staff of 1,450, RTI conducts research in public health and medicine, environmental protection, advanced technologies, and public policy. Scientific disciplines at RTI include applied statistics, social sciences, environmental sciences, electronics, physical sciences, engineering, chemistry, and life sciences. RTI was established in 1958 as the initial R&D center in the Research Triangle Park.

SOCIAL SCIENCES AND INTERNATIONAL DEVELOPMENT

Applies economic, sociological, psychometric, and policy analysis methods to develop policies for governments and companies. Studies education, social welfare, environmental protection, public utilities, and economic development.

STATISTICS, HEALTH, AND SOCIAL POLICY

Conducts collaborative research on public health, medical, environmental, social, and other areas of public policy and research. Designs and carries out scientific sample surveys, epidemiologic studies, community-based research, and clinical research. Provides evaluations of products and programs for public- and private-sector sponsors. Evaluates the effectiveness of national, regional, and local initiatives. Provides specialized data capture, management, and analysis for statistical, social, and policy research.



CHEMISTRY AND LIFE SCIENCES

Designs, makes, and assesses pharmaceuticals; abused drugs; and agricultural, industrial, a environmental chemicals. Performs research in synthetic and bioorganic chemistry, metabolism, immunology, toxicology, and polymers.

ANALYTICAL AND CHEMICAL SCIENCES

Develops fundamental analytical methods and applies them in research on pharmaceuticals, pollutants, toxicology, and industrial processes.

ELECTRONICS AND SYSTEMS

Develops electronic technologies for aerospace, manufacturing, and medicine. Technical areas include materials and devices, reliable high-performance systems, graphics, communications, automation, software engineering, and computational intelligence.

ENVIRONMENTAL SCIENCES AND ENGINEERING

Develops basic information, regulatory strategies, and new technologies for environmental protection. Provides environmental measurements, quality assurance, risk assessment, technology assessment, chemical engineering, indoor and outdoor air quality analysis, pollution prevention, and contamination control.

AN OVERVIEW OF RTI

Research Triangle Institute (RTI) is an independent 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.

For clients in government and industry, RTI conducts applied and basic research in public health, medicine, the environmental protection, advanced technologies, and public policy.

ORGANIZATION AND STAFF

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

Almost three-quarters of the 1,450-person staff are professional and technical specialists in research, development, and technical sevices. Two-thirds have advanced degrees, and their backgrounds include more than 115 degree fields. 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 of survey methodology.

Mathematics, Statistics, and Computer Sciences: data management and analysis, statistical methods development and analysis, biostatistics, clinical trials, epidemiology, computer-aided engineering, systems software, software verification, computer assurance, modeling, and virtual reality.

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

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, semiconductor, chemical, biochemical, energy, industrial, mechanical, manufacturing, materials, biomedical, aerosol, civil, petroleum, aeronautical, and transportation engineering.

UNIVERSITY AFFILIATIONS

RTI was created as the first scientific organization of North Carolina's Research Triangle Park, a science park based on the strengths of three universities.

RTI's capabilities are supplemented by frequent collaboration with university scientists. Additional relationships include adjunct faculty appointments and cooperative research.

LABORATORY AND OFFICE FACILITIES

RTI's main campus includes 565,000 square feet of laboratory, computer, and related facilities. RTI also has facilities at project locations in the U.S. and abroad.

COMPUTER FACILITIES

In-house facilities for data management/analysis, modeling, software R&D, computer-aided engineering, and laboratory management include networked microcomputers, a computer center, and daily traffic with national and regional scientific networks.

INFORMATION SERVICES

RTI Information Services provides on-line access to in-house and external databases. RTI subscribes to more than 1,200 professional periodicals and maintains specialized libraries in its research buildings.

RTI staff use the Research Triangle Libraries Network, a 10 million-volume, 89,000-periodical collection with an on-line cross-catalog, fax and on-line document access, and daily delivery.

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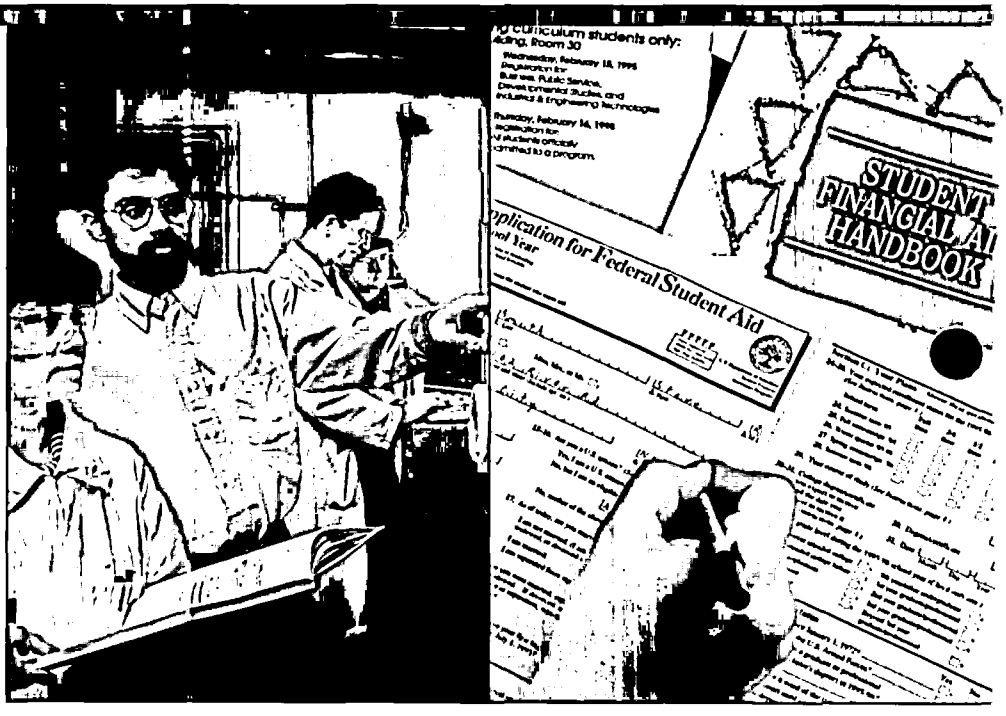

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