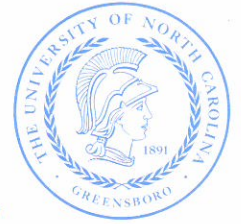


MINERVA



A JOURNAL OF RESEARCH AND CREATIVE ACTIVITY



THE UNIVERSITY OF NORTH CAROLINA
GREENSBORO

Inside This Issue
The Body Human



Dr. Brad Bartel
Dean of the
Graduate School

Doing an issue of *Minerva* devoted to *The Body Human* presents an embarrassment of riches for UNCG, or for that matter most universities. The explosion of research in human genetics including the decipherment of the human genome, understanding and curing disease, and new approaches to human physiological disorders has become commonplace during the last decade. To select only four articles in this issue to represent the scope and nature of the theme only skims the surface. I am sure we will be coming back to this theme in the future to highlight many more of our faculty.

One of the great joys for our university is the establishment of the first graduate degree in genetic counseling for North Carolina. The great southeastern part of the United States suffers a shortage of qualified genetic counselors. Our new program will assist in alleviating this problem. Our program is unique since many of the existing programs nationally are housed within medical schools. The UNCG program is administratively housed within The Graduate School, and the curriculum comes from various departments across the university, with clinical practice support from the medical centers of the state.

Another strength of UNCG allied health fields is seen in the article on Dr.

Bedini's therapeutic recreation program. Like genetic counseling, this is another area of critical need, especially in terms of increasing the diversity of therapeutic recreation specialists. Dr. Shields' research to find a biosensor for cancer detection is in the forefront of biochemical research, and demonstrates quite effectively the types of practical applications that are the basis of many university-based science programs. Finally, we highlight our new comprehensive approach to studying the relationship between iron deficiency anemia and bone growth: a relationship with important implications for youth and young adults.

The 1999 fiscal year was the best year UNCG ever had in externally derived grant and contract awards. Our faculty obtained more than \$23.5 million; a significant achievement. We highlight the diversity of awards in our last section, containing some of the faculty who received funding last year, and graphs explaining the type of awards and growth in research.

MINERVA

The University
of North Carolina
at Greensboro

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C O N T E N T S

Page 2	Genetic Counseling Establishing the first program in North Carolina
Page 4	Biosensors in Cancer Detection A new biochemical approach
Page 6	Iron Deficiency Anemia Comprehensive models for bone growth
Page 8	Therapeutic Recreation Specialists Preparing more diverse professionals
Page 10	Award Listings Selected FY 99 research awards
Page 13	Awards Charting research activity

On the cover: Arthur B. Davies, *Tribute to Youth*, no date, oil on canvas.
Gift of Jefferson-Pilot Corp., Weatherspoon Art Gallery, UNCG, 1972

GENETIC COUNSELING

ESTABLISHING THE FIRST PROGRAM IN NORTH CAROLINA



Ms. Nancy Callanan
Director of Genetic
Counseling

If you knew it were possible to find out what disease or diseases your body might fall prey to, or what inherited anomalies might affect your unborn children, would you want to do it? Would you know how to go about it? Then what would you do once you had the information? These are questions large segments of our society face as scientists unravel the fabric of genetic makeup. As the scope of this information increases, so will the need for qualified professionals to interpret and explain it, and help manage the options.

As it launches the first and only masters degree program for genetic counselors in North Carolina during the Fall 2000 semester, the University of North Carolina at Greensboro takes the lead in training the healthcare professionals who provide this guidance. Genetic counselors are trained to understand and communicate the volumes of complex technical information about inherited conditions, and tests for those conditions, to individuals and families who need to process that information.

Until now, North Carolina students interested in the burgeoning field of genetic counseling had to attend one of twenty-three other programs scattered throughout the country. Under the direction of Nancy Callanan, a board-certified genetic counselor with more than twenty years of clinical experience, the two-year program will lead to a master's degree in genetic counseling. It is an interdisciplinary program with faculty drawn from biology, counseling, mathematics, psychology, philosophy, and public health.

Genetic counselors work on teams with other specialists and physicians trained in genetics at university medical centers, private hospitals, public health clinics, HMOs, and screening programs. "The goal of the interaction is to help people understand a specific genetic condition and the impact it may have on their lives," Callanan said. "For example, a young couple planning to start a family might seek genetic counseling about a concern in their family history. Perhaps

one member of the couple has a sister with cystic fibrosis, one of the most common genetic conditions. Having seen what this means regarding treatments and hospital admissions, and all she has had to go through, they are concerned about whether they have an increased risk for having children with the same condition. They may want to undergo testing to see if they are at increased risk. "In this case, the genetic counselor who is familiar with cystic fibrosis, looks at the family history carefully, explains how the condition is inherited and answers questions about the condition, the medical management, the prognosis, etc.

"The genetic counselor explains what kind of testing might be helpful; how it's done; where it's done; what it costs; how accurate it is; limitations to the testing and so on. The genetic counselor translates all the technical information for them. The counselor helps them explore the pros and cons, so they can reach a decision they are comfortable with," Callanan said.

Until recently, most genetic counseling has focused on reproductive issues, dealing with the risk of a child being born with a specific disorder. Should there be a risk, the counselor helps the couple deal with the options that are available. "One of the critical components in the education and training of genetic counselors is that they have first-hand clinical experience," Callanan said. "Our program is formally affiliated with clinical genetics programs in the medical schools at Duke, UNC Chapel Hill, Wake Forest, and the Fullerton Genetic Center in Asheville to provide that training. In a sense, this is an all-state program since we incorporate so many resources throughout the state."

Ultimately, the program will accept about ten students a year, said Callanan. "The coursework covers human and molecular genetics, clinical genetics, techniques used in genetic counseling, and the impact of genetic disorders on patients and their families. Another important component will be an ethics of genetics course."

Genetic counseling is a relatively young pro-

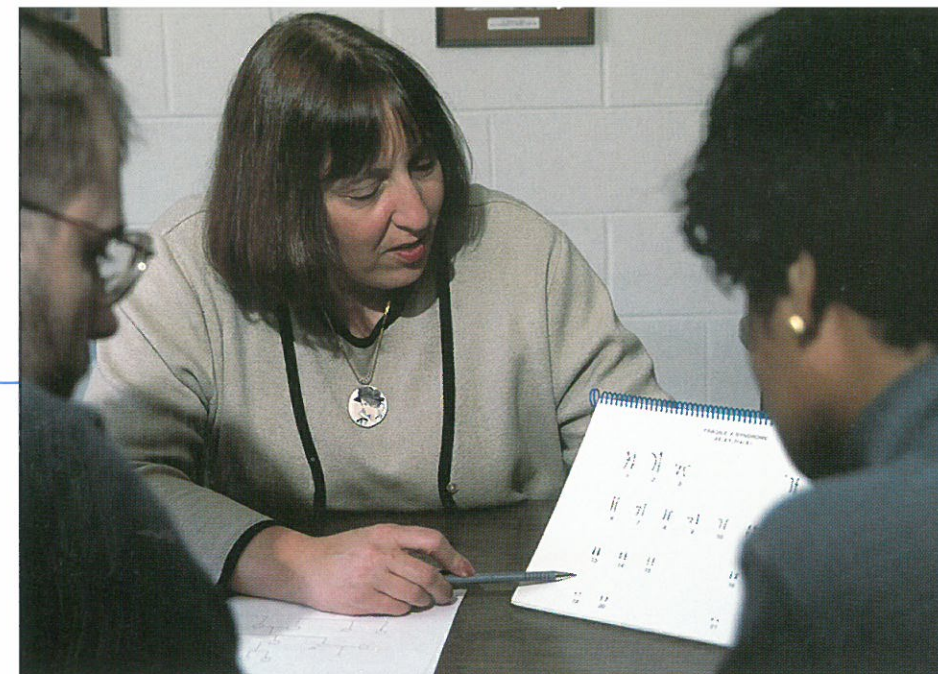
fession. A recent study reports the field has approximately 1,300 practitioners nationally. Currently about 125 new genetic counselors are graduated nationally each year. According to a recent National Society of Genetic Counselors survey, on average it takes graduates about one to two months to find a position. Most genetic counselors (70 percent) are employed in university medical centers. Others are employed in state genetic programs in public health centers, still others work for private genetic labs, health maintenance organizations, and in teaching and administration; a majority have some clinical responsibilities at a hospital.

"Research conducted by the 15-year, international Human Genome Project, begun in 1990, is responsible for an explosion in the information we have about how genes influence our health. As more and more genes and their involvement in various diseases and physical anomalies are discovered, an increased number of genetic counselors will be needed to help people deal with the myriad of choices confronting them." Ultimately, with this kind of information, the medical professional will be able to focus less on treatment and more on prevention.

"For example," Callanan said, "we now know there are some hereditary forms of breast and ovarian cancer. Some women have an increased risk for developing breast cancer because of a gene that runs in their family. So now, we're shifting from a reproductive concern to learning something about ourselves, to what is called predictive testing. Predictive testing can be presymptomatic. We may be able to test at an early age for a condition that doesn't show itself until later in life, or we might do susceptibility testing to see if we're at risk for a condition because of the genes we have inherited."

Genetic counselors are also trained to deal with the moral and ethical issues that impact decisions for patients. For instance, the question arises: can genetic information cause you to be

Ms. Nancy Callanan explaining
a genetic problem.



discriminated against when applying for insurance?

Callanan, who has been a genetic counselor for twenty-two years, has served in clinical positions, providing genetic services in prenatal and pediatric counseling. As an undergraduate in biology, Callanan became interested in what was then a fairly new profession. "I attended the first graduate training program for genetic counselors in the country, at Sarah Lawrence College. Like many other students, I came to this profession as a person who found the science of genetics fascinating. What appeals to me is the wonderful combination of exciting science and helping profes-

sion."

As a clinical assistant professor in the department of pediatrics at UNC Chapel Hill, where she worked for nineteen years, Callanan said she met many students interested in becoming genetic counselors, but no programs existed in North Carolina. Callanan has been very active in the National Society of Genetic Counselors, serving on the board of directors and numerous committees, including the one that developed the society's code of ethics. She recently received the society's prestigious Award for Regional Leadership. She currently serves on the American Board of Genetic Counseling, the organization responsible for accrediting all genetic counseling programs.

"I feel privileged to be able to contribute to the education of the next generation of genetic counselors," she said.

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BIOSENSORS IN CANCER DETECTION

A NEW BIOCHEMICAL APPROACH



Dr. Thomas Shields
Department of Chemistry
and Biochemistry

"THE BIG
PICTURE IS,
WE'RE TRYING
TO DIAGNOSE
CANCER."

A new biochemistry lab at UNCG is on its way to developing a simple biosensor for detecting cancer and monitoring chemotherapy. This research can be accomplished through start-up funds from the University of North Carolina at Greensboro, and two \$40,000 starter grants, one from the N.C. Biotechnology Center (NCBC) and the other, the Cottrell College Scholars Award (CCSA), from the Research Corporation.

According to the project director, Dr. Thomas Shields, Department of Chemistry and Biochemistry, the direction the lab is taking is based on a discovery originally made at NeXstar Pharmaceuticals in Boulder, Colorado in 1993. Dr. Shields, who was a post-doctoral fellow at the University of Colorado at Boulder until he came to UNCG in 1998, says those researchers were able to prove that ribonucleic acid (RNA) molecules can be used for molecular recognition; to tell the difference between two molecules. RNA research is traditionally associated with biological research, Dr. Shields explains, but he is interested in it from a chemical standpoint, to use as a tool for molecular recognition, which is the basis of almost all biochemical processes.

"Most people are familiar with DNA, our fundamental genetic material, and the proteins that are regarded as the workhorses of the cell. We have always thought of RNA as an intermediate between the DNA world of information storage and the protein world of activity, and that we need DNA, RNA and proteins for cells to exist. But more recently, we have learned that RNA alone can store genetic information. For instance, retroviruses, such as HIV, do in fact store their genetic information as RNA, not DNA. Then, two biochemists, Tom Cech and Sid Altman, won the Nobel Prize in Chemistry in 1989 for showing that RNA can actually have catalytic activity similar to protein. The RNA-world hypothesis now is that RNA can do everything," Dr. Shields said.

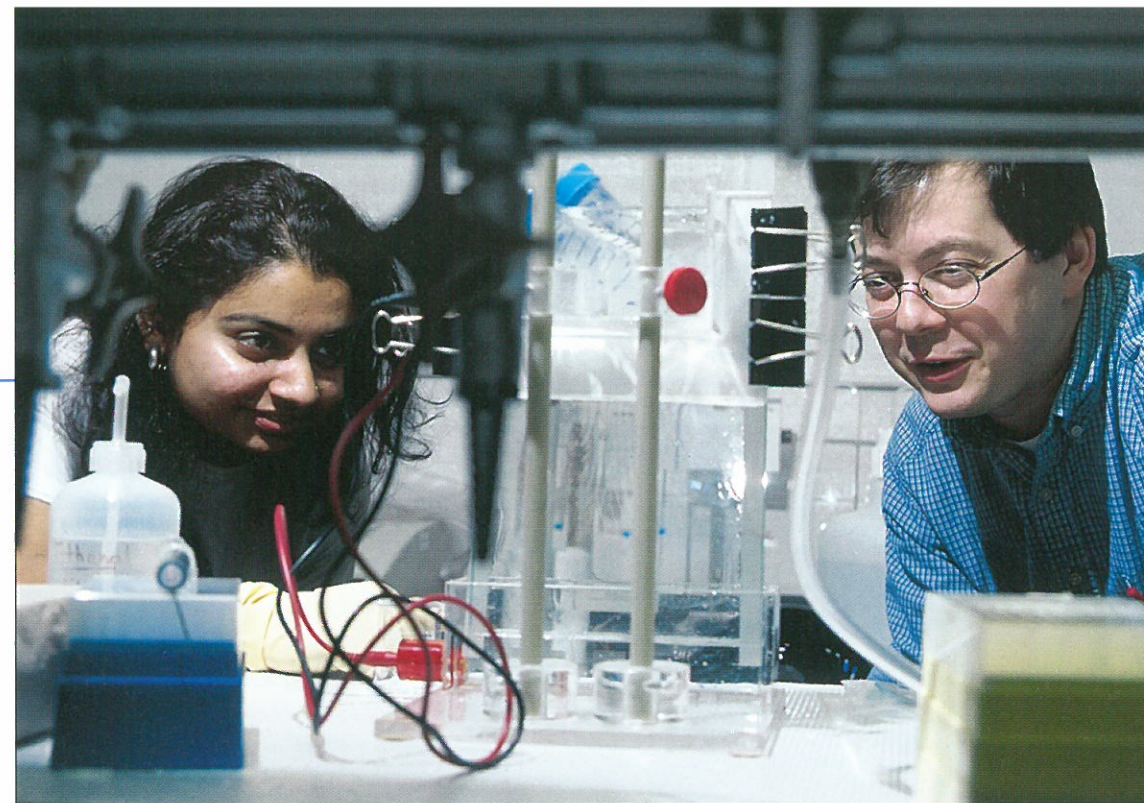
"Molecular recognition is very important diagnostically," he added. "For example, take the

two molecules, theophylline and caffeine: caffeine is almost identical to theophylline, but it has one additional carbon. So, when a doctor treating a patient with the anti-asthmatic drug theophylline wants to know how much of the theophylline is getting into the blood stream, it's difficult to separate it out from the background of all the caffeine we consume on a daily basis. This is a problem of molecular recognition. How do you recognize one molecule and not the other?"

The scientists at NeXstar had approached exactly this problem. They had been challenged by Abbott Laboratories, a company that already had a working biosensor for theophylline, to examine whether an RNA molecule could outperform the existing biosensor.

After chemically selecting RNA that is bound to theophylline by a process called in vitro selection, the NeXstar scientists isolated an RNA sequence that bound to theophylline 10,000 times stronger than to caffeine. The existing biosensor is only capable of 500-100 fold level of differentiation. At the same time, the researchers in Colorado came up with the RNA that binds to theophylline, another group at Harvard University in Boston selected an RNA that binds ATP (adenosine triphosphate). Referred to as the energy source of the cell, ATP is a classic biochemical molecule and one of the four basic building blocks of RNA. "Both of these initial results were proof that RNA could work as the basis for a biosensor," Dr. Shields said, "but since there is already a biosensor for theophylline, and since ATP isn't considered that important as a diagnostic target, no one has taken that next step to convert these RNA's into commercially viable biosensors."

Half of Dr. Shields' research will focus on how to make a biosensor out of these RNAs. "We'll try to adapt several techniques found in the literature for making biosensors of DNA. The RNA that binds to theophylline and not caffeine is a great test case." The other half of Dr. Shields'



Dr. Thomas Shields (r), in
his lab with undergraduate
student Ms. Rubaiya
Talukdat (l).

research is pursuing new targets. "In going through the literature, we find other important small molecules chemically similar to theophylline or ATP: pseudouridine and methyladenosine. The levels of pseudouridine and methyladenosine are higher in the urine of cancer patients and are urinary prognosticators for cancer. The idea is, if you can come up with an RNA that binds a small molecule and doesn't bind another small molecule, that becomes the basis for your biosensor. The extension is that any biosensor for pseudouridine would be a biosensor for cancer. The big picture is, we're trying to diagnose cancer. The small picture is purely scientific."

At present, Dr. Shields has six students working in the lab and hopes eventually to have eight to ten. "It's really exciting to work with people who are right at the start of their scientific careers," Dr. Shields said. "We're here to teach students not just the mechanics of doing research. They have to learn how to have an original idea and to develop an experiment to test it. We also encourage them to present at conferences and write real-life research papers. That's an important component of their education."

"A large portion of our grants goes to pay undergraduates to work in the lab on summer fellowships. The grant from CCSA is specifically for undergraduate research," Dr. Shields said. Shields said biochemistry and the department are attracting many new students. "I literally have students stopping in every week saying, 'I was a chem major,' or

'I was a biology major, but I'm really interested in both.' "We want the students to enjoy the research...that's when you think independently and that's when you get the best results. When students are happy and excited about what they're doing, they'll come up with the innovative ideas one needs."

Dr. Shields feels fortunate to have gotten the grant from NCBC. Aside from the funding, NCBC is a valuable contact, he says. "They are a conduit for start-up biotech companies. They are asked constantly who is doing research applicable to the start-up company.... and they know what we're doing. We're just starting. We haven't developed a cancer test. But some day we may be in the position to try to develop commercial applications."

STUDENT PROFILE

Joe Darty

Joe Darty '99 — One of the undergraduate students working in Dr. Shields' lab, Darty finds his lab experience spills over into his other classes: "It's really valuable in terms of problem solving," he said. Darty graduates in the spring and says his one and half years of lab work should be helpful if he decides to apply to graduate school.

IRON DEFICIENCY ANEMIA

COMPREHENSIVE MODELS FOR BONE GROWTH



Dr. Deborah Kipp
Associate Dean, The School
of Human Environmental
Sciences

"THE WORK
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Iron deficiency anemia is an acknowledged health risk in the United States and developing countries, but only recently have researchers undertaken studies to investigate the link of this nutritional deficit with brittle bones, which may ultimately lead to osteoporosis.

Dr. Deborah Kipp, associate dean of the School of Human Environmental Sciences and Professor in the Department of Nutrition and Foodservice Systems at the University of North Carolina at Greensboro, is in the early stages of a project to investigate how iron deficiency anemia affects bone growth and creates changes in bone structure in rats. Dr. Kipp, whose main body of research is in nutrition and the skeleton, also has had a long-term interest in the deficiency and excess of ascorbic acid on the skeleton.

Both iron and vitamin C play a significant role in the production of collagen, she explains. Collagen, which is prevalent in bone, gets mineralized and forms the basic structure of the skeleton, so a severe deficiency in iron interferes with the normal development of bone. "We hear a lot about calcium and vitamin D and the bones," Dr. Kipp said, "and we're encouraged to consume dairy products and other foods high in calcium to maintain strong bones, but vitamin C and iron are two other nutrients that also have a direct effect on the skeleton. Although most people get enough vitamin C," she added, "there are pockets of people who don't."

Dr. Kipp's studies evaluate the effects of mild and severe iron deficiency on bone growth compared to bone development when a normal diet is consumed. She then goes a step further, to determine if, and to what extent, the damage caused by iron-deficiency anemia can be corrected with the reintroduction of adequate iron intake. "Although we know that severe iron deficiency results in skeletal abnormalities, it is very important to determine how severe the abnormalities are when the iron deficient state occurs for a short period of time compared to a long period of time, and the extent that early intervention with a diet adequate in iron will reverse

skeletal abnormalities and thereby prevent serious health problems, such as osteoporosis, that may otherwise occur in later life," she said.

Dr. Kipp's research has implications for teenagers and young adults, particularly those who are pregnant, have an inadequate diet, and whose prenatal care is negligible. She questions the effects iron-deficiency and lack of vitamin C have on the growth and strength of their skeletons, and whether the skeletons of the fetuses they are carrying are being compromised. "The work I'm doing is to try to tease out what effects these specific nutrients have on bone, and to figure out, first of all, if these are important health issues," she said.

The initial results from Dr. Kipp's iron-deficiency anemia studies, done on animal models, show that it has a dramatic affect on bone. "Take iron out of the diet and bones become brittle," she said. She reports that severe iron-deficiency anemia has a major effect on the bones of young, growing male rats, and the longer the condition exists, the worse effect it has on bone. She found that over a five to six-week period, the skeleton mass was reduced 20 percent, and the bones proved to be porous and brittle. The skeleton is influenced by many factors, Dr. Kipp said, so it is important to evaluate the overall density and mineral content of the bone mass, then look microscopically to see how the mass is altered. It is also necessary to analyze why the bone effects occur by looking at such things as serum vitamin D. "We have also started to evaluate gene expression of bone-specific proteins as another way to determine why the iron-deficiency effects occur. It is important to understand which effects are due to iron deficiency itself — the direct effects — and which effects are due to the iron-deficiency altering other factors that affect bone — indirect effects."

Although both sexes appear to be affected by iron-deficiency, more work is needed to determine if one sex is more susceptible or if one sex can more quickly reverse the abnormalities when a normal diet is resumed, she said. Dr. Kipp is

presently completing some basic studies in iron deficiency using pair-fed animals. Since iron-deficiency anemia causes lower than normal body weight, it is necessary to have a control group of normal animals with the same body weight as the iron deficient animals to be sure the body weight does not have a direct relationship to the loss of bone density. The results of this study assess the extent that long-standing, severe iron-deficiency anemia influences bone modeling.

Dr. Kipp has one part-time research assistant working with her in the lab. She looks forward to working with undergraduate and graduate students in the near future. "This is such a great opportunity for them," she said. "They get lab experience, prepare presentations and do some original writing."

Dr. Kipp, who came to UNCG in 1998, began her research at the University of Kansas Medical Center where she was the Midland Dairy Council Endowed Professor in the department of dietetics and nutrition. Her research projects have been funded by agencies such as the National Institutes of Health, the National Dairy Council, and the J.B. Reynolds Foundation. Dr. Kipp says that although this area of nutrition has been studied in bits and pieces elsewhere, no one has approached the research comprehensively.

"The advantage my collaborators and I have," she said, "is that we can do bone densitometry, histomorphometry, and biochemical and molecular biology analyses to obtain a more thorough understanding of the impact of inadequate iron and vitamin C intake on the skeleton." In the iron-deficiency anemia studies, Dr. Kipp collaborates with Don Kimmel, PhD., from Merck in Philadelphia; Barbara Lukert MD, an endocrinologist from the University of Kansas Medical Center; and Cynthia Lees, DVM, PhD and Robert Brommage, PhD, from Wake Forest University School of Medicine. Her primary colleague in the studies is John Beard, PhD, professor of nutrition at The Pennsylvania State University.



Dr. Deborah Kipp (standing) working in
her lab with research assistant Ms. Paula
Cooney.

THERAPEUTIC RECREATION SPECIALISTS

PREPARING MORE DIVERSE PROFESSIONALS



Dr. Leandra Bedini
Associate Professor,
Department of Recreation,
Parks, and Tourism

**"WE SUCCEEDED
IN GRADUATING
AND PLACING
79 PERCENT OF
OUR PROJECT
PARTICIPANTS
IN PROFESSION-
AL POSITIONS."**

Recreation is serious business. Particularly in the therapeutic recreation program of the Department of Recreation, Parks and Tourism at the University of North Carolina at Greensboro. Associate Professor Leandra Bedini, a Certified Therapeutic Recreation Specialist, recently received a federal grant from the US Department of Education Office of Special Education for \$520,000 for a three-year project: *Preparing Underrepresented Personnel in Therapeutic Recreation*. She explains that in the field of therapeutic recreation, while the population with disabilities has an overrepresentation of minorities, and youth compared with the general population, African Americans, other minorities and males are severely underrepresented. Ninety-five percent of the practitioners are European Americans and 80 percent are female.

A previous five-year grant, from 1994 to 1999, from the same source, funded a similar project. "Although those numbers haven't changed much over the past five years," says Dr. Bedini, "we succeeded in graduating and placing 79 percent of our project participants in professional positions. "When I first came here eight years ago, the therapeutic recreation concentration had a handful of people of color and a few males," Dr. Bedini said. "One course I taught in 1993 was all white female. However, of the thirty people in an equivalent course in the fall of '98, fifteen were African American and fifteen European American, and about 40 percent were male. They were more comfortable with this mix, and it encouraged frank discussion on a number of issues. The learning experience was enriched far beyond my previous experiences."

During the first grant, the department's therapeutic recreation concentration rose from an 11 percent participation of students of color to 34 percent. "It was a byproduct of the grant we could not have predicted," Dr. Bedini said. The study concentration in therapeutic recreation prepares students to enter the profession and provide services to culturally diverse children and

youth with disabilities in the public schools and through a variety of other delivery systems such as group homes, independent living agencies, rehabilitation centers and long-term care facilities. In addition, it prepares them to be certified by the National Council for Therapeutic Recreation after graduation. "Therapeutic recreation specialists work on a team with other physical therapists, physicians and nurses to develop treatment and evaluation plans for the client," Dr. Bedini said. Terri Phoenix, a research associate on the project, said, "Therapeutic recreational specialists are more likely to deal with clients of a racial or ethnic minority, and some have run into ethnic, racial, or gender discomfort. You can work with cross cultural competence to a degree, but there's something to be said about cultural affiliation."

"Our project has a mentoring component, as well," Dr. Bedini said. "Practitioners in the field, some who are African American graduates of the program, come here to share their experiences and to discuss the benefits of being a person of color, and what it's like to work with clients."

Job placement is also an important factor in the program. "We want our graduates to be successful," she said. That shouldn't be too difficult. In the 1998 Career Guide published by the U.S. News & World Report, therapeutic recreation is one of the "hot track" occupations. In 1995, the Wall Street Journal estimated a 40 percent growth in the field between 1992 and 2006. Potential candidates learn about the popular project by word of mouth. For the first project, the department actively recruited students through high school advisors and community colleges, and distributed information about the program to departments in the University. As in the previous project, the department works in collaboration with NC Agricultural and Technical State University (NCA&T), a school that is 84 percent African American. "Now that the word has gotten out about our program," Dr. Bedini said, "students contact us. We're at full capacity for this year,



Dr. Charlsena Stone
(standing) Project
Coordinator, working
with undergraduate stu-
dents.

though we may have openings from those who graduate next year. The students have to take therapeutic recreation concentration courses available through our department. At A&T it's a little more difficult. Students have to use their free electives, since the school doesn't have a concentration in therapeutic recreation in their curriculum."

"We also have increased the grade point average requirement since the last grant, and the students have to attend one conference per year and staff meetings.

"We've added three required courses to the curriculum to give them a well-rounded perspective: *Exceptional Children, Leisure Education in Transition, and Recreation in the School System* for children and youth with disabilities. These are in keeping with the directives of the office of special education."

Therapeutic recreation students take courses in biological and developmental sciences. In addition, the students who are part of the grant program take courses in special education and counseling. The program is unique in the US and is possibly the only therapeutic recreation program with a cultural diversity component. Recreation therapy reaches a broad range of clients. It is an early intervention technique for youth at risk, providing them with alternatives to antisocial and destructive behavior. A course in *Leisure Education and Transition* developed by Dr. Charlsena Stone, project coordinator, teaches students how to help the physically disadvantaged learn about leisure activity skills, identify resources in the community how to access them, to develop social skills, and

discover where they want leisure in their lives.

"It's important to know how to access assisted technology," Ms. Phoenix said. "People with physical disabilities need to use adaptive devices like a lap board, a hand driven bicycle, or a bowling ball with a handle. Knowing how to find them in the community is important. Therapists also help their clients develop confidence and assertiveness, and teach them to make decisions."

Dr. Bedini said, "Our students even learn how to write foundation grants. Some of them have been successful at getting equipment this way. One past student, who is now working in Charlotte and is one of our mentors, submitted a proposal for funding for her class that was rejected, but that didn't diminish the skill she had learned. She recently wrote a new foundation grant for which she was awarded \$44,000 to purchase an accessible van. She is now able to take clients out on field trips in that van."

Dr. Bedini explains that about 65 percent of the funding is used for student stipends and non-work awards to cover tuition, fees, books, and one conference. Dr. Bedini, who was the recipient of the National Therapeutic Recreation Society's 1997 Professional Research Award, has written extensively and presented internationally on topics dealing with people with disabilities. She recently completed research on perceived stigma and community recreation pursuits for people with disabilities.

AWARD LISTINGS
FISCAL YEAR 1999

Sampling of Awards in Education

Principal Investigator & Department	Sponsor	Amount	Project Title
Gertrude Ross <i>Special Support Services</i>	US Department of Education	\$209,150	Student Support Services
Richard Ehrhardt <i>Information Systems & Operations Management</i>	Internationale Fachhochschule Worms	\$73,820	MBA Program Agreement and Fiscal Amendment
George Bright & Nancy Vacc <i>Curriculum & Instruction</i>	National Science Foundation	\$209,344	CGI-Cognitively Guided Instruction Dissemination
Judy Niemeyer <i>Curriculum & Instruction</i>	Guilford County Partnership for Children	\$11,350	Parent Education Plan: Parent Power
John Van Hoose <i>Curriculum & Instruction</i>	Champion Middle School Partnership	\$31,000	Middle School Development Activities
Garry Walz <i>Counseling & Educational Development</i>	US Department of Education	\$417,980	Eric Clearinghouse on Counseling
Larry Coble <i>Educational Leadership & Cultural Foundations</i>	Ohio University	\$358,225	Ohio Appalachian Leadership Project
Edgar Shroyer & Mary Compton <i>Specialized Education Services</i>	US Department of Education	\$186,316	Educational Interpreter/ Transliterator Training
Vicki McCreedy & Jacqueline Cimorelli <i>Communication Sciences & Disorders</i>	US Department of Education	\$144,488	New Master's Level Program Track in Speech
Deborah Cassidy & Linda Hestenes <i>Human Development & Family Studies</i>	NC Division of Child Development	\$15,000	Impact of AAS College Transfer Agreements
Virginia Karb <i>Nursing</i>	DHHS	\$82,602	Professional Nurse Traineeship Program
Laurie Kennedy-Malone <i>Nursing</i>	DHHS	\$167,544	Adult Gerontological Nurse

Sampling of Awards in the Social and Behavioral Sciences

William Gruchow <i>Institute for Health Science & Society</i>	DHHS/Office of Public Health & Science	\$200,000	Wise Guys: Peer Education and Reproductive Health
Carol MacKinnon-Lewis <i>Center for the Study of Social Issues</i>	HUD	\$399,325	Community Outreach Partnership Center
Lee Bernick, <i>Political Science</i> & David Pratto, <i>Sociology</i>	Winston-Salem/Forsyth Co. Utility Commission	\$10,615	Survey of Winston-Salem/ Forsyth Co. Utilities
Susan Calkins, Susan Keane, Arthur Anastopolous, & Terri Shelton <i>Psychology</i>	PHS/NIH/NIMH	\$304,670	Developmental Trajectories of Early Behavior
Jacquelyn White, <i>Psychology</i> John Humphrey, <i>Sociology</i> Paige Smith, <i>Public Health Ed.</i>	National Institute of Justice	\$999,745	Developmental Antecedents of Violence
Rebecca Adams <i>Sociology</i>	Grateful Dead Productions	\$9,246	Terrapin Station
Benton Miles <i>Business</i>	NC Small Business & Technology Development	\$3,000	Faculty Liaison Program- SBTDC
Vidyaranya Gargeya <i>Information Systems & Operations Management</i>	VF Services	\$5,000	Threading the Needle: Modeling the Supply Chain
Gerald Juhnke <i>Counseling & Educational Development</i>	NC Governor's Institute on Alcohol and Substance Data Analysis Abuse	\$4,000	Collegiate Binge Drinking
Susan Dietrich <i>Communication Science & Disorders</i>	Malcolm Fraser Foundation	\$7,000	Casual and Contributing Factors of Stuttering
Daniel Gould <i>Exercise & Sport Science</i>	US Tennis Assoc. (Player Development Division)	\$7,763	Helping Coaches Develop Mental Toughness Skills
Stuart Schleien <i>Department of Recreation, Parks & Tourism</i>	Community Foundation of Greater Greensboro	\$10,000	Building Community Through Inclusive Volunteer Work
Paige Smith <i>Public Health Education</i>	Governor's Crime Commission	\$5,551	Effective Practices for Health Care Providers
Carla Miller <i>Nutrition & Foodservice Systems</i>	NC Institute of Nutrition	\$9,000	Tracking Supermarket Food Purchases
Jacalyn Claes, Raleigh Bailey & John Rife <i>Social Work</i>	NC Department of Human Resources	\$24,935	Family Violence Prevention in Refugee Communities

Sampling of Awards in Arts and Humanities

Nancy Doll <i>Weatherspoon Art Gallery</i>	NC Arts Council	\$10,000	NC Arts Council Fellowship Exhibition
Pamela Hill <i>Weatherspoon Art Gallery</i>	Community Foundation of Greater Greensboro	\$1,500	Hot Spots Community Festival Day

Joseph Mountjoy <i>Anthropology</i>	Puerta Vallarta, Mexico	\$1,000	Archaeological Investigations in the Municipalities of Puerta Vallarta & San Sebastian Del Oeste, Summer of 1998
Russ McDonald <i>English</i>	Mellon (Andrew W.) Foundation	\$80,000	Professional Balance
Kathleen Ahern <i>German & Russian</i>	Council for the International Exchange Of Scholars	\$32,500	African-American Authors in Dialogue with Russians
Jodi Bilinkoff <i>History</i>	National Humanities Center	\$24,500	Confession & the Construction of Identities
Robert Calhoon <i>History</i>	Louisville Institute	\$9,000	Protestant Denominations and their Critics
Kenneth Caneva <i>History</i>	Dibner Institute for the History of Science & Technology	\$30,600	The Reconstruction of Scientific Knowledge
James Prodan <i>Music</i>	Greensboro Symphony Orchestra	\$2,996	Greensboro Symphony Orchestra Graduate Internships

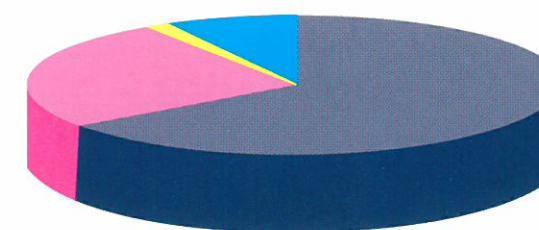
Sampling of Awards in Science and Mathematics

Anne Hershey <i>Biology</i>	National Science Foundation	\$86,732	Key Connections in Arctic Aquatic Landscapes
Parke Rublee <i>Biology</i>	ECOHAB (Subcontractor from Univ. of Maryland)	\$124,940	PCR-Based Strategies to Monitor Estuarine Dinoflagellate Diversity
Ann Somers <i>Biology</i>	NC Department of Transportation	\$5,000	Remediation Hydrology of a Degraded Meadow
Alice Haddy <i>Chemistry</i>	National Science Foundation	\$60,000	Biophysical & Electron Paramagnetic Resonance Studies: Energetics of the Oxygen Evolving Complex & New Curricula for Undergraduates
Gregory Rainer <i>Chemistry</i>	Research Corporation	\$34,552	Mechanistic Investigation of Cytochrome P450
Roy Stine <i>Geography</i>	Audubon International	\$15,000	Development of Geographic Information Systems
Cheryl Logan <i>Psychology</i>	National Science Foundation	\$48,415	The History of Animal Models
Don Morgan <i>Exercise & Sport Science</i>	PHS/NIH/NICHD	\$75,449	Physical Growth and the Aerobic Demand of Locomotion
Nancy Cassill <i>Textile Products Design & Marketing</i>	US Department of Agriculture (Subcontractor from LSU)	\$36,000	Resources Supporting Fiber, Textile, and Apparel
Mark Failla <i>Nutrition & Foodservice Systems</i>	US Department of Agriculture	\$50,000	Influence of Copper Status on Monocyte/Macrophage Function
George Loo <i>Nutrition & Foodservice Systems</i>	American Institute for Cancer Research	\$148,746	How Do Flavonoids Kill Human Breast Cancer Cells?

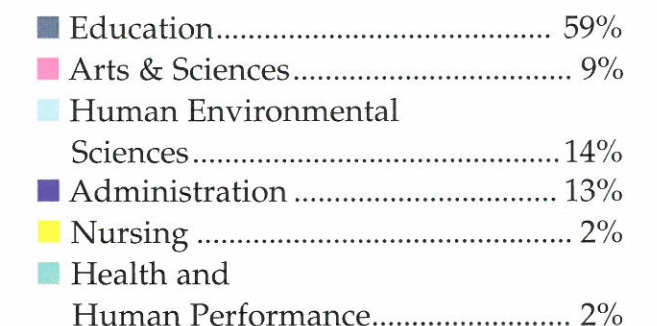
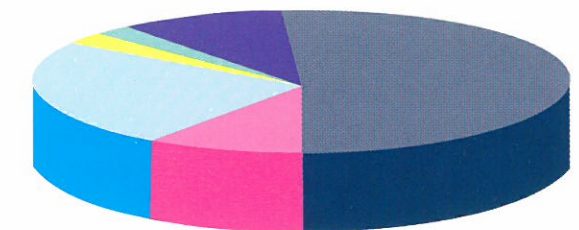
AWARDS & EXPENDITURES

FISCAL YEAR 1999

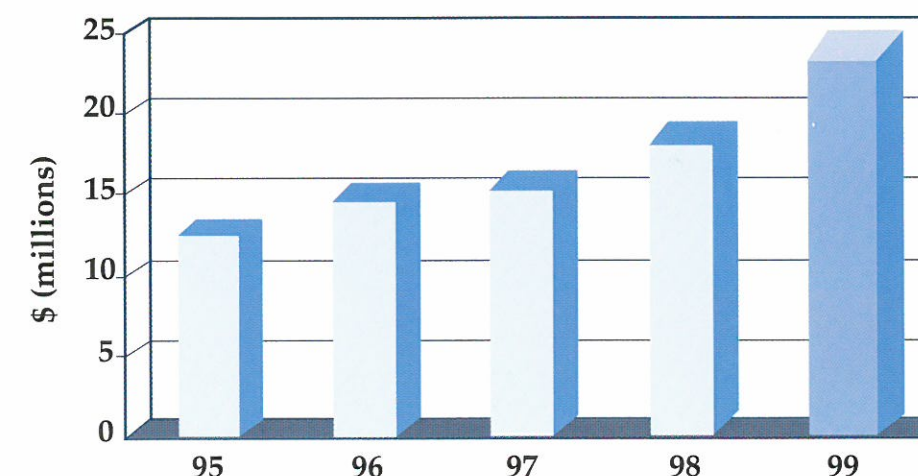
By Source (fiscal year 1999)



By Academic Unit (fiscal year 1999)



External Awards



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