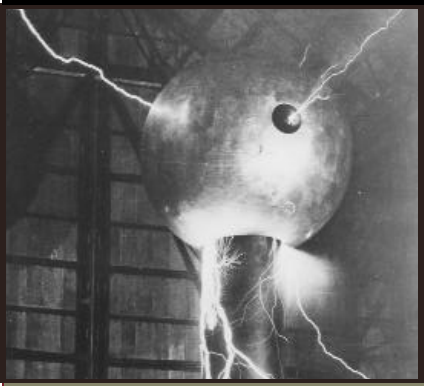



RESEARCH CORPORATION 2002 ANNUAL REPORT

For the Advancement of Science:

A HISTORY OF GRANT PROGRAMS at Research Corporation

1912 ▪ 2002

~ NINETY YEARS IN THE SERVICE OF SCIENCE ~

RESEARCH CORPORATION is the fulfillment of the unique philanthropic concept of scientist and inventor Frederick Gardner Cottrell, who established the foundation in New York State in 1912 with the assistance of Charles Doolittle Walcott, Secretary of the Smithsonian Institution.

One of the first philanthropic foundations in the United States, Research Corporation was chartered to "make inventions and patent rights more available and effective to the useful arts and manufactures," and to devote the net earnings of the corporation to providing "means for scientific research and experimentation" at scholarly institutions. Research Corporation has continued its philanthropic mandate through its endowment following the separation of its technology transfer operations to Research Corporation Technologies.■

PRESIDENT'S MESSAGE

THE FOLLOWING OVERVIEW of the grants programs of Research Corporation skims the surface of activities that span more than eighty years. The true and lasting importance of the foundation's awards and initiatives await a more thorough analysis of the impact they have had on the course of careers and on science itself.

From my review, it is apparent that the foundation's grants fall into two categories, namely those few that were *revolutionary*, and those in the majority whose impact was *evolutionary.* In the former class, funds that went to Grote Reber were fundamentally responsible for establishing radio astronomy as an important and new branch of astronomy. The creation of The Five College Observatory in 1960 had a revolutionary impact as will the funding for the Large Binocular Telescope. In the field of public health and medicine, the effort to eliminate beriberi on a world-wide scale, the initiation of the Mothercraft Program in Haiti, and several other legacies of the Williams–Waterman program represent defining moments in history in which Research Corporation played a leading role. Several of our Venture Grants and departmental development efforts have likewise played catalytic and critical roles in the lives of individuals and institutions.

Awards that we point to with considerable pride, such as the funding the foundation provided in its early years to Robert Goddard to support his research in the fledgling field of rocketry, the grants to E.O. Lawrence for the cyclotron, or to Robert Van de Graaff for his generator were certainly enabling. However, they responded to concepts and needs that were well along and we served as an important catalyst for programs that were in progress. Our role was evolutionary, not revolutionary in these instances. The same is probably true of most of the thousands of start-up grants that we have made to beginning faculty members in colleges and universities around the world. Nonetheless, the impact of each grant that the foundation makes has the potential to play a revolutionary role in the life of the principal investigator.

As we approach the end of the foundation's first century, science remains one of mankind's most exciting and important intellectual pursuits. It is a social force that will dictate the terms of our prosperity and survival. As a science foundation we will continue to have an important, perhaps defining, role to play if we use our wisdom and resources to "make a difference." That is the challenge that we collectively must address.

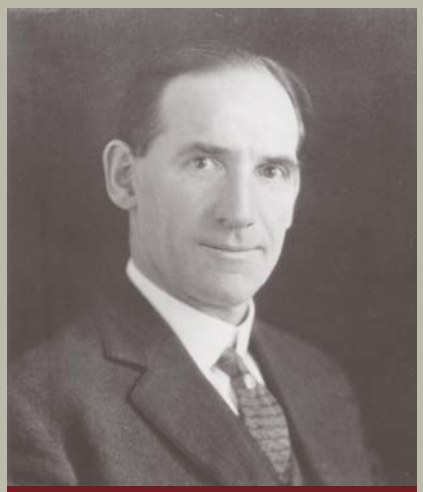
JOHN P. SCHAEFER
PRESIDENT

For the Advancement of Science: A HISTORY OF GRANT PROGRAMS AT RESEARCH CORPORATION

By John P. Schaefer

It is probably as risky to rely upon a single biography to paint an image of a man as it is to assess someone's character from an isolated photograph. In both instances, the biases of the artist or writer inescapably influence our conclusions. Similarly, experiences, and prejudices of the reader or viewer lead to differing interpretations of the same information. Given that caution, the biography of Frederick Gardner Cottrell by Frank Cameron (*Cottrell: Samaritan of Science*) is a portrait of the philanthropist–inventor that is certainly consistent with his actions, his work, and the dreams he occasionally shared with those around him.

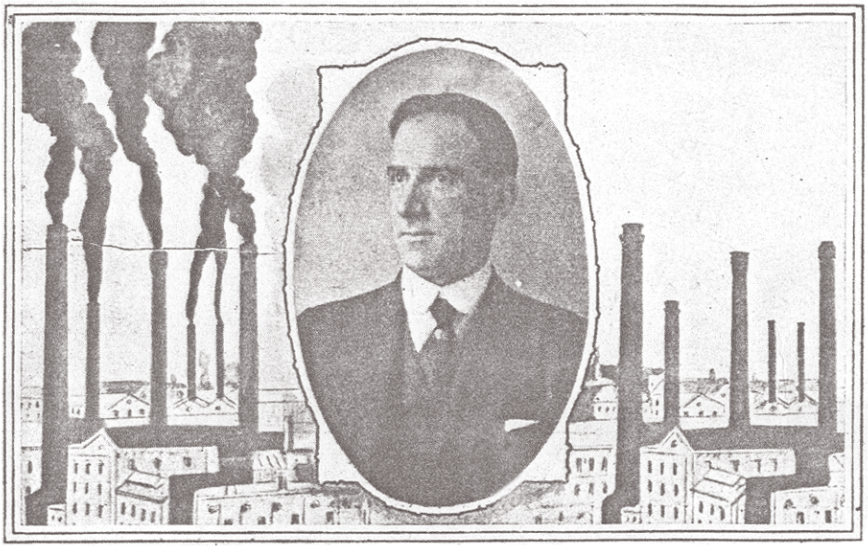
"Cott," as his friends called him, was born in modest circumstances in Oakland, California in 1877. He was a bright, curious student, fascinated by science and technology at an early age. As an eleven-year-old he was an avid reader of publications such as *Scientific American* and spent time with his father building induction coils, batteries, and whatever fanciful devices were described. On one occasion he built himself a simple camera and circulated a notice advertising "F. G. Cottrell, Landscape Photographer — real estate work a specialty." To earn spending money, he also offered his services as a competent electrician who could install doorbells, and ran a small print shop in his basement.



FREDERICK G. COTTRELL

At the age of thirteen he began to publish a weekly flyer for subscribers called *Boy's Workshop,* "dedicated to the public in general and boys in particular." Its four pages provided instructions for projects such as how to build a simple telegraph, how to detect alum in bread, and how to bleach ink. In the 1890 Christmas issue of the *Workshop,* he ran a story on "the deposition of smoke and dust by electrical aid" — almost certainly a reference to the work that Sir Oliver Lodge, with mixed success, was doing in England. Fifteen years later the ultimate solution to the problem was to be Cottrell's great contribution to science and technology.

His views on the uses and obligations of wealth were remarkable for a thirteen-year-old. In one issue of the *Boy's Workshop* he wrote, "Among men who have made the best use of their money is Stephen Girard, who erected and endowed the noted Girard College at Philadelphia, Pennsylvania." And under the heading of "A Noble Man": "It is with deepest regret that we learn of the death of Charles Pratt, the founder of the Pratt Institute and the friend of every institution of learning. . . . As a man he performed his work in life in such a manner that it left nothing to be desired. He did his duty not in the restrictive sense of the word



AN ILLUSTRATION FROM THE JULY 3, 1920 ISSUE OF SCIENTIFIC AMERICAN, SHOWING THE EFFECTS OF COTTRELL'S ELECTROSTATIC PRECIPITATOR ON SMOKESTACK EMISSIONS.

but in its broadest and noblest meaning." A similar statement could easily apply to the founder of Research Corporation at his life's end.

Cottrell was a brilliant student with a clear aptitude for science. As an undergraduate at Berkeley, the faculty often called on his skills to build or fix complicated scientific equipment. After graduation he taught high school in Oakland for a few years, then went to Germany where he worked first with Jacob Henry van't Hoff, then with Wilhelm Ostwald, with whom he wrote a thesis and received his Ph.D., summa cum laude, in 1902. He returned from Germany to a faculty position in chemistry at the University of California and began his academic career.

Cottrell's genius was his extraordinary breadth of scientific knowledge and his ability to apply lessons learned in one branch of science to a new problem in an entirely different field. This talent made him an invaluable consultant, though some criticized him for a lack of focus and his pursuit of whatever issues intrigued him at the moment. It was this latter skill that made him such a valuable catalyst for identifying individuals and projects that were in need and merited support, a characteristic that he melded into the personality of Research Corporation.

POLLUTION, PATENTS AND PHILANTHROPY

At the beginning of the 20th century industrial America faced a serious environmental crisis. Smokestack emissions were wreaking havoc in cities and the countryside, fouling the air with poisonous fumes, denuding the landscape, and enveloping corporate America in an avalanche of costly lawsuits. For example, during normal operation at the Anaconda smelter in Montana, 3200 tons of sulfur dioxide, 200 tons of sulfur trioxide, 30 tons of arsenic trioxide, 3 tons of zinc, and over 2 tons each of copper, lead, and antimony trioxide were being emitted from the smokestack *every day*! It was Cottrell, in a story too long to relate here, who found a solution with his invention of the electrostatic precipitator. And in the spirit of those he so admired when he wrote his articles for the *Boy's Workshop* he donated his patents in 1912 to create the first science foundation, Research Corporation.

The stated purposes of Research Corporation were to make inventions and patent rights "more available in the useful arts and manufactures" and to provide the means for "technical and scientific investigation, research and experimentation" by contributing the earnings of the corporation to scientific and educational institutions. The concept was so appealing that influential leaders of America's largest corporations (Arthur D. Little, T. Coleman du Pont, Elon Hooker, Elihu Thompson, James Storrow, for example) agreed to be founding members of the board of directors, fund the fledgling organization, and serve without compensation to achieve its ends. The first and obvious task was to create a stable business that could provide the world with needed services and the foundation with funds to carry out its objectives.

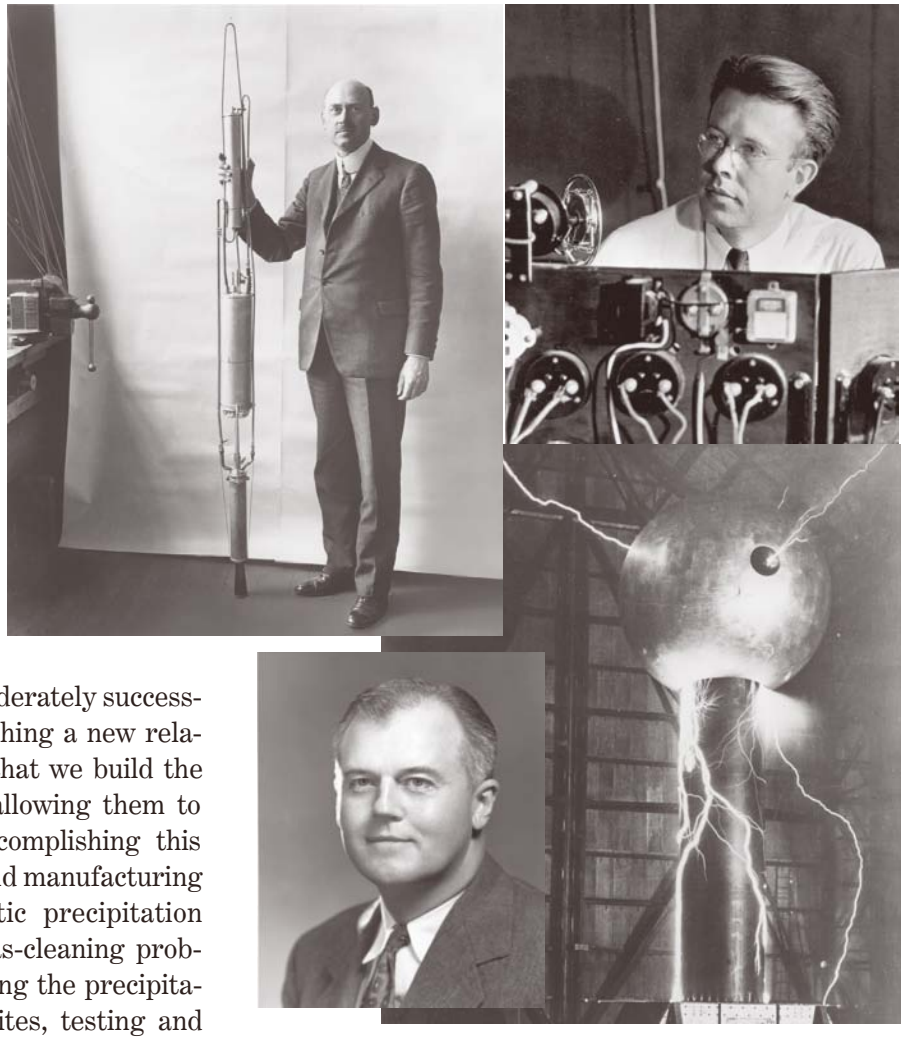
Research Corporation, unlike foundations created by gifts of money, securities or other income-producing property, could not fulfill its charitable purposes until it established a business producing the reserves and income to support its philanthropies. For the first quarter century the foundation was only peripherally involved in funding research in the sciences. The early years were focused on establishing

the electrostatic precipitator business and generating sufficient funds to stabilize and grow the fledgling company. The expertise developed in patenting and licensing needed to protect Research Corporation's own intellectual property proved to be a major attraction to many inventors in the university community.

The original endowment of Research Corporation consisted solely of the patent rights donated by Frederick Gardner Cottrell and his associates. Development of these intangible rights into an income-producing property first took the form of licensing Cottrell's patents to industry — a strategy which proved to be only moderately successful. A 1919 report refers to establishing a new relationship with customers, "namely, that we build the precipitators ourselves instead of allowing them to blunder through the process." Accomplishing this meant building up an engineering and manufacturing organization to design electrostatic precipitation installations suited to particular gas-cleaning problems, then fabricating and assembling the precipitators, erecting them at industrial sites, testing and guaranteeing them.

For its first fifteen years Research Corporation was operated almost solely as a business. Within two years of its incorporation it had repaid without interest or other gain the $10,100 invested by the original board of directors, thereafter reinvesting almost all of its earnings in the business.

From the outset, Cottrell's involvement with the management of Research Corporation was peripheral, though his vision dominated its philosophy and evolution. After a few years on the faculty, he left the University of California and spent most of his professional career in the U.S. Bureau of Mines and the Department of Agriculture where he worked on a number of important scientific and technical problems. As an "ambassador at large" to science for Research Corporation he had a remarkable ability to find and recommend support for people who were doing pioneering work in the fields of chemistry and physics.



EARLY GRANT RECIPIENTS OF THE FOUNDATION INCLUDED, CLOCKWISE FROM TOP, ROBERT H. GODDARD (1925), ERNEST O. LAWRENCE (1938), AND ROBERT VAN DE GRAAFF (1933).

Much of the work supported during this and the earlier period was as significant as it was varied. It ranged from experiments in low temperature physics at Harvard to the acquisition of a magnet for Ernest O. Lawrence's first large cyclotron; from aid to Robert H. Goddard in building his liquid-fueled rocket to development of the Van de Graaff generator, an early tool for nuclear research. In 1925 the foundation inaugurated the Research Corporation Award which was to be given "to a scientist whose unselfish devotion to his work merits public recognition." The award was one of the few major science awards at the time of its inception and was presented to prominent scientists such as Werner Heisenberg (1929), Van-

ROBERT R. WILLIAMS (LEFT) AND ROBERT E. WATERMAN SUCCESSFULLY SYNTHESIZED VITAMIN B_1 IN 1935. THE PATENT ROYALTIES FUNDED RESEARCH CORPORATION'S FIRST FORMAL GRANTS PROGRAM.

nevar Bush (1938), and Charles H. Townes (1957). Nine awards were made prior to World War II, then annually until 1969.

THE CREATION OF A GRANTS PROGRAM

By 1928 a fund of $116,000 had been accumulated from the profits of the precipitator business. Grants made by the foundation prior to 1928 were sporadic and few. A fellowship was granted in 1917 and a small number of grants were made beginning in 1920. Grant making became a recognized activity in 1928 when, for the first time, the foundation carried on its books an entry for grants paid. Amounts awarded for scientific research projects from 1928 through 1940 ranged from $23,000 to $96,000 a year, but there were no defined grant programs.

In 1935 a new source of income for the foundation was provided when Robert R. Williams, Robert E. Waterman and their associates, following Cottrell's example, gave Research Corporation their patents on the synthesis of vitamin B_1. This occurred amid intense discussion of whether it was moral to patent vital discoveries related to making a vitamin. Patenting was later shown to have encouraged the capital investment necessary to reduce the cost of the vitamin severalfold, thus making it available to large populations of the world. The royalties on the invention, after a small share to the inventors, went toward the charitable purposes of Research Corporation and to support its first grant program.

VITAMIN PATENT FUNDS FIRST FORMAL PROGRAM

While full credit must go to Cottrell for originating the concept of Research Corporation, the foundation owes its ultimate success to the dedication and business acumen of its founding directors and the engineers who refined and perfected the electrostatic precipitator. Without them, Cottrell's vision would not have been realized. From the perspective of the Research Corporation grants programs, R. R. Williams justifiably deserves credit as the foundation's most important figure in that realm.

Robert Williams was born in Nellore, India where his parents served as Baptist missionaries. As a boy he witnessed the effects of malnutrition, and the eradication of its causes became a major focus of his life. His family returned to the United States in 1896, enabling him to attend secondary schools in Kansas before enrolling at the University of Chicago. After a brief stint as a teacher in the Philippines, Williams joined the Manila Bureau of Science and began a twenty-five-year search for the cure for beriberi. During World War I he was employed by the Bureau of Science in Washington, D.C. to work on war-related projects, and later took a job at Bell Labs where he served for twenty years as director of chemical research.

Independently, Williams pursued the synthesis of vitamin B_1 and successfully achieved it in 1935 with the aid of Robert Waterman and other associates. The patents were given to Research Corporation with the understanding that the major portion of the generated revenues would be used to establish a research program dedicated to combating dietary diseases. The *Williams–Waterman Fund for the Combat of Dietary Diseases* became the foundation's first organized grants program in 1940 and continued to be a cornerstone of the its programs until 1978.

THE WILLIAMS–WATERMAN FUND FOR THE COMBAT OF DIETARY DISEASES

The Williams–Waterman Fund for the Combat of Dietary Diseases is ostensibly the most important grants program in the foundation's history. Its achievements have had a permanent impact on the well-being of mankind, and royalties generated from the vitamin B_1 patents helped to launch several other important initiatives of the foundation. The structure designed to administer the Williams–Waterman fund was adopted by the foundation and became the modus operandi still utilized in the foundation's current operations.

Accomplishments of the Williams–Waterman program include the enrichment of flour, cornmeal, and other cereal grains in the United States and legislation to that effect, the wiping out of pellagra and riboflavin deficiency common among the malnourished, and the conquest of beriberi worldwide.

As had been characteristic of Research Corporation from the outset, grants were made to support both basic and applied research. The first Williams–Waterman grants were made in 1940 and dealt with subjects as diverse as thiamine metabolism, regeneration of serum albumin, basic minimum daily requirements for vitamins, and the nutritional requirements of women during pregnancy, to the treatment of pellagra in poor communities and the development of hybrid corn with high niacin content. During the lifetime of the program over 400 projects were funded.

The fund's largest grant was made in 1971 to the Institute of Nutrition of Central America and Panama (INCAP), the premier research and training institution for Central and Latin America. Over $2 million in funds committed to INCAP supported graduate education in the nutritional sciences and for basic research in allied areas. The program produced generations of scientists who now populate institutions throughout Latin America.

THE ELIMINATION OF BERIBERI

The Williams–Waterman Fund also became an active advocate for cereal enrichment programs, both in the United States and abroad. For example, starting in 1942, over $200,000 of funding was provided to Clemson University to fund a broad-spectrum program to enrich bread and flour in South Carolina. Small mills were developed and thousands sold to millers at cost to enable them to blend a premix of niacin, iron, thiamine and riboflavin into the flour they produced. As a consequence diseases such as pellagra are now virtually unheard of in this country. Research Corporation, through the Williams–Waterman Fund, was actively involved in seventeen projects worldwide to establish similar programs.

The efforts of the program to eliminate beriberi as a disease are probably one of the program's — and Research Corporation's — most important accomplishments. An extensive study of the relationship between vitamin B_1 deficiency and beriberi was carried out with funding from Research Corporation in what is now known as the Bataan experiment. Nearly 100,000 people were involved in a controlled study measuring the efficacy of vitamin B_1 rice enrichment. While aspects of the study were criticized, the overwhelming conclusion was that beriberi did not arise as a disease when an adequate amount of vitamin B_1 was part of the normal diet.

Williams expressed the philosophy that guided the Williams–Waterman fund in his 1956 book that reviewed the program. "The decision was to spend rather than conserve for the future," he wrote. Current needs "were as great as they were likely to be some decades later." Rather than build a "Williams–Waterman Endowment" the foundation chose to dedicate its resources to an aggressive program that responded to the obvious challenges and opportunities of the time.

Over the fund's thirty-eight years of operation grants of more than $12 million were awarded (a present value of about $66 million) to a spectrum of basic and applied research initiatives. The fund also contributed 25 percent of the royalties received from its patents to Research Corporation for the support of the foundation's other grant programs. In every sense the Williams–Waterman Fund remains a formative landmark in the history of Research Corporation. It set rules and a pattern for giving, and demonstrated a willingness to venture into areas where the application of science to social problems could provide tangible benefits to mankind.

MOTHERCRAFT CENTERS FIGHT MALNUTRITION

Another significant achievement of the Williams–Waterman program was the creation of Mothercraft Centers in the Caribbean and Central America. José María Bengoa, a Venezuelan physi-

UNDER THE WILLIAMS–WATERMAN PROGRAM, MOTHERCRAFT CENTERS WERE SET UP HAITI AND PROVIDED A MEANS THROUGH WHICH ENRICHED FOODS COULD BE DISTRIBUTED TO MALNOURISHED CHILDREN. MOTHERS WORKED WITH A PROGRAM FACILITATOR AND WERE GIVEN INSTRUCTION IN SELECTING AND PREPARING FOOD AND IMPROVING SANITATION PRACTICES.

cian, first proposed the concept in 1955 before he became head of the Nutrition Section of the World Health Organization. Research showed that children provided with adequate nutrition during the first months of life exhibit a dramatic increase in survival rates, mental development, and have an increased likelihood of growing into healthy adults.

Examination of preschool children in the Fond Parisien region of Haiti revealed that nearly 60 percent of the children suffered from serious malnutrition that would result in death for the majority. Research identified mixtures of locally grown cereals and legumes that would bring severely malnourished children back to health, and infant foods were developed that would provide a child with adequate amounts of very high-quality protein. Mothercraft Centers were set up in a village home to provide a mechanism through which these foods could be fed to children at a cost of no more than ten cents per day per child.

Mothers worked with the program facilitator, received help selecting and preparing food, and were given simple instructions for improved sanitation practices at home. After five years the results obtained were remarkable: fatal malnutrition among preschool children in the village had been eradicated. Subsequent studies showed that the dietary status of the village as a whole had improved measurably. Furthermore, the successes achieved in Fond Parisien were replicated in numerous other centers. The model pioneered by support from the Williams–Waterman Fund has been used on a worldwide basis and is cited by the Agency for International Development as one of the most successful aid programs in the world.

THE POST-WAR GRANTS PROGRAM

> The granting of funds for scientific research is the principal reason for the being of our Corporation and the earnings of the precipitation business and of the Division of Patent Management are the means whereby the products of scientific research are accumulated for distribution to the support of scientific research.
>
> —*Research Corporation Annual Report, 1946*

Prior to 1946 there were no formal guidelines for consideration of proposals for grants from general funds. Grants funds, which depended on the Corporation's net earnings, were drawn from money made available annually for that purpose. Frequently the funds were applied to projects in which Research Corporation had a direct financial or other interest (for example, patent rights to the Van de Graaff generator and the cyclotron), though there was usually no requirement that the rights to any inventions be given to Research Corporation. While the total amount of funding provided to the academic community prior to World War II was slightly in excess of a

million dollars, its impact was clearly significant and played a key role in areas as diverse as rocketry, pharmaceuticals, atomic structure, nuclear magnetic resonance, and molecular beam research. (It is interesting to note that approximately one-third of the funds granted up until 1945 went to the support of the Smithsonian Institution and the International Auxiliary Language Association). A review of grants made in 1945 indicates that support was provided in widely varied fields including astrophysics, chemistry, engineering, mathematics, electronics, psychology, nuclear physics, and medicine.

During the war years, privately sponsored and independent research in the United States essentially ceased to exist. The ability to do fundamental research in academic institutions was severely impaired as research laboratories were moved, research teams separated, and lines of communication were lost or forbidden due to the war effort. In addition, scientists returning from wartime laboratories had new expectations and visions for their research that required new resources. With the war's end, the nation's colleges and universities faced a long and difficult task of scientific reconversion and rehabilitation.

When World War II ended, the foundation's investment portfolio stood at about $6 million. The board of directors acted in 1945 to make the first commitment to a formal grants program — a five-year program of special grants-in-aid for post-war scientific research, for which they set aside $2,500,000. The program was named in honor of the founder (Frederick Gardner Cottrell Research Grants) and was designed "to provide incentive for the return to academic pursuits of the younger scientists and technically trained personnel who had been drafted into war research, war industry and the armed forces," and was directed toward "assisting smaller colleges and universities in securing assistance and equipment for projects in physics, chemistry, mathematics and engineering." The board also named Robert R. Williams as the first director of the newly created Grants Division.

As director of the Grants Division, Williams' research and administrative experiences at Bell Labs and elsewhere were quickly transferred to the structures he established at Research Corporation. Committees of experts were appointed to review and evaluate formal proposals. Charles (Hap) Schauer, who served as the first secretary to the Grants Advisory Committee, was appointed as assistant to Williams. Schauer traveled extensively to assess academic institutions and individuals. This led to the establishment of regional representatives who were strategically placed in field offices across the country to minimize travel. Intimately involved in all aspects of the grants-making process, they were the eyes and ears of the foundation until 1982 when the regional offices were consolidated.

Awards were peer-reviewed and based upon the scientific merit of written proposals, institutional need, and "the war record of the applicant." In the first year 175 applications were received and 101 proposals were funded. Grants were restricted to investigators at liberal arts colleges and smaller universities. That focus has remained at the core of the grants program throughout the history of the foundation.

PROGRAM DIVERSIFICATION IN THE FIFTIES

During the latter part of the 1940s Research Corporation sponsored three grant-making activities: The Williams–Waterman fund, the Cottrell Research Grant (CRG) program, and the General Grants program for which projects were "valued primarily for their prospective contributions to knowledge rather than for stimulus to the quality of teaching."

By 1950 the five-year Cottrell Research Grant program to help attract young scientists back to academic positions was judged to be a success and its objectives achieved. The experience of working closely with liberal arts colleges and smaller universities led the grant staff, officers and directors to conclude that there were significant opportunities for Research Corporation to strengthen and advance science by providing continuing support for basic research in these institutions.

Four minor programs were also added in the mid-fifties:

The West German Grant Program was initiated in 1954 using funds available from the vitamin B_1 patents that had accumulated in Germany during the war. The monies were used to support the rebuilding of science departments in West German universities. The program was in place from 1954 to 1960 and disbursed over $295,000; two of the grant recipients eventually became Nobel laureates.

The Howard Andrews Poillon Fund, which continued through the mid-seventies, was used by the

MICROBIOLOGIST ELIZABETH HAZEN (LEFT) AND ORGANIC CHEMIST RACHEL BROWN WORKED IN COLLABORATION TO PRODUCE THE FIRST ANIFUNGAL ANTIBIOTIC, NYSTATIN. THE PATENT RIGHTS WERE DONATED TO RESEARCH CORPORATION TO SUPPORT RESEARCH IN MEDICAL BIOSCIENCES.

president of Research Corporation to respond to needs outside of the formal programs, that were deemed worthy of support. The fund was named in honor of Howard Poillon who served as president of the foundation from 1927 until 1945. The International Rescue Committee (Dr. Thomas A. Dooley), radio astronomer Grote Reber, The Mathematical Association of America, and the Chesapeake Bay Center for Field Biology were included among the recipients of this discretionary award.

The Secondary School Program represented an initiative in the state of Connecticut to improve the quality of high-school science teaching. Operating for three-years, it offered teachers opportunities to attend summer workshops to enhance their understanding of science and provided equipment that could be used in the high school setting.

The Kendall–Hench Program was funded from royalties generated by Research Corporation's patents on cortisone, which were donated to the foundation by Edward C. Kendall and Philip S. Hench. The grants were intended to encourage research in allied fields, but the number of proposals received never rose to a significant level, and further royalties were used to support foundation programs.

THE BROWN-HAZEN FUND

The most significant new program of the 1950s was sponsored, like the Williams–Waterman Fund, by a team of scientists who wanted their patent royalties used for the advancement of their field. After a long and diligent research effort, organic chemist Rachel Brown and microbiologist Elizabeth Hazen, isolated and characterized the first known antifungal antibiotic, which they called nystatin. Both worked for the New York State Department of Health in Albany. Following the precedent set by Williams and Waterman, the intellectual property rights to nystatin were donated by Brown and Hazen to Research Corporation. The foundation obtained appropriate patent protection and licensed rights to manufacture the drug to numerous pharmaceutical companies.

Royalties began to flow to the foundation in 1956. Over the life of the patent and licensing agreements (1955–1976) more than $13.4 million in royalties were earned. Of these funds, $6.7 million went into the Brown–Hazen Fund and an equal amount went to the foundation for the support of its other programs. (Today the value of these funds would exceed $70,000,000).

With the guidance of Elizabeth Hazen, Rachel Brown, and Gilbert Dalldorf (director of research at the Albany laboratories) guidelines for the Brown–Hazen Fund were established. Grants were to be made to support research and training in the medical biosciences including medical mycology, biochemistry, microbiology, and immunology. Investigators to be supported were faculty and staff members — especially women scientists — in colleges, universities, and medical institutes.

For several years the Brown–Hazen program was the largest single source of nonfederal funding for training and research in medical mycology in the United States. Funds were utilized on a global basis to fund research programs in Canada, Mexico, Central America, Lebanon, Taiwan, Uganda, and the United Kingdom as well as the United States.

Sam Smith, who served as a Research Corporation member of the Brown–Hazen committee, commented on the problems of setting up a new grants program:

> It's a cliché among foundation people, but nevertheless still true, that giving away money wisely is a very hard thing to do. You

can invest in experienced individuals who have proven track records and expect to get results of high order. Or you can bet on promising youngsters, helping them to establish themselves in their chosen fields and bringing along a new generation of seasoned performers. The former is a low-risk investment with almost certain payoffs; the latter is high-risk but eminently worthwhile for those cases where the youngsters develop into true professionals making real contributions to their fields.

Those views represent the spirit in which Research Corporation has operated its grantmaking activities throughout its history.

THE VENTURE PROGRAM

From time to time our attention is directed forcibly to an individual who is regarded by his colleagues and competent scientists as exceptionally promising – as early leaders in their fields, who have the potential of being the great scientists of five, ten or twenty years in the future. Sometimes their names come up during visits to institutions. Frequently they are so designated by referees in making comment on applications for Research Corporation grants made by these men.

With the thought that a foundation of this character should try at all times to seek out the most effective means of using its funds, the Advisory Committee on Grants has recommended that a specified portion of the funds available for 1957 be set aside for use in experimental ways which might reinforce this concept of academic research in its purest sense.

— *Research Corporation Annual Report, 1956*

With this view in mind, the staff of the foundation began to look for individuals whom they felt had these characteristics. Although this program of Research Corporation had a short tenure (1957–1960) and less than three dozen awards were made, the list of grantees constitute a "Who's Who of Science" at the time and included physicist Eugene Parker, biophysical chemist Ignacio Tinoco, and organic chemist Gilbert Stork. Many alumni of this program became members of the National Academy of Sciences and one, Frederick Reines, was awarded a Nobel prize for his research.

The selection process for Venture Grants was primarily through nominations of individuals by distinguished scientists. In a few cases, a particularly promising applicant to the regular programs was awarded a Venture Grant. The awards were unrestricted and expenditures were left to the discretion of the grantee. Most of the awards were for $22,500, which translates into approximately $140,000 in current dollars. The Venture Grant initiative was redirected toward making institutional science development awards as other foundations launched similar programs geared to funding promising individuals.

CONCERNS SURFACE ABOUT GRANTS' BENEFITS

With the creation of the National Science Foundation in 1950 and the rapid growth of federal funding for the basic and applied research that followed, the issue of how a private foundation could provide meaningful support for the sciences became a growing source of concern. In the 1960 Annual Report of the foundation these sentiments were expressed:

There has been a great deal of soul-searching in Committee and on the part of the staff as to the continuing need for the project-type grant based upon formal application. There are many indications in published articles and news releases that massive federal funds are flowing into the areas with which these grants have been concerned, and this evidence would seem to suggest that these funds are flooding the fields in which Research Corporation has stood virtually alone for many years.

However, it seems probable that there will continue for some time to be a vital role for Research Corporation grants, at least at the far edges of this traditional program area. This will be in continuing to help initiate and maintain research in many smaller and more remote institutions, with particular reference to their newer and younger faculty members. At the other end of the spectrum, there will always be a need for the kind of support which has been another of Research Corporation's hallmarks – gambling funds to help men start in hazardous but promising new areas.

Two foundation actions followed as a consequence of these concerns: beginning in 1960

Research Corporation no longer made project grants to faculty members in the larger universities and the foundation began an aggressive program of departmental development efforts at selected colleges and small universities.

In 1961 the sentiment for funding project grants in the university community was further diminished. To quote from that year's annual report:

> It appears that, as with the project-type grant, there is a marked decrease in uniqueness and any real need to Research Corporation's small contribution toward unrestricted funds for the brilliant individual. Many others have entered this field, making it a competitive matter to see who gets there first. As early pioneers, we can quite gracefully retire and leave the field to newcomers.

At the same time the response to science development efforts was enthusiastic and viewed as a unique way of having an impact on an important but underfunded segment of the science community.

During 1963 only twenty project grants were made, all of them given at the discretion of the foundation's field representatives, not through the traditional application and review process. In 1965, responding to concerns that new faculty members at the larger universities were still experiencing difficulties getting their research careers started, the foundation published a guide to prospective applicants and began to accept proposals once again.

SCIENCE DEVELOPMENT AWARDS

The success of the Venture Grant effort in finding and supporting promising individuals suggested that expanding the basic concept to identifying and funding promising academic departments might prove to be an interesting new initiative for the foundation. To test the idea, a special college program was initiated in the southeastern United States. Several college faculties and administrations prepared proposals, members of the staff and selected consultants made institutional visits, and, after evaluation and consideration, some unrestricted grants were made.

The enthusiasm generated by these trial efforts was compelling; the foundation made the decision to expand the program and make it a mainstay of its activity for the years ahead. From 1960 to 1968 almost $5.5 million was given to eighty-one schools with grants ranging from $8,000 to $325,000. The Science Development Awards represented a decade-long effort of the foundation and were marked by

Science education concerns of the 1960s are still relevant . . .

Our principle concern is that the leaders of even the presently fine 50 to 100 liberal arts colleges do not fully appreciate the challenge that confronts them, do not fully realize how fast the sciences have advanced, and – with the outpouring of funds to the big universities – how much they have been bypassed in the on-rush of the sciences. If we are to look to these leading institutions as pacesetters for the liberal arts colleges, as we should, they must be challenged to raise their sights still higher by the assurance that far more financial assistance will be made available if they can present a substantial case for it. Research Corporation has found in working with the liberal arts colleges that objective outside interest, plus the stimulus of thorough self-study and the prospect of monetary aid, will encourage both science faculties and administrations to plan more boldly and to dedicate themselves to realization of their plans.

The critical element, of course, in any science program in the colleges is the quality of the faculty. This is primary to the stature of the science division and indeed to the stature of the college as a whole, whether in the sciences or the other academic departments. If the liberal arts colleges cannot offer the promising young scientist-scholar-teacher an opportunity to pursue his own research, they will not be able to attract or hold faculty of the caliber they need to be competitive. It is a fact of life in today's world that any young scientist must involve himself in research if he is to keep up and remain alive in his field.

Research has become a way of life in the sciences and it is critical that the liberal arts colleges provide the atmosphere for it. This means ample time must be given members of the science faculty for the pursuit of their own research programs. To be effective and meaningful, research must be made possible on a year-round basis – not merely during the summer months, in off-semesters or during sabbatical leaves, but as an on-going and continuing part of teaching

some notable successes. Science departments in prominent schools like Denison University, Furman University, Franklin and Marshall College, College of the Holy Cross, Hope College, Middlebury College, Occidental College, and St. Olaf College owe much of their current success to the catalytic role played by Research Corporation during a critical phase of their development.

A CHANGE OF FOCUS

In 1966 the foundation noted with pleasure that, following Research Corporation's lead, the Alfred P. Sloan Foundation committed $7.5 million to twenty liberal arts colleges for purposes parallel to those of the Venture Grants program. The National Science Foundation also announced its College Science Improvement Program (COSIP) which would make available approximately $10 million in its first year to support their programs for the broad development of their science departments.

It was also noted that the ratio of funding flowing to support of research in universities relative to liberal arts colleges was 100 to 1. Because the majority of students entering graduate programs in the sciences in the United States were graduates of liberal arts colleges, it was clear that support and development of these institutions was overwhelmingly in the national interest.

As other private foundations began to provide funding for the sciences in liberal arts colleges, and the National Science Foundation and other federal agencies made significant commitments to these institutions, Research Corporation once again considered how it might most effectively use its limited resources. After thoughtful consideration, the foundation decided to terminate the science development grant program in 1968. Its objectives — to strengthen faculties, integrate research programs into the liberal arts tradition, upgrade facilities and equipment, expand the perspectives of liberal arts colleges, and encourage external support of the sciences in these institutions — had been achieved.

In the same year the Williams–Waterman program was incorporated into the foundation's regular grants programs after its own funds had been depleted, and the decision was made to increase the funding allocated for individual project grants in both the liberal arts colleges and universities.

NEW TAX LAWS CHANGE FOUNDATION STRUCTURE

As tax laws in the United States evolved during the 20th century, the private foundation status of

These thoughts expressed in the 1966 Annual Report remain as apt today as then.

and scholarly life. Whether the colleges like this or not, this means that they must break drastically with many long-held concepts of teaching and administrative loads and other burdens that are placed on their faculties. They must of necessity dismiss any hope of maintaining balanced teaching loads between the other disciplines and the sciences. That is not to say that research should take precedence over the teaching function but rather that research should be made an integral part of the teaching process through active involvement of students in faculty-directed research.

A second critical element is the adequacy of science facilities. They are expensive, vary tremendously among the fields of endeavor that the scientist-teachers may wish to undertake, and are extremely difficult to identify.... Such facilities, in terms of good buildings and modern instrumentation, are essential not only for the faculty but for the students. They must be available first of all if there is to be faculty of high caliber. They must also be available if the students are to be caught up in the sweep of modern science and enabled to comprehend its significance to them personally and to the world they will live in, whether they make their careers in the sciences or in any other branch of adult activity.

It is Research Corporation's hope that the liberal arts colleges of the country can be helped to fully recognize the problems they face — particularly in the sciences, that they may be encouraged to draw programs sufficiently strong to meet these problems, and that both private and governmental funds can be made available to assist in the implementation. The liberal arts tradition is a long and respected one in the United States. It has within it a tremendous potential for continued contributions to society, but this potential cannot be realized if the colleges do not act imaginatively to bring the sciences up to the high level of their other academic departments. A liberal arts college excellent in all but the sciences will not long be able to claim excellence.

Research Corporation came into question. With the passage of the 1950 tax act it was clear that the foundation could no longer continue to operate the precipitator business and maintain its tax-exempt classification, even though the profits of the business were dedicated to charitable purposes. Consequently, in 1954, the foundation created Research–Cottrell as a tax-paying stock corporation that was wholly owned by Research Corporation.

The initial year of operation under the new structure proved successful and for the first time in its history the foundation had an "endowment" that it could dedicate to the objectives envisioned by Frederick Gardner Cottrell. As stated in the 1954 annual report:

> Good financial results such as these enable us to continue our important and sole objective – the support of scientific research and investigations dedicated to broadening scientific knowledge and extending the frontiers of science into the unknown.

An initial public offering of Research–Cottrell stock was made in 1967 and the process of divestiture of the foundation's holdings in the precipitator business began. The last of Research–Cottrell stock was sold by the foundation in 1982.

Meanwhile, complicating the foundation's planning, a question arose about one of its primary activities, the Invention Administration Program or Patent Program: Under the new tax laws, would this program continue to be a permissible activity for a tax-exempt foundation? Evidence was accumulating that it was not.

THE BEGINNINGS OF TODAY'S GRANT PROGRAMS

The decade of the seventies began on a wave of extraordinary optimism for Research Corporation. The foundation's assets were rapidly increasing as Research Cottrell stock emerged into the marketplace. Both the staff and directors began to seek new opportunities to pursue the foundation's missions.

In 1969, the foundation announced its decision to concentrate on the Cottrell program of project grants. It agreed to fund the program at approximately $2 million per year, a fivefold increase over the amount allocated at the program's inception. The focus of the program was primarily on young scientists in colleges and universities who wanted to initiate independent research efforts.

By 1971 it was evident that the limited financial resources available for funding research in the major universities was having an even more serious impact on the liberal arts colleges. The foundation initiated the Cottrell College Science Grants (CCSG) program while continuing to fund university faculty through Cottrell Research Grants (CRG) to address the growing funding crisis.

The CCSG program was "aimed directly at the private, predominantly undergraduate institutions as a means of reasserting the importance of research as a vital component of their academic programs," and included all of the disciplines in the natural sciences. Over $15.7 million in funding was distributed between 1971 and 1981.

The CRGs continued to focus on research being carried out in institutions with graduate programs. Disciplines supported included chemistry, physics, astronomy, engineering, and geology. A review of the grants made during this decade indicates that the greatest number of the $7 million in awards made under the CRG program went to investigators at the smaller institutions rather than at major research universities.

DEFICIT SPENDING PROMPTS REVIEW

Total foundation income reached a peak of $6.3 million in 1974, of which slightly more than $2 million was from royalties on the nystatin patent, which expired that year. In the following year, the total revenues were $4.1 million, mirroring the reduction in royalty rate from the license to Research–Cottrell in accordance with the 1954 agreement. From 1976 to 1978 total income continued to decrease as other patents expired, leaving the return on the investment portfolio as the major source of revenue for Research Corporation.

Anticipation of this income loss in the face of increasing demand for grant support prompted the directors in 1974 to establish a "program support" effort to bring added funds to basic research in the sciences through Research Corporation programs. This initiative had been introduced with the expectation that over the years it could become a substantial new source of money for grants, as well as enhancing the endowment to support future programs.

Despite these efforts, the excess of grants and expenses over income remained at high levels from 1975 to 1979, ranging from $1.6 to $2.4 million. Each

year the board determined that the contributions being made by the foundation to science and technology should be held at levels to meet defined program needs.

In October 1978, in approving another deficit budget for fiscal 1979, *the 23rd such since 1955*, the board voted to "direct the President to appoint a special committee of Directors to review the foundation's goals and objectives, to consider the various options available and to bring recommendations back to the Board." The result of this effort was the extensive Committee on Goals and Objectives report. Their study resulted in recommendations that would give the foundation direction in the years to come.

ENGINEERING STABILITY FOR PROGRAM SUPPORT

By 1982 the foundation's fund balance had fallen to less than half of what it had been in the early 1970s. Concurrently, the expenses of the Invention Administration Program from 1977 through 1981 significantly exceeded the income generated by the program and were an additional drain on the fund balance of the foundation. A further complication was that the Internal Revenue Service was seriously challenging the foundation's involvement in technology transfer, maintaining that it was not a tax-exempt activity.

Among the issues needing to be addressed were the stabilization of the foundation, the creation of a balanced budget, the resolution of issues surrounding the Invention Administration Program, and a review the scope and objectives of the grants program

Moving from New York City to Tucson and consolidating the offices that Research Corporation staffed around the country yielded immediate financial and structural benefits. After a careful analysis of options, the CRG program was terminated because the awards could not be funded at a meaningful level. The foundation's holdings in Research Cottrell stock were sold, and a wide-ranging examination of options available to Research Corporation for disposition of the Invention Administration Program ultimately led to special legislation from Congress. This enabled the foundation to create Research Corporation Technologies, a not-for-profit, tax-paying entity as a program-related investment that would carry out the technology transfer mandate of the foundation's charter.

New Programs for a New Era

COTTRELL COLLEGE SCIENCE AWARDS RECONFIGURED

In 1986 the Cottrell College Science Awards were opened to faculty from public undergraduate institutions as well private, and limited to chemistry, physics, and astronomy when funding for biology and geology was eliminated.

The origins of this program reflect a commitment first made in 1945 by the foundation to the liberal arts colleges as World War II ended. It was given a distinctive identity in 1971 with the creation of the Cottrell College Science Grants, then restricted to research programs conducted in the private undergraduate colleges. One motivation for the initiative stemmed from the knowledge that the majority of science majors attending graduate schools were the products of liberal arts colleges. This is a niche that was first spotlighted by Research Corporation and remains an arena in which it is still a dominant factor.

The foundation pioneered working with undergraduate institutions and has had a major impact on the quality of science education they offer. The Cottrell College Science Awards have been a consistently important program since its initiation and will continue to be a core activity in the foreseeable future. From 1995 to 2002, 626 awards were made for a total of approximately $20 million.

THE PARTNERS IN SCIENCE PROGRAM

With the passage of time and a growing endowment, the staff considered new initiatives for the grants program. The first to be launched was the Partners In Science Program in 1988. It was intended as a response to nationally expressed concerns about the quality of science education in secondary schools, the preparedness of high school science teachers in their subject matter, and the limited involvement of college and university faculty members with the high school community.

Partnerships were created between high school teachers and faculty members and two summers were spent in the laboratory or field doing scientific research. An annual conference was held during which teachers were afforded an opportunity to present their research and share their experiences. The program was national in scope and involved funding partners from both the foundation and corporate communities. The foundation also worked closely

HIGH SCHOOL TEACHERS WHO PARTICIPATED IN THE PARTNERS IN SCIENCE PROGRAM MADE PRESENTATIONS OF THEIR RESEARCH AT A YEARLY CONFERENCE.

with organizations across the country who had a clear commitment to improving the quality of science education in our schools.

After twelve highly successful years, Partners In Science was terminated in 1999, enabling the foundation to move on to new efforts with the satisfaction of seeing similar programs adopted by other organizations around the country. Now under the administration of longtime sponsor, the M.J. Murdock Charitable Trust of Vancouver, Washington, the program continues in much the same form in the Pacific Northwest. Similar initiatives also exist under the auspices of Columbia, Princeton and Rutgers Universities, and the NSF now makes comparable awards using a plan first proposed by Research Corporation in the mid-1990s.

RESEARCH OPPORTUNITY AWARDS

Initiated in 1988, this program addressed the problems of successful mid-career scientists in departments of chemistry, physics, and astronomy who lost funding for research for valid reasons, such as the return to teaching and research after an administrative assignment, a change of direction in research, or the termination of a agency program. Its primary goals were to seed a vigorous, competitive basic research program reestablishing the individual as a productive member of the scientific community, and to catalyze initial developments in a new research area that would bring a long-term resurgence of creativity to the grantee.

The program has always been modest in scope and in its first 15 years of operation 130 individual awards were made and slightly less than $3 million in funding provided to successful applicants. In 2002 a questionnaire was sent to Research Opportunity Award recipients still actively engaged in research and fifty-four responses were received. Respondents indicated by a large majority that the award had resulted in other external funding, led to publications, and had a great impact on their subsequent research efforts.

DEPARTMENT DEVELOPMENT AWARDS

This 1991 reinvention of the 1960s Science Development Program was motivated by a conviction that the foundation staff's knowledge and experiences could be used to accelerate the natural evolution and advancement of carefully selected college science departments. Awards serve to enhance the environment for research and are based on a mutually agreed-upon set of goals and significant financial commitments from both the institution and Research Corporation. Consultants are utilized by the foundation to work closely with the institution to develop long-range plans for the departments involved, with clearly defined milestones that must be achieved.

To date, awards have been made to the University of Wisconsin–Eau Claire, Hendrix College, Lawrence University, Bowdoin College, and Western Washington University. This program is demonstrably effective and should continue to be a major effort of the foundation in the future. As an example, a five-year award made to both the chemistry and physics departments at Hendrix College in 1992 provided funding for new faculty and technical staff positions,

A DEPARTMENT DEVELOPMENT AWARD TO HENDRIX COLLEGE ENHANCED THE ENVIRONMENT FOR RESEARCH, PROVIDED FUNDING FOR FACULTY AND EQUIPMENT, AND STIMULATED THE CONSTRUCTION OF NEW SCIENCE FACILITIES.

equipment and start-up funds for faculty. The award fostered extraordinary success in terms of faculty securing significant external support for research and enhancement of their academic programs. This productive partnership between faculty and the administration at Hendrix and Research Corporation also stimulated the construction of new science facilities. Their achievements in undergraduate research were recently recognized with a Heuer Award from the Council of Independent Colleges.

COTTRELL SCHOLAR AWARDS

The Cottrell Scholar program was created in 1994 and reflects Research Corporation's conviction that teaching, scholarship, and a commitment to furthering knowledge through an active program of research are values that should be encouraged and supported throughout the university community. An ongoing concern of the foundation has been the separation of research and teaching functions in the physical sciences in faculty hiring and in perceived expectations of responsibilities. However, there is also a growing awareness that the two functions are complementary rather than wholly or partially exclusive.

The Cottrell Scholar Awards seek to reinforce faculty mentorship, communication and collegiality in university science departments. Targeting faculty members who are beginning their careers, the awards aim to assist the recipients to become outstanding scientists and educators as well as tomorrow's academic and scientific leaders.

Research Corporation still believes the objective of encouraging the teacher-scholar is worth pursuing. This is an important program for the foundation and will be continued as we strive to make this a coveted prize for young faculty members. Since the first awards in the spring of 1994, 160 Cottrell Scholar Awards of over $9.4 million have been made.

UNIVERSITY FUNDING AND THE RESEARCH INNOVATION AWARDS

For more than four decades Research Corporation has been of a mixed mind about the role that it should play in funding the physical sciences at major universities. While it was comfortable to serve in the role of a funding agency up until the early 1950s, the creation of the National Science Foundation and the National Institutes of Health resulted in an unprecedented and massive influx of funds to the university community to support basic and applied research programs in every imaginable area of scientific interest.

When the Frederick Gardner Cottrell awards were inaugurated in 1946, they favored young faculty

members associated with the smaller colleges and universities, though about 20 percent of the grants made went to faculty at major institutions. In the early years of the program awards often were made to encourage research in specific areas in which the foundation had a financial interest, for example, the synthesis of cortisone (the foundation held the basic patents on cortisone). As the 1950s drew to a close, the foundation believed that the magnitude of the funds that it was providing to the university community was inconsequential and were having no real impact beyond providing modest recognition to individuals who were generally well funded. For approximately four years the foundation's involvement with universities was minimal.

Funding was only resumed in the mid-1960s at the urging of the staff, who felt that contact with these institutions and providing early funding to young faculty members was important. One justification for this viewpoint was that it was getting increasingly difficult to obtain federal funds for research. However, this was counterbalanced with the passage of time by the marked increase in start-up funds that were being made available to new faculty members as part of the hiring process. Funding for young university faculty members continued at a modest level as the Cottrell Research Grants from 1971 to 1986, at which point the financial constraints facing the foundation led to the decision to terminate the program and concentrate its limited resources on Cottrell College Science Grants.

Research Innovation Awards of $35,000 each were initiated in 1997 as an effort to re-enter the university community as a funding source for the sciences. In light of the extraordinary magnitude of funding available for the support of research community from federal agencies, a challenge was (and is!) to craft a program whose significance would rise above that of "noise level" on the granting scene.

After much discussion, the foundation staff decided to target young investigators in chemistry, physics, and astronomy and judge proposals based on *innovative ideas* that they were encouraged to present. Though greeted as a welcome addition to funding sources available to beginning faculty members, because institutional start-up funds average about ten times the amount of a Research Innovation Award, the structure and significance of the program remains an issue within the foundation.

Over the past fifty years, program-related investments have been an important feature of Research Corporation's activities and operations. They support projects which are compatible with and advance the foundation's mission, but which do not fall within the scope of the defined grant programs.

SUPPORT FOR ASTRONOMY

Astronomy has been an interest of Research Corporation since the initiation of its formal grants program in 1945. Of the first twenty-six regular and Venture Grants made in 1946, the largest was awarded in the field of astronomy ($35,000 to the University of Colorado for the construction of a coronagraph). Two other grants made in that year supported pioneering efforts to measure the spectra of 40,000 stars.

The First Radio Astronomer

In 1952 the foundation began an involvement with radio astronomy that continues to this day. The work of radio astronomer Grote Reber came to the attention of Research Corporation in 1951. The grants that were made to him as an independent investigator enabled him to continue his pioneering role in the establishment of radio astronomy as an important field of study.

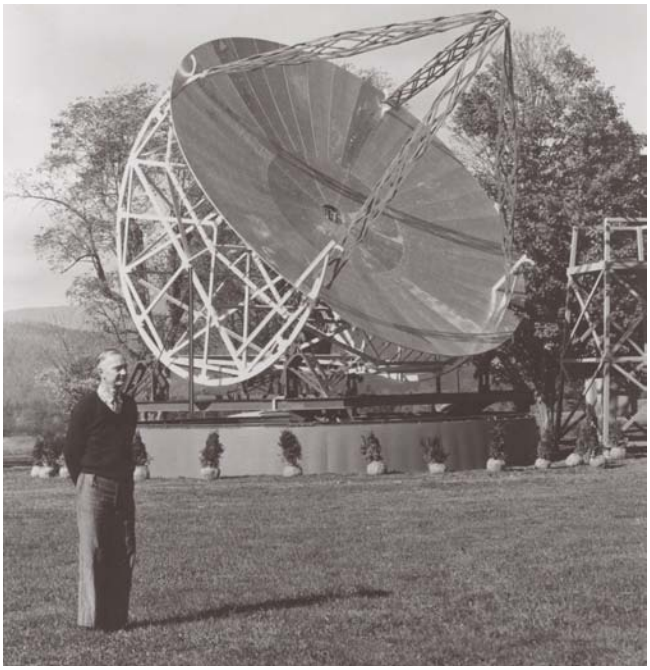
Reber was an engineering graduate from the Illinois Institute of Technology in the 1930s and was intrigued by the reports of Karl Jansky of Bell Laboratories, who first discovered that radio waves were emanating from sources outside the solar system. The twenty-six-year-old Reber proceeded to build a large radio telescope in the backyard of his parent's home in Wheaton, Illinois in 1937 and eventually detected several strong radio sources in the galaxy. His publications in 1940 and 1944 marked the beginning of radio astronomy as a recognized discipline.

Over a twenty-one year period, the foundation provided Reber with his sole source of funding and enabled him to establish observatories in Hawaii and Tasmania. He received the Bruce Medal (1962) for work performed as an amateur, the Jansky Prize (1975) for his contributions to radio astronomy, the Jackson–Gwilt Medal of the Royal Astronomical Society (1983), and the Elliot Cresson Medal from the Franklin Institute. Reber died in Tasmania on December 20, 2002.

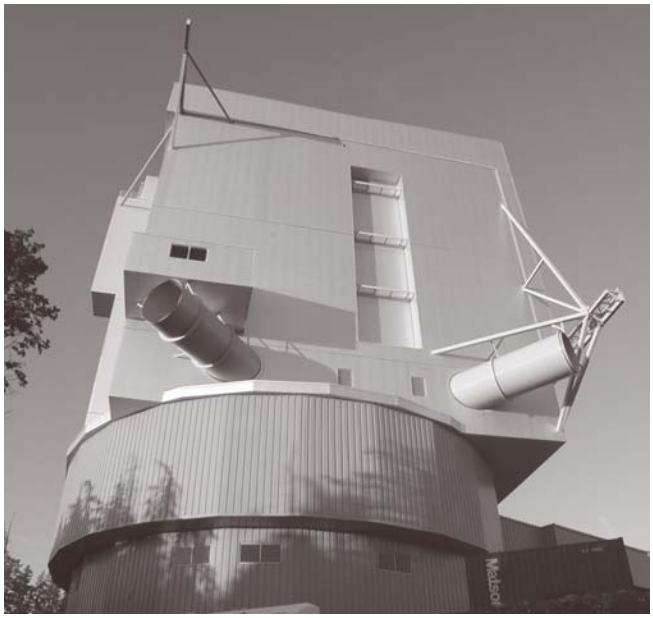
The Five College Radio Observatory

In 1960 Research Corporation responded to a request to provide the initial finding for what would ultimately become The Five College Radio Observatory. This was a consortium formed by Amherst College, Mount Holyoke, Smith College, the University of Massachusetts, and Hampshire College. A second and much larger grant was made in 1970 and attracted added support from the National Science Foundation and the Polaroid Corporation. The observatory was fully functional by 1974.

From its inception, the observatory emphasized a commitment to basic, leading edge research, the development of state-of-the-art technology, and the training and education of students, both undergraduate and graduate. The development of instrumentation within their laboratories contributed to the discovery of the binary pulsar system PSR 1913+16 by Professors Joe Taylor and Russel Hulse, for which they received the Nobel Prize in physics.



RESEARCH CORPORATION SUPPORT FOR ASTRONOMY HAS SPANNED MORE THAN 50 YEARS FROM SUPPORT FOR RADIO ASTRONOMER GROTE REBER, ABOVE, TO A PARTNERSHIP IN THE LARGE BINOCULAR TELESCOPE.



The Large Binocular Telescope

In 1992 the foundation agreed to intercede and ultimately take an ownership position in the Large Binocular Telescope (LBT). The project was experiencing serious difficulties due to conflicts that centered on environmental and cultural issues and the withdrawal of funding by a partner institution. Among arguments for intervention were: (1) a perception that if the project were allowed to fail, it would be a serious setback for American science; (2) failure would mean the end of a project that would significantly extend the capabilities of astronomical observations, and (3) it would provide Research Corporation an opportunity to fulfill an important role as a catalyst in enabling leading-edge science to take place.

With the commitment by Research Corporation, the new partnership, which included the University of Arizona and the Istituto Nazionale di Astrofisica of Italy, moved to proceed with the project on a timely basis and to seek additional partners. Working cooperatively, the associates were successful in bringing a consortium of German institutions into the partnership, thereby also bridging the remaining funding gap. Research Corporation then began identifying potential institutions to which it could allocate its viewing rights.

The dedication of the telescope is currently scheduled in June 2004 for a "first light" celebration, while the summer of 2005 is targeted for the beginning of its operation in the binocular mode. In addition to the extraordinary achievement that the LBT represents for astronomy and science, Research Corporation has four additional accomplishments that it can add to this chapter of its history. By making it

AT SEAWATER FARMS, A CHANNEL FROM THE RED SEA PROVIDES WATER FOR FISH PONDS, SHRIMP TANKS AND SALT-TOLERANT CROPS. ABOVE, ERITREAN WOMEN PLANT MANGROVE TREES ON A FORMERLY BARREN COASTLINE.

possible for Ohio State University, the University of Notre Dame, the University of Virginia, and the University of Minnesota to have access to one of the world's largest and most advanced telescopes, along with use of the facilities of Steward Observatory at the University of Arizona, the foundation has laid the groundwork for those institutions to take their place as leading centers of research in astronomy.

SEAWATER FARMS: CULTIVATING SOLUTIONS

The issues of global warming, diminishing fresh water resources, carbon dioxide build-up in the atmosphere, periodic famines in Africa and unrestrained population growth certainly have a dampening effect on hopes for the future of our planet, its environment, and its inhabitants. Many of these concerns are by-products of both the successes and failures of science and technology. It is also true that the solution to these problems resides in the application of science, technology, human intelligence and good will, to a universal endeavor in which every segment of society has the ability to make a contribution.

In reviewing areas that offered the foundation a chance to be involved in efforts with long-term potential, we explored the possibility of working cooperatively with the Environmental Research Laboratory at the University of Arizona in one of its areas of expertise. A project that offered intriguing promise was a consequence of their decades-long search for salt-tolerant plants that were potential producers of food for human or animal consumption. There are over 20,000 miles of desert seacoast that are unproductive from the perspective of food crop cultivation. Any opportunity to utilize these lands in a sustainable manner for tangible economic benefits would represent a major contribution to the welfare of the world.

Investigations led to the work being carried out by Seaphire International, a start-up company headquartered in Phoenix, Arizona. They were focusing on the development of an "integrated seawater farm," dedicated to the environmentally sound production of Seaphire, a proprietary version of salicornia, a salt-tolerant plant. The tips of the plant can be eaten, the seeds produce edible oil and high-protein meal, and the stalks can be used for animal fodder, firebricks, and particle board. Shrimp, tilapia, and other marketable fish are also a component of aquaculture farming. As a result of this integrated method, land that once was useless can produce food

Some have suggested that public accountability results in an excess of conservatism, an unwillingness to gamble on the uncertain, and a timidity in the face of potential criticism on the part of foundations. With this I disagree. Foundation executives and their trustees are well aware that the venturesome and the unorthodox are the essence of the reason for the foundations' establishment and for their continuing existence in the framework of our society. I believe the knowledge that a foundation must account publicly for its actions encourages rather than represses the undertaking of the venturesome, and provides impetus for the foundation to be purposeful, not merely charitable.

J.W. Hinkley, President, Research Corporation — from the 1962 Annual Report

for both humans and animals and the need for new agricultural land is reduced.

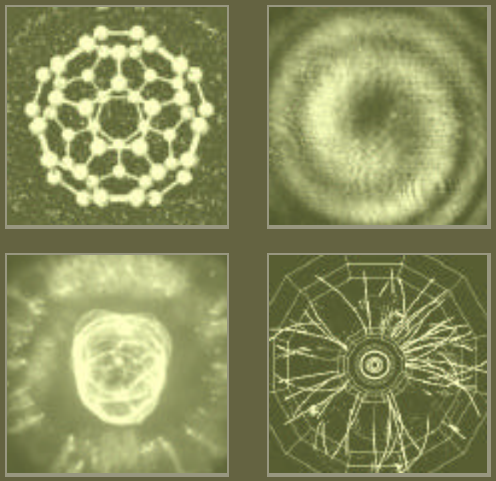
In partnership with the government of Eritrea, Africa, Seaphire International has built a commercial-scale farm on the country's Red Sea coastline. A two-mile canal draws water from the sea into shrimp tanks and ponds holding millions of fish. From there, the nutrient-rich water is diverted into the salicornia fields then channeled into wetlands planted with thousands of mangroves where it is filtered through the soil before it returns to the sea. Seawater Farms also provides training and employment opportunities for more than 300 Eritreans and serves as a lab for marine biology students from a local university. The farm is expected to achieve commercial production in 2003.

FRAMING A VISION FOR THE FUTURE

As America's first foundation devoted exclusively to the advancement of science, Research Corporation has played a defining role in providing funding for the support of projects ranging from public health and nutrition, medicine, and pharmaceuticals, to engineering, chemistry, physics, astronomy, biology, forestry, geology, and mathematics.

Today's foundation is a tribute to the vision of our founder, Frederick Gardner Cottrell, and to those staff members and directors who, over nine decades, made his ambitious hopes for science and technology a reality. The information presented here was gleaned from annual reports and various other publications of the foundation, as well as from my personal experience with most aspects of its programs over the past forty-four years.

It is my hope that this survey of the remarkable scope of our interests and past achievements can be instrumental as Research Corporation determines how it can most effectively serve science and its practitioners in the future. ■



As President Schaefer's introductory history makes clear, over the last ninety years Research Corporation has had a rich and varied history in pursuit of its mission to advance science in the service of mankind. The foundation of the 1920s, of the pre- and post-World War II years and of recent decades certainly seemed to present different faces to the scientific community. Research Corporation is the organization that first attacked a serious environmental problem, fought dietary diseases and malnutrition, served as a pioneer in astronomy funding, and helped initiate the research careers of some of the best and brightest scientists in North America. Scientists from an earlier era would not likely recognize the foundation of today and the opposite is also true.

While the foundation's face may appear to change with time, the focus on our mission has not. The ability to recognize opportunity and to adapt advantageously have characterized the foundation from its beginnings and enabled it to impact science significantly. In 1970, following a review of our programs, Carl W. Borgmann, a Ford Foundation executive and scientist, said "Research Corporation has behaved more like the theoretically perfect foundation than most. [It] has taken unusual chances and sought to fill the needs difficult to meet." If this is so, why? Much is due to the strong and interactive relationship between Research Corporation and the academic scientific community. The reviewers, consultants, our science advisors and staff all contribute to an interactive, two-way process that both informs and positions the foundation to act.

Reviewers — thousands annually — unselfishly offer their time and talents to evaluate proposals submitted to our regular grant programs. Their scholarly analyses certainly guide us to fund the best proposals, but also make us keenly aware of emerging disciplines and new trends in scientific research. Our Science Advisory Committee was first empaneled in 1945. Its members are scientists from across the nation who have broad scientific interests and ongoing active research programs. Advisors fully understand the problems facing research, can convincingly present the merits and shortcomings of a proposed project and are able to judge those proposals fairly. They give extraordinarily of their time to evaluate proposals and reviews, and to make funding recommendations. Beyond that, discussions with our advisors help keep us abreast of the ebb and flow of the scientific enterprise and often aid in the development of new programs.

But the feature which sets us apart from other agencies is the role played by Research Corporation's program officers, who in previous eras were called field representatives and later regional directors. These Research Corporation scientists visit a significant number of colleges and universities annually. On these visits they engage in open, frank discussions with faculty applicants and awardees and with administrators. They mentor, consult, and advise. They come to know individual investigators, institutions and their environment for scientific research. The unique insight they gain is brought to bear on proposals under consideration. They engage the scientists who toil on the cutting edge of scientific research. "On their backs," former Vice President Kendall King remarked, "rides the burden of the foundation's reputation for vigor, insight and skill as a patron of individually conceived basic research." It is this dynamic, the interplay between the scientific community and Research Corporation personnel, that time and again presents the foundation with unique opportunities to advance science, and to change perhaps what we do but not who we are.

Raymond Kellman
Vice President

Approved in 2002 were 147 awards in support of faculty research, research-enhanced teaching, and special projects in science. For the foundation's programs noted below — a summary of the awards listed on the following pages — the funding totaled $5,366,310.

Cottrell College Science Awards

The Cottrell College Science Awards committed $2,409,110 in support of faculty research in chemistry, physics and astronomy at undergraduate institutions. The program, which encourages student research involvement, funded 70 projects out of 276 applications. The faculty whose proposals were funded included 41 chemists and 29 physicists. The average award in 2002 was about $35,000.

Cottrell Scholar Awards

The Cottrell Scholar Awards recognize excellence in research and teaching, and supported 14 faculty projects chosen from 98 applications in 2002. Open to faculty in the third year of their first tenure-track positions in departments of chemistry, physics, and astronomy at Ph.D.-granting institutions, these awards are made in the amount of $75,000 each and can be used at the discretion of the Scholar.

Research Innovation Awards

Initiated in 1997, the Research Innovation Award program is open to beginning faculty at Ph.D.-granting institutions and encourages innovation by scientists early in their academic careers. Of 200 proposals received, 45 were recommended for awards which totaled $1,575,000.

Research Opportunity Awards

Research Opportunity Awards support midcareer faculty of demonstrated productivity who seek to explore new experimental research at Ph.D.-granting institutions. In 2002, seven candidates were nominated by their department chairs and six proposals were funded for a total of $254,200.

Special Opportunities in Science Awards

A program of invited proposals, (previously called General Foundation Grants) Special Opportunities in Science Awards provide support for projects that advance scientific research or that impact the infrastructure of science, but that fall outside other program guidelines. Approved in 2002 were two awards totaling $78,000.

COTTRELL COLLEGE SCIENCE AWARDS

ACADIA UNIVERSITY

Robert A. Gossage: Platinum-oxazoline complexes as potential breast cancer chemotherapy agents—$33,608

ALLEGHENY COLLEGE

Doros T. Petasis: Development of a crystalline thermometer for the accurate temperature determination of frozen metalloprotein EPR samples—$30,200

AMHERST COLLEGE

Jonathan R. Friedman: Investigation of resonant magnetization tunneling in molecular magnets via transverse-field AC susceptibility—$36,604

BARNARD COLLEGE

Dina C. Merrer: Relative and absolute kinetic studies of stable nucleophilic carbenes—$35,000

BOISE STATE UNIVERSITY

Charles B. Hanna: Nanoscale magnetism in quantum dots—$23,683

BOWDOIN COLLEGE

Brian R. Linton: Organic scaffolds that promote extended peptide structure through interstrand hydrogen bonding—$33,100

CALIFORNIA POLYTECHNIC STATE UNIVERSITY, SAN LUIS OBISPO

Derek E. Gragson: Exploring the factors affecting polyelectrolyte multilayer film formation using a mutli-technique approach—$37,720

CALIFORNIA STATE UNIVERSITY, BAKERSFIELD

Carl R. Kemnitz: Finding the missing link in ozonolysis: The carbonyl oxide/aldehyde complex—$40,518

CALIFORNIA STATE UNIVERSITY, FULLERTON

Chandra Srinivasan: Metal metabolism in *C. elegans* and its relevance to oxidative stress and aging—$36,142

CALIFORNIA STATE UNIVERSITY, LONG BEACH

Jeffrey Cohlberg: Aggregation of wild-type and mutant superoxide dismutase *in vitro*—$40,110

CALIFORNIA STATE UNIVERSITY, LOS ANGELES

Yong Ba: Xenon NMR for the study of chromatographic column materials and the solute retention mechanisms—$42,683

CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

Dong-Ning (Donna) Sheng: Numerical study of the quantum Hall stripe phases in strong magnetic field—$24,683

CARLETON COLLEGE

Arjendu K. Pattanayak: Nonlinear dynamics of Liouville fields in mixed chaotic and regular Hamiltonian flows with added noise—$31,144

COLBY COLLEGE

Julie T. Millard: *In vivo* mapping of diepoxybutane damage using a ligation-mediated polymerase chain reaction—$33,516

COLGATE UNIVERSITY

G. Richard Geier III: The synthesis of conformationally locked 2,2'-bipyrroles and their incorporation into porphyrinic macrocycles—$29,606

COLLEGE OF WILLIAM AND MARY

John C. Poutsma: The study of the intrinsic gas phase chemistry of non-protein amino acids using electrospray ionization-tandem mass spectrometry—$32,912

CONNECTICUT COLLEGE

Stanton Ching: Nonaqueous manganese oxide colloids as precursors to layered and tunneled materials—$27,645

Marc Zimmer: Computational analysis of green fluorescent protein and its mutants—$35,435

FORDHAM UNIVERSITY

Robert H. Beer: Millisecond DNA cleavage with hydroxyl radical—$32,530

GEORGIA SOUTHERN UNIVERSITY

Xiao-jun Wang: Quantum cutting through energy transfer in rare earth-doped systems—$42,948

GOUCHER COLLEGE

Sasha Dukan: Theoretical and numerical study of thermal properties of extreme type-II superconductors at high magnetic fields—$22,000

GRINNELL COLLEGE

Brian P. Borovsky: Quartz crystal microbalance and sample chamber for studies of the molecular origins of friction in the high-speed regime—$41,400

Mark M. Levandoski: Mechansims of the allosteric modulation of nicotinic acetylcholine receptors by levamisole—$33,400

HAMILTON COLLEGE

John R. LaGraff: Structure-function relationships of microcontact printed protein patterns investigated by in-situ scanning force microscopy—$41,224

Seth A. Major: Observational constraints on quantum gravity effects—$24,882

ILLINOIS STATE UNIVERSITY

Jon A. Friesen: Determination of the mechanism whereby the regulatory domain of CTP:phosphocholine cytidylyltransferase inhibits catalysis—$33,232

Richard W. Nagorski: Metal-ion and general buffer catalysis of the aqueous reaction of N-(hydroxymethyl)benzamide as a model for enzymatic catalysis—$31,914

Q. Charles Su: Resonant relativistic dynamics of one- and two-electron synthesis and their radiation properties—$33,317

ILLINOIS WESLEYAN UNIVERSITY

Gabriel C. Spalding: Studies of optical trapping involving large numbers of particles—$35,891

ITHACA COLLEGE

Beth Ellen Clark: X-type asteroid exploration: A spectroscopic compositional study of a mysterious class of objects—$28,330

LAKE FOREST COLLEGE

Harold S. Schnyders: Experimental investigation of the extrinsic regime magnetoresistance in beta-Ag_2Te near perfect compensation—$38,253

LEBANON VALLEY COLLEGE

Scott N. Walck: Topology, geometry, and visualization of the pure three-qubit state space—$33,218

LEWIS AND CLARK COLLEGE

Stephen L. Tufte: Further emission line studies of high-velocity interstellar clouds using the WHAM spectrometer—$32,148

LOYOLA MARYMOUNT UNIVERSITY

Gabriele U. Varieschi: Ultra-high-energy cosmic rays and neutrinos: Phenomenology and computational studies—$32,648

MIAMI UNIVERSITY

Samir Bali: Non-Brownian motion of cold atoms in optical lattices: An investigation based on correlation measurement of scattered light—$39,166

MOUNT HOLYOKE COLLEGE

Janice A. Hudgings: The role of spin coupling and dichroism in semiconductor laser dynamics—$46,954

NORTHERN KENTUCKY UNIVERSITY

K. C. Russell: Synthesis and characterization of novel dehydroheteroarylannulenes—$38,218

PACIFIC LUTHERAN UNIVERSITY

Kristy Mardis: The interplay of hydrogen bonds, steric strain, and configurational entropy in the assembly of molecular capsules—$33,218

PHILADELPHIA UNIVERSITY

Cheryl A. Longfellow: Measurements of Henry's Law constants under tropospheric conditions for naturally occurring volatile organic compounds—$32,904

ROCHESTER INSTITUTE OF TECHNOLOGY

Michael Kotlarchyk and Andreas Langner: An integrated scattering and spectroscopic study of the effect of alcohols on the structure of nanodispersions—$42,413

ROWAN UNIVERSITY

Ernst Knoesel: Cluster and aggregate formation of salts upon dilution in water—$31,985

STATE UNIVERSITY OF NEW YORK AT BINGHAMTON

Jian Q. Wang: Magneto-transport and infrared magneto-refractive spectroscopy of magnetic granular thin films—$35,420

SAINT LAWRENCE UNIVERSITY

Jeffery A. Greathouse: Molecular simulation of uranium interactions with clay minerals—$25,244

SAINT LOUIS UNIVERSITY

Paul A. Jelliss: Synthesis and characterization of luminescent rhenacarborane complexes—$43,040

SAN DIEGO STATE UNIVERSITY

Matthew E. Anderson: Studying blue-light induced red absorption with shaped ultrashort laser pulses—$38,074

SAN FRANCISCO STATE UNIVERSITY

Andrew S. Ichimura: Heterogeneous solid state reduction of organic electron acceptors—$41,301

SMITH COLLEGE

Shizuka Hsieh: Mechanistic studies of ring-opening reactions for small heterocyclic compounds—$38,000

SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE

William A. Atkinson: A numerical study of defects and other nanoscale structures in strongly-correlated superconductors—$21,818

SOUTHWEST TEXAS STATE UNIVERSITY

L. Kevin Lewis: Interplay between telomerase and DNA repair complexes in preservation of structural integrity of chromosomal DNA—$36,713

SWARTHMORE COLLEGE

Frank A. Moscatelli: Trapping and guiding atoms using evanescent fields above microfabricated optical waveguides—$43,496

TEXAS A&M UNIVERSITY AT COMMERCE

Howard L. Richards: Analytic and computational study of the equilibrium statistics of steps with short-range attractions on vicinal crystal surfaces—$21,181

UNIVERSITY OF MINNESOTA–DULUTH

Cecilia Giulivi: Oxygen- and nitrogen-derived radicals on hexokinase activity—$35,000

UNIVERSITY OF NEVADA, LAS VEGAS

Pradip K. Bhowmik: Design and synthesis of rigid-rod polyelectrolytes for light-emitting devices—$39,500

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Joanna Katherine Krueger: Distance contraints for building an atomic model of gelsolin: 2Actin complex determined by chemical cross-linking and peptide mapping—$39,718

UNIVERSITY OF PORTLAND

Osiel Bonfim: Experimental investigation of resonant activation in mechanical systems—$33,382

Steven G. Mayer: Physical characterization of solute-solvent behavior in supercritical fluids—$40,000

UNIVERSITY OF RICHMOND

Michelle Hamm: Investigations into the base pairing and enzyme recognition of 8-Oxo-2' deoxyguanosine through the use of nucleotide analogues—$32,000

UNIVERSITY OF TENNESSEE AT CHATTANOOGA

Robert C. Mebane: Deuterium labeling by catalytic transfer hydrogenation with Raney catalysts and deuterium donors—$30,684

UNIVERSITY OF TEXAS AT EL PASO

Luis E. Martinez: Chromium-mediated benzannulations on solid support—$36,154

UNIVERSITY OF WINNIPEG

Athar Ata: Microbial transformations of bioactive marine natural products—$20,800

UNIVERSITY OF WISCONSIN–EAU CLAIRE

Marcus T. McEllistrem: Influence of In on the surface chemistry and morphology of InGaN alloys—$35,918

James A. Phillips: Molecular complexes in cryogenic matrices: UV spectra, photochemistry, and microsolvation of H_2O-SO_X and H_3N-SO_X—$37,000

UNIVERSITY OF WISCONSIN–LA CROSSE

Michael Jackson: High resolution spectroscopy of free radicals in the far-infrared—$36,800

UNIVERSITY OF WISCONSIN–OSHKOSH

Michael T. Umlor: Relationship of the magnetic anisotropies measured with a MOKE loop tracer to the film morphology observed by STM—$31,592

UNIVERSITY OF THE SOUTH

Robert E. Bachman: Construction of metallogelators and metallogels: Pyridine and bipyridene ligands with glutamic acid-based lipid tails—$38,518

WESTERN WASHINGTON UNIVERSITY

Milton L. From: Low temperature measurements of magnetic anisotropies in thin Fe layers grown on GaAs (001)—$32,506

Brad L. Johnson: Large-scale numerical studies of interacting charged particles—$22,568

Mark L. Wicholas: Isoindolines as pincer ligands: Complexes with d^8 and d^{10} transition metal—$35,218

WITTENBERG UNIVERSITY

Mark Ellison: Investigation of the adsorption of gases on carbon nanotubes—$40,745

YESHIVA UNIVERSITY

Fredy Zypman: Effect of interface defects on electronic transport through quantum multi-layered systems—$40,218

RESEARCH INNOVATION AWARDS

AMERICAN UNIVERSITY

Monika Ilieva Konaklieva: Beta-lactamase activated NO-containing beta-lactams—$35,000

BOSTON UNIVERSITY

Scott E. Schaus: The development of novel chiral bifunctional catalyst systems for carbon-carbon bond formation reactions—$35,000

BRIGHAM YOUNG UNIVERSITY

Dallin S. Durfee: An "optical clock" measurement of the drift of the fine structure constant—$35,000

CALIFORNIA INSTITUTE OF TECHNOLOGY

Andrew William Blain: Unveiling dust-enshrouded galaxy formation: CODEX a new instrument to probe the most enigmatic distant galaxies—$35,000

Charles Patrick Collier: Real-time single molecule characterization of facilitated diffusion for restriction enzymes on DNA—$35,000

DALHOUSIE UNIVERSITY

Mark J. Stradiotto: Homogeneous catalyst release, capture and recycling within a fluorous biphasic environment—$35,000

DARTMOUTH COLLEGE

Robert B. Grubbs: Polymer encapsulated multi-metallic nanoparticle arrays—$35,000

EMORY UNIVERSITY

Justin P. Gallivan: New selection methods for the cloning of biosynthesis genes and the directed evolution of proteins—$35,000

MARQUETTE UNIVERSITY

Maria G. Kurnikova: Spanning time- and length-scales in modeling ion channel and receptor function by a hierarchical approach—$35,000

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Senthil Todadri: Momentum-dependent non-Fermi liquid behaviour in correlated metals—$35,000

NORTHEASTERN UNIVERSITY

Mark C. Williams: Single molecule force spectroscopy studies of RNA-protein interactions—$35,000

NORTHERN ILLINOIS UNIVERSITY

Michel A. van Veenendaal: Dynamic Jahn-Teller effects in photoinduced magnetism in molecule-based magnets—$35,000

NORTHWESTERN UNIVERSITY

Teri W. Odom: Generation and characterization of optical mesostructures: Investigating the optical analog to the quantum mirage—$35,000

PORTLAND STATE UNIVERSITY

Peter Moeck: Structural transformations in semiconductor quantum dots: Produced by annealing and analyzed by goniometry of direct lattice vectors—$35,000

STATE UNIVERSITY OF NEW YORK AT STONY BROOK

Thomas Weinacht: Two-color ultrafast spectroscopy of melting ice—$35,000

SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE

Boyd M. Goodson: Enhancing the nuclear spin polarization of biomolecular thin films with optical/electron/nuclear triple resonance—$35,000

TEXAS A&M UNIVERSITY

Vitaly Kocharovsky: Semiconductor transistor laser for multiwavelength operation—$35,000

TEXAS TECH UNIVERSITY

Jorge Alberto Morales: Valence bond/coherent state approach to quantum/classical charge-transfer models—$35,000

UNIVERSITY OF ARIZONA

Indraneel Ghosh: A model system for studying small molecule allosteric regulation of protein function—$35,000

UNIVERSITY OF CALIFORNIA, BERKELEY

F. Dean Toste: Development of new methods and transition metal catalysts for enantioselective synthesis—$35,000

UNIVERSITY OF CALIFORNIA, DAVIS

Nemanja Kaloper: Cosmological signatures of new physics—$35,000

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Frank L. H. Brown: Methods for interpreting single molecule spectroscopy: Generating functions, stochastic simulation and ε-machine reconstruction—$35,000

UNIVERSITY OF COLORADO AT BOULDER

Robert T. Batey: Development of a tool for x-ray crystallographic structural analysis of RNA-drug interactions—$35,000

UNIVERSITY OF CONNECTICUT

Susanne F. Yelin: Reliable quantum communication with macroscopic light pulses—$35,000

UNIVERSITY OF HOUSTON

Steven J. Baldelli: Spatially resolved surface vibrational spectroscopy—$35,000

UNIVERSITY OF ILLINOIS AT URBANA–CHAMPAIGN

Paul J. Hergenrother: A novel approach towards combating multi-drug-resistant bacteria—$35,000

UNIVERSITY OF MARYLAND, BALTIMORE COUNTY

Veronika A. Szalai: Transition metals in guanine quartets: Development of novel materials—$35,000

UNIVERSITY OF MASSACHUSETTS, AMHERST

Anthony D. Dinsmore: Direct measurements of melting and defects in colloidal crystals—$35,000

UNIVERSITY OF MICHIGAN

Marc J. A. Johnson: Triple bond metathesis for synthesis and nitrogen fixation—$35,000

John P. Wolfe: Metal-catalyzed insertion of olefins into small heterocycles—$35,000

UNIVERSITY OF MINNESOTA–TWIN CITIES

T. Andrew Taton: Nanotube-liquid crystal composites: Aligning soft mesophases with hard nanostructures—$35,000

UNIVERSITY OF MISSISSIPPI

Gregory S. Tschumper: Toward the automated theoretical determination of chemical reactions: Systematically guided reaction path searches with graph theory—$35,000

UNIVERSITY OF NEVADA, RENO

Benjamin T. King: Total syntheses of short, open carbon (3n,3n) nanotubes—$35,000

UNIVERSITY OF OKLAHOMA

James P. Shaffer: Angular resolved spectroscopy for the study of ultracold collisions—$35,000

UNIVERSITY OF PITTSBURGH

Shigeru Amemiya: Probing molecular transport through single nuclear pore complexes by scanning electrochemical microscopy—$35,000

UNIVERSITY OF ROCHESTER

Alison J. Frontier: Development of a catalytic, enantioselective Nazarov cyclization for stereospecific creation of vicinal chiral quaternary centers—$35,000

Nabi A. Magomedov: A novel stereoselective synthesis of highly functionalized cyclohexenones—$35,000

UNIVERSITY OF WATERLOO

Jan B. Kycia: The development of a novel high-sensitivity calorimeter for the study of low temperature phase transitions—$35,000

UNIVERSITY OF WISCONSIN

Qiang Cui: Understanding allosteric transition in biomolecules with novel molecular simulation methods—$35,000

Martin Zanni: Protein solvation structures and dynamics studied with two-color 2D infrared spectroscopy—$35,000

WAYNE STATE UNIVERSITY

David Eric Benson: Design and construction of crosslinked amino acid cofactors—$35,000

Peter M. Hoffmann: Single atom manipulation at room temperature in an atomic force microscope—$35,000

Boris Nadgorny: Weighing the electron spin: Current-driven excitation of magnetic nanostructures—$35,000

Mary Kay H. Pflum: Studies toward a site-specific peptide cleavage reaction for proteomics research—$35,000

YALE UNIVERSITY

Ann M. Valentine: The bioinorganic chemistry of titanium: Uptake, sequestration and function of titanium in ascidians—$35,000

COTTRELL SCHOLARS AWARDS

BRANDEIS UNIVERSITY

Jane Kondev: Theoretical studies of dense polymer systems—$75,000

COLUMBIA UNIVERSITY

David M. Adams: Single molecule spectroscopy of interfacial electron transfer—$75,000

INDIANA UNIVERSITY AT BLOOMINGTON

Andrew L. Feig: Thermodynamics of RNA cold denaturation and its relationship to the cold shock response—$75,000

MCGILL UNIVERSITY

Hanadi F. Sleiman: Transition metal-linked branched oligonucleotides: Synthesis and applications—$75,000

TULANE UNIVERSITY

Sankaran Thayumanavan: Globular macromolecules with functionalized interiors—$75,000

UNIVERSITY OF CONNECTICUT

Barrett O. Wells: Interactive classroom for physics majors and interactive electrons in functional oxide films—$75,000

UNIVERSITY OF DELAWARE

Edmund R. Nowak: Experimental studies of dense granular media: Towards a thermodynamic description of powders—$75,000

UNIVERSITY OF ILLINOIS AT URBANA–CHAMPAIGN

Neil L. Kelleher: Solution phase hydrogen/deuterium exchange of proteins with a novel mass spectrometric readout—$75,000

UNIVERSITY OF MONTREAL

Antonella Badia: Atomic force microscopy studies of the phase behavior and lipid/protein interactions in supported phospholipid membranes—$75,000

UNIVERSITY OF PENNSYLVANIA

Max Tegmark: Beyond cosmological parameters—$75,000

UNIVERSITY OF TEXAS AT AUSTIN

Michael J. Krische: Enantioselective catalysis via chiral (β-diketonato) metal templates—$75,000

John J. G. Tesmer: The structure and function of RGS homology domains: X-ray crystallographic studies powered by undergraduate research—$75,000

UNIVERSITY OF UTAH

Eric L. Hegg: Heme A synthase: Elucidating the mechanism of this novel heme-containing monooxygenase and identifying its physiological partners—$75,000

UNIVERSITY OF WISCONSIN–MILWAUKEE

Patrick R. Brady: Towards the detection of gravitational waves from black hole binaries—$75,000

RESEARCH OPPORTUNITY AWARDS

CALIFORNIA INSTITUTE OF TECHNOLOGY

Kenneth G. Libbrecht: Electrically enhanced structure formation from the vapor phase—$50,000

IOWA STATE UNIVERSITY

E. Walter Anderson: Neutron-neutron correlations in kinematically complete measurements—$20,000

NORTHEASTERN UNIVERSITY

Clive H. Perry: Investigation of sub-surface structures in semiconductors by STM and NSOM -light emission spectroscopy—$49,000

UNIVERSITY OF FLORIDA

Gary G. Ihas: Generation and decay of turbulence in an inviscid quantum fluid: Towed grid measurement in liquid ^{4}He very near T=0—$50,000

UNIVERSITY OF MICHIGAN

Anthony H. Francis: Spectroscopic and photo-physical studies of thin-film polymer interfaces—$38,600

UNIVERSITY OF WISCONSIN

Marshall F. Onellion: Studying phase transitions using femtosecond optical techniques—$46,600

SPECIAL OPPORTUNITIES IN SCIENCE AWARDS

AMERICAN PHYSICAL SOCIETY

Alan Chodos: Edward A. Bouchet Lectureship Award 2003–2007—$38,000

NATIONAL ACADEMY OF SCIENCES

Douglas J. Raber: Support of the Chemical Sciences Roundtable—$40,000

Board of Directors
Research Corporation
Tucson, Arizona

We have audited the accompanying statements of financial position of Research Corporation (the "Foundation") as of December 31, 2002 and 2001 and the related statements of activity and changes in net assets and of cash flows for the years then ended. These financial statements are the responsibility of the Foundation's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, such financial statements present fairly, in all material respects, the financial position of the Foundation at December 31, 2002 and 2001 and the results of its operations and its cash flows for the years then ended in conformity with accounting principles generally accepted in the United States of America.

Deloitte & Touche LLP

March 31, 2003
Phoenix, Arizona

STATEMENTS OF FINANCIAL POSITION

DECEMBER 31, 2002 AND 2001	2002	2001
ASSETS		
INVESTMENTS:		
Marketable securities – at market *(Note 2)*	$ 67,654,478	$ 86,598,708
Other investments *(Note 5)*	21,092,312	19,873,378
Program-related investment in Research Corporation Technologies, Inc. *(Note 3)*	25,000,000	25,000,000
Science and technology investments *(Notes 4 and 8)*	4,430,000	10,896,190
Total investments	118,176,790	142,368,276
Cash and cash equivalents	753,229	119,041
Accrued dividends and interest receivable	122,000	391,049
Property and equipment – net *(Note 6)*	36,366	58,755
Notes receivable *(Note 4)*	7,581,928	
Prepaid pension cost *(Note 8)*	5,258,433	4,769,757
Other assets	32,816	22,218
TOTAL	$ 131,961,562	$ 147,729,096
LIABILITIES AND NET ASSETS		
LIABILITIES:		
Grants payable	$ 4,346,924	$ 4,538,056
Line of credit *(Note 7)*	11,000,000	4,144,821
Notes payable *(Note 4)*	2,788,914	
Other *(Notes 4, 8 and 11)*	3,103,808	1,362,787
Total liabilities	21,239,646	10,045,664
COMMITMENTS AND CONTINGENCIES *(Notes 5, 9 and 10)*		
NET ASSETS	110,721,916	137,683,432
TOTAL	$ 131,961,562	$ 147,729,096

SEE NOTES TO FINANCIAL STATEMENTS

STATEMENTS OF ACTIVITY AND CHANGES IN NET ASSETS

YEARS ENDED DECEMBER 31, 2002 AND 2001	2002	2001
REVENUE:		
Unrestricted revenues and gains:		
Interest and dividends from marketable securities	$ 1,339,283	$ 1,786,997
Interest income from program-related investment *(Note 3)*	1,750,000	1,750,000
Other interest income	180,747	327,863
Pension income *(Note 8)*	488,676	596,001
Total unrestricted revenues and gains	3,758,706	4,460,861
Contributions released from restrictions	26,282	167,000
Total revenue	3,784,988	4,627,861
EXPENSES *(Note 11)*:		
Grants approved *(Note 4)*	8,411,094	6,027,016
Science advancement	1,404,493	1,080,129
Information and communications	95,930	99,910
General and administrative *(Notes 8, 10 and 11)*	3,700,105	1,892,007
Interest and other expense *(Note 7)*	326,374	537,325
Total expenses	13,937,996	9,636,387
DECREASE IN NET ASSETS BEFORE NET LOSS ON INVESTMENTS	(10,153,008)	(5,008,526)
NET LOSS ON INVESTMENTS *(Notes 2, 4 and 5)*	(16,808,508)	(5,283,875)
DECREASE IN NET ASSETS	(26,961,516)	(10,292,401)
NET ASSETS, BEGINNING OF YEAR	137,683,432	147,975,833
NET ASSETS, END OF YEAR	$110,721,916	$137,683,432

SEE NOTES TO FINANCIAL STATEMENTS

STATEMENTS OF CASH FLOWS

YEARS ENDED DECEMBER 31, 2002 AND 2001	2002	2001
CASH FLOWS FROM OPERATING ACTIVITIES:		
Decrease in net assets	$(26,961,516)	$ (10,292,401)
Adjustments to reconcile decrease in net assets to net cash used in operating activities:		
Net realized losses (gains) on sales of marketable securities	5,397,648	(1,587,881)
Unrealized net depreciation of marketable securities	11,482,181	8,099,489
Unrealized net depreciation of science and technology investments		1,320,000
Noncash grants of technology investments	2,674,000	
Unrealized appreciation of other investments	(72,316)	(2,547,733)
Depreciation and amortization	22,917	21,844
Decrease (increase) in accrued dividends and interest receivable	269,049	(290,832)
Increase in prepaid pension cost	(488,676)	(596,001)
Decrease in other assets	10,597	549,525
Increase (decrease) in grants payable	191,132	(135,054)
Increase (decrease) in other liabilities	617,021	(54,584)
Other	(225,153)	(573,075)
Net cash used in operating activities	(7,083,116)	(6,086,703)
CASH FLOWS FROM INVESTING ACTIVITIES:		
Purchase of marketable securities		(13,783,400)
Proceeds from sale of marketable securities	2,064,401	26,210,767
Purchase of science and technology investments	(1,353,500)	(2,699,000)
Purchase of other investments	(4,500,000)	(4,150,000)
Proceeds from distribution of other investments	3,352,382	
Proceeds received for repayments on notes receivable	1,300,000	600,000
Purchases of property and equipment	(528)	(10,123)
Proceeds from sale of property and equipment		250
Net cash provided by investing activities	862,755	6,168,494
CASH FLOWS FROM FINANCING ACTIVITIES:		
Borrowings on line of credit	14,406,522	13,780,690
Repayments on line of credit	(7,551,973)	(14,135,869)
Net cash provided by (used in) financing activities	6,854,549	(355,179)
NET INCREASE (DECREASE) IN CASH AND CASH EQUIVALENTS	634,188	(273,388)
CASH AND CASH EQUIVALENTS, BEGINNING OF YEAR	119,041	392,429
CASH AND CASH EQUIVALENTS, END OF YEAR	$ 753,229	$ 119,041
NONCASH TRANSACTIONS:		
Receipt of notes receivable in exchange for viewing rights	$ 8,281,929	
Issuance of note payable in exchange for viewing rights	$ 2,789,544	

SEE NOTES TO FINANCIAL STATEMENTS

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Research Corporation (the "Foundation") prepares its financial statements in accordance with accounting principles generally accepted in the United States of America. The following are the significant accounting policies followed by the Foundation:

a. *Nature of Business* – The Foundation is a New York not-for-profit corporation dedicated to the advancement of science.

b. *Basis of Accounting* – The financial statements are prepared on the accrual basis of accounting and are prepared in accordance with standards set forth in the *Statement of Financial Accounting Standards* ("SFAS") No. 117, *Financial Statements of Not-for-Profit Organizations,* and the American Institute of Certified Public Accountants' *Audit and Accounting Guide for Audits of Not-for-Profit Organizations.*

c. *Securities Valuation* – The Foundation carries its investments in marketable securities at fair market value (see Note 2). Realized gains and losses are computed based on the difference between the net proceeds received and cost at time of acquisition using the average cost method. Unrealized net appreciation or depreciation of investments in marketable securities represents the change in the difference between acquisition cost and current market value at the beginning of the year versus the end of the year.

d. *Other investments* consisting of unconsolidated limited partnership interests are recorded at estimated fair value in accordance with SFAS No. 124, *Accounting for Certain Investments Held by Not-for-Profit Organizations*. Investments in limited partnerships are valued at the quoted market price for securities for which market quotations are readily available or an estimate of value (fair value) as determined in good faith by the general partner. Investments without a readily determinable fair value are recorded at cost. The cost of investments sold is determined using the specific identification method. Other than temporary impairments are recognized in the period in which they occur and are included in net loss on investments.

e. *Revenue and Expenses* – Interest income is recorded as earned; dividends are accrued as of the ex-dividend date. Grant expense is recorded at the time the awards are approved by the board of directors.

f. *Contributions* – Restrictions on contributions received are generally satisfied in the year the contributions are received. The Foundation reports contributions as restricted support if they are received with donor stipulations that restrict the use of donated assets. When a donor purpose restriction is accomplished, temporarily restricted net assets are recognized as unrestricted net assets and reported as contributions released from restrictions in the statements of activity and changes in net assets.

g. *Property and equipment* are stated at cost. Depreciation is calculated using the straight-line method over estimated useful lives as follows:

Tenant improvements	5 years
Furniture, fixtures and equipment	5–10 years

Maintenance and repairs are charged to operations as incurred. Major renewals and betterments are capitalized.

h. *Income Taxes* – The Foundation qualifies as a tax-exempt private operating foundation under Internal Revenue Code Section 4940(d).

i. *Statements of Cash Flows* – For purposes of reporting cash flows, cash and cash equivalents include cash on hand, demand deposits, savings accounts and highly liquid debt instruments purchased with an original maturity of three months or less which are not carried in the Foundation's portfolio of marketable securities.

j. *New Accounting Pronouncements* – In October 2001, the Financial Accounting Standards Board ("FASB") issued SFAS No. 144, *Accounting for the Impairment or Disposal of Long-Lived Assets.* SFAS No. 144 requires that long-lived assets be measured at the lower of carrying amount or fair value less cost to sell, whether reported in continuing operations or in discontinued operations. The standard was effective for the Foundation's fiscal year beginning January 1, 2002. The implementation of this standard did not have a material effect on the Foundation's financial position or results of operations.

In November 2002, the FASB issued Interpretation No. 45 ("FIN 45"), *Guarantor's Accounting and Disclosure Requirements for Guarantees, Including Indirect Guarantees of Indebtedness of Others.* FIN 45 addresses the disclosure requirements of a guarantor about its obligations under certain guarantees that it has issued. FIN 45 also requires a guarantor to recognize, at the inception of a guarantee, a liability for the fair value of the obligation undertaken in issuing the guarantee. The disclosure requirements of FIN 45 are effective for the Foundation for 2002. The liability recognition requirements will be applicable prospectively to all guarantees issued or modified after December 31, 2002. The Foundation had no guarantees requiring disclosure at December 31, 2002, except as disclosed in Note 9.

k. *Use of Estimates* – The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates. The Foundation utilizes various investment instruments. Investment securities, in general, are exposed to various risks, such as interest rate, credit and overall market volatility. Due to the level of risk associated with certain investment securities, it is reasonably possible that changes in the values of investment securities will occur in the near term and that such changes could materially affect the amounts reported in the statements of financial position.

2. MARKETABLE SECURITIES

Marketable securities consist of the following at December 31:

	2002		2001	
	MARKET VALUE	COST	MARKET VALUE	COST
Capital Guardian Trust Funds:				
Emerging Markets Growth Fund	$ 3,653,753	$ 5,557,494	$ 4,107,035	$ 5,557,494
U.S. Value Equity Fund	11,924,603	13,523,439	15,568,231	14,642,186
Global Equity Fund	48,692,007	48,666,865	63,047,926	54,730,703
American High Income Fund	3,384,115	4,708,058	3,875,516	4,708,058
Total	$67,654,478	$72,455,856	$86,598,708	$79,638,441

The objectives of the mutual funds, according to each fund's prospectus, are as follows:

a. *Emerging Markets Growth Fund* seeks to obtain long-term growth of capital through investment in equity securities of businesses located in developing countries.

b. *U.S. Value Equity Fund* seeks to outperform the Russell 1000 Value Index over a full market cycle, with a similar level of risk, by investing primarily in U.S. large CAP stocks with value characteristics.

c. *Global Equity Fund* seeks to achieve capital growth and future income through investments in a portfolio of securities of U.S. issuers, American depository receipts for securities of foreign issuers and securities whose principal markets are outside of the United States.

d. *American High Income Fund* seeks to achieve monthly income through investments primarily in bonds and also U.S. and foreign securities.

Annual activity for marketable securities consists of the following at market value for the years ended December 31:

	2002	2001
Opening balance	$ 86,598,708	$ 105,537,683
Purchases		13,783,400
Sales	(2,064,401)	(26,210,767)
Net depreciation	(16,879,829)	(6,511,608)
Ending balance	$ 67,654,478	$ 86,598,708

Proceeds from sale of marketable securities in 2002 and 2001 were used to fund purchases of other investments.

Net loss on investments in marketable securities consists of the following for the years ended December 31:

	2002	2001
Net realized (losses) gains on sales of marketable securities	$ (5,397,648)	$ 1,587,881
Unrealized net depreciation of marketable securities	(11,482,181)	(8,099,489)
Net loss on marketable securities	$(16,879,829)	$(6,511,608)

3. PROGRAM-RELATED INVESTMENT IN RESEARCH CORPORATION TECHNOLOGIES, INC.

On March 2, 1987, as amended on March 25, 1994, in accordance with Section 1605(c) of the Tax Reform Act of 1986, the Foundation and Research Corporation Technologies, Inc. (“RCT”), a nonprofit corporation subject to regular corporate income tax laws, entered into agreements through which RCT assumed responsibility for the Technology Transfer Program (the “Program”), which the Foundation had operated for many years. In addition to the transfer of the Program, the Foundation transferred $35,000,000 in cash and securities in exchange for a $35,000,000 fully subordinated unsecured note from RCT (the "Note”) due February 28, 2017.

RCT has prepaid $10,000,000 of the Note, and the remaining $25,000,000 principal amount of the amended Note is due on February 28, 2017, subject to acceleration at the option of the Foundation after December 31, 2012, provided RCT’s retained earnings exceed $100,000,000. Basic interest at the rate of 7% per annum on the outstanding principal amount is due semiannually.

To qualify as a program-related investment under Section 4944(c) of the Tax Reform Act of 1986, the terms of the loan were required to be less than prevailing terms. In addition, this investment is a vehicle for the Foundation to continue one of its charter purposes, the furthering of technology. As there are no comparable alternative program-related investments available to the Foundation, the Foundation believes it is not practicable to estimate the fair value of this investment.

Interest income on the Note for each of the years ended December 31, 2002 and 2001 was $1,750,000.

4. SCIENCE AND TECHNOLOGY INVESTMENTS

The Foundation has invested in and made advances to various entities that engage in the advancement of science and technology. Such investments are not readily marketable and are carried at cost. Such investments consist of the following at December 31:

	2002	2001
Large Binocular Telescope Project *(Note 9)*	$	$ 5,866,190
Seaphire International Inc.	4,430,000	5,030,000
Total science and technology investments	$4,430,000	$10,896,190

The largest portion of the investment in Seaphire International Inc. consists of a note receivable in the amount of $4,250,000 bearing interest at the London Interbank Offered Rate ("LIBOR") plus 2% (3.75% at December 31, 2002). The note is payable as follows: $500,000 (2003), $750,000 (2004), $750,000 (2005), $1,000,000 (2006) and $1,250,000 (2007). During 2002, the Foundation received payment on notes receivable in the amount of $600,000 from Seaphire International Inc., which reduced the investment balance.

In 2002, the Foundation sold or granted all remaining viewing rights available under the Large Binocular Telescope Project (the "Project") to research institutions in exchange for notes receivable totaling $8,281,928 (net of unamortized discounts of $718,072 based on an imputed interest rate of 3.375%) with payments of principal and interest to be received as follows: $1,800,000 (2003), $1,800,000 (2004), $1,800,000 (2005), $1,800,000 (2006), and $1,000,000 (2007). Included in the sales prices to these institutions was compensation for viewing rights on other University of Arizona telescopes that the Foundation purchased from the University of Arizona. These rights were purchased in exchange for a note payable for $2,788,914 (net of unamortized discount of $211,086 based on an imputed interest rate of 3.375%) with interest and principal payments as follows: $866,667 (2003), $600,000 (2004), $600,000 (2005), $600,000 (2006), and $333,333 (2007). In connection with these transactions, the Foundation recognized a liability for future amounts payable to the Project of approximately $1,421,000, which is included in other liabilities. As a result, the Foundation recognized grants expense of approximately $2,874,000 representing a new grant of viewing rights valued at $1,750,000 on the Project and an additional grant expense of approximately $1,124,000, representing a final adjustment on viewing rights granted in prior years.

In 1999, the Foundation sold one-quarter of its viewing rights to a research institution in exchange for $400,000 cash and a note receivable of $1,062,669 (net of unamortized discount of $137,331 based on an imputed interest rate of 8.5%). The note receivable was paid in full in 2001.

5. OTHER INVESTMENTS

Other investments consist of the following at estimated fair value at December 31:

	2002	2001
Limited partnership interest (AG Super Fund L.P.)	$ 7,111,592	$ 7,153,109
Limited partnership interest (AG Realty Fund IV L.P.)	4,609,480	5,227,405
Limited partnership interest (AG Realty Fund V L.P.)	1,682,834	1,000,000
Limited partnership interest (AG Capital Recovery Fund)	3,998,674	6,492,864
Limited partnership interest (AG Capital Recovery Fund III)	3,689,732	
Total other investments	$21,092,312	$19,873,378

Increases in other investments in 2002 relate to additional investments in AG Realty Fund V L.P. of $500,000 and in AG Capital Recovery Fund III of $4,000,000. These increases were offset by distributions received from AG Capital Recovery Fund in the amount of approximately $2,591,210 and from AG Realty Fund IV L.P. of approximately $761,177. In addition, unrealized (depreciation) appreciation of $(41,517), $143,252, $97,020, $182,834 and $(310,268) was recorded in AG Super Fund L.P., AG Realty Fund IV L.P., AG Capital Recovery Fund, AG Realty Fund V L.P. and AG Capital Recovery Fund III, respectively, as included in net loss on investments.

At December 31, 2002, the Foundation was committed to additional funding of $4,500,000 in the above investments.

The objective of AG Super Fund L.P. is to achieve capital appreciation through specialized investment strategies, including investing in merger arbitrage, distressed debt, special situations and convertible hedging.

The objective of the AG Realty Funds IV and V L.P. is to invest in opportunistic real estate assets, including options and mortgage loans.

The objective of the AG Capital Recovery Fund and AG Capital Recovery Fund III is to invest in the distressed credit sector of the fixed income market. Investment in these companies consists largely of commercial bank loans and publicly traded debt securities.

6. PROPERTY AND EQUIPMENT

Property and equipment consist of the following at December 31:

	2002	2001
Tenant improvements	$358,289	$358,289
Furniture, fixtures and equipment	316,314	315,786
Total property and equipment	674,603	674,075
Less accumulated depreciation	638,237	615,320
Property and equipment – net	$ 36,366	$ 58,755

7. LINE OF CREDIT

The Foundation has a $15,000,000 revolving line of credit that is due May 30, 2003 and bears interest at the prime rate (4.25% at December 31, 2002) or LIBOR plus 1.50% (3.25% at December 31, 2002), at the Foundation's option. At December 31, 2002 and 2001, borrowings of $11,000,000 and $4,144,821, respectively, were outstanding under the line of credit. The Foundation recognized interest expense of $308,746 and $302,987 for the years ended December 31, 2002 and 2001, respectively.

8. PENSION PLAN AND POSTRETIREMENT BENEFITS

Pension Plan – The Foundation has a noncontributory defined benefit pension plan (the "Plan") covering substantially all of its employees. The benefits provided by the Plan are generally based on years of service and employees' salary history. It is the Foundation's policy to fund pension cost accrued; however, at December 31, 2002 and 2001, the Plan is in an overfunded status and no contributions are required.

The components of the net periodic pension income are as follows for the years ended December 31:

	2002	2001
Service cost–benefits earned during the period	$(191,380)	$(172,491)
Interest cost on projected benefit obligations	(202,916)	(195,182)
Expected return on plan assets	727,771	759,376
Net amortization and deferral	155,201	237,467
Net periodic pension income	488,676	629,170
Postretirement benefits transfer		(33,169)
Total pension income	$ 488,676	$ 596,001

Assumptions used in the accounting for the Plan are as follows for the years ended December 31:

	2002	2001
Discount rate	6.75%	7.25%
Rate of increase in compensation levels	4.75%	5.25%
Expected long-term rate of return on assets	7.50%	7.50%

The measurement date for the Plan is December 31. The following sets forth the Plan's funded status at December 31:

	2002	2001
Accumulated benefit obligation	$(2,579,968)	$(2,360,209)
Projected benefit obligation	$(2,987,938)	$(2,796,056)
Plan assets at fair value, primarily invested in stocks and bonds	8,022,314	9,793,545
Funded status	5,034,376	6,997,489
Unrecognized transition net asset	(227,179)	(340,769)
Unrecognized net gain	312,418	(1,959,595)
Unrecognized prior service cost	138,818	72,632
Prepaid pension cost	$ 5,258,433	$ 4,769,757

During 2001, $33,169 was transferred out of the Plan to provide for payment of postretirement medical benefits. No such transfer was made in 2002. The transfer was made in accordance with the Omnibus Budget and Reconciliation Act and was treated as a negative contribution. In addition, during the years 2002 and 2001, total benefits paid were $422,719 and $282,488, respectively. There were no other participant or employer contributions in 2002 or 2001.

During 2001, the Foundation decided to terminate the pension plan. The Foundation intends to provide a new plan with similar benefits to participants upon termination of the existing plan.

The Foundation is in the process of determining the benefit obligation using liquidation type assumptions at December 31, 2002; however, the Plan is overfunded and no additional liability is expected to result from termination.

Postretirement Plan – In addition to providing pension benefits, the Foundation provides certain health care benefits to retired employees and their spouses. Substantially all of the Foundation's employees may become eligible for these benefits if they reach normal retirement age while working for the Foundation.

The components of net periodic postretirement benefit cost are as follows at December 31:

	2002	2001
Service cost–benefits earned during the period	$ 39,633	$ 34,430
Interest cost on accumulated postretirement benefit obligation	76,551	73,700
Net amortization and other	44,739	33,689
Net periodic postretirement benefit cost	$160,923	$141,819

During 2002 and 2001, benefits paid were $81,454 and $89,025, respectively. Other than the transfer from the pension plan, there were no participant or employer contributions.

A reconciliation of the accumulated postretirement benefit obligation to the liability recognized in the statements of financial position in other liabilities is as follows at December 31:

	2002	2001
Accumulated benefit obligation	$1,284,802	$1,028,025
Unrecognized net gain subsequent to transition	462,412	715,532
Unrecognized transition obligation	(985,557)	(1,061,369)
Accrued postretirement benefit liability	$ 761,657	$ 682,188

The actuarial calculation assumes a health care inflation assumption of 10% in 2002, decreasing uniformly to 4.25% by 2010 and remaining level thereafter. The assumed discount rate is 7.25%.

The Foundation's postretirement medical plans are not funded.

9. CONTINGENCY

The Foundation is a partner with a 12.5% interest in the Large Binocular Telescope Project (the "Project"), which is building and will manage an astronomical observatory. The Foundation has sold or granted to other astronomy research institutions all of its viewing rights in the observatory along with the obligation to pay related operating costs. The Foundation remains contingently liable for its proportionate interest in observatory costs to the extent the other astronomy research institutions become unable to pay and forfeit their viewing rights.

10. LITIGATION

The Foundation is subject to claims arising out of the conduct of its business. Management believes these matters are without merit and intends to contest them vigorously. These claims, when finally concluded, in the opinion of management based on information it presently possesses, will not have a material adverse effect on the Foundation's financial position, results of operations or cash flows.

During 2002 and 2001, the Foundation incurred legal fees to defend itself against certain litigation relating to the Program transferred to RCT in 1987. These costs totaled approximately $2,007,000 and $391,000 for the years ended December 2002 and 2001, respectively, and are included in general and administrative costs.

The Foundation believes it may be entitled to recovery of certain legal fees paid, in whole or in part, under certain insurance and indemnity agreements. No amounts have been recognized for any possible recoveries.

11. RELATED PARTY TRANSACTIONS

The Foundation and RCT have certain agreements under which:

a. The Foundation has an office facilities lease agreement with RCT that expires July 31, 2003. Lease expense paid to RCT under this agreement for the years ended December 31, 2002 and 2001 was approximately $248,000 and $201,000 respectively.

b. Through December 31, 2001, the Foundation paid a management service fee to RCT for making available professional and other services to the Foundation to the extent that such services were reasonably required by the Foundation. The management service fee for the year ended December 31, 2001 was approximately $112,400. Effective January 1, 2002, the management service agreement was terminated.

c. At December 31, 2002 and 2001, the Foundation had amounts payable to RCT of approximately $480,000 and $286,000, respectively, relating to expenses paid by RCT on behalf of the Foundation.

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