BROOKHAVEN BULLETIN
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BROOKHAVEN NATIONAL LABORATORY

Brookhaven Breakthrough in DNA Sequencing Promises to Speed Human Genome Project

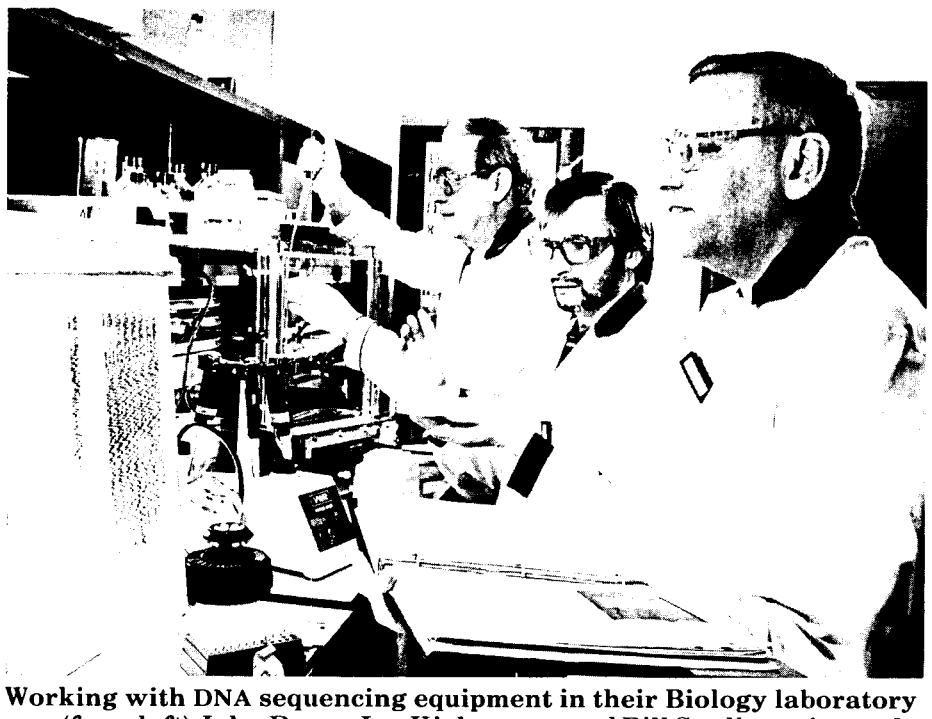
A breakthrough that promises to increase the speed of DNA sequencing at least tenfold is reported in today's issue of *Science* magazine by BNL researchers Jan Kieleczawa, John Dunn and Bill Studier of the Biology Department.

If its promise can be realized, their method will give a substantial boost to the Human Genome Project, a national endeavor to identify all 100,000 human genes and to sequence all three billion base pairs of human DNA.

DNA is the molecule that carries genetic information, and DNA sequencing is the method of deciphering that information. Determining the entire set of genetic instructions of humans is a formidable challenge but will provide a new depth of understanding of human biology and a basis for understanding and treating genetic diseases.

Said Laboratory Director Nicholas Samios, "This clever development is yet another example of how first-rate activities in basic research lead in unpredictable ways to breakthroughs in areas of benefit to humankind. As such, BNL is pleased to be able to contribute so effectively to such an important scientific endeavor as the Human Genome Project."

The BNL researchers improved and simplified a sequencing method called primer walking. Their breakthrough can be understood by taking a closer look at the sequencing process.



Working with DNA sequencing equipment in their Biology laboratory are: (from left) John Dunn, Jan Kieleczawa and Bill Studier, who made the breakthrough that promises to increase the speed of DNA sequencing at least tenfold.

A Primer on Sequencing

DNA contains two chains of four kinds of bases, called A, T, G and C. The two chains are wrapped around each other and held together by the base pairs, A with T, and G with C. Because of the base pairing, the two chains are perfectly complementary: Where one chain has an A the other has a T, and where one has a G the other has a C.

To form new DNA, an enzyme called DNA polymerase uses one DNA chain as a template upon which to assemble a new complementary chain. DNA polymerase adds one base at a time to the growing end of the new chain, according to the base-pairing rules. Copying both chains in this way duplicates the original molecule.

"DNA polymerase cannot start new chains by itself," explained Studier, who is a Senior Biophysicist and Chairman of the Biology Department. "However, it will extend a chain from a primer, a short piece of DNA chain that is perfectly paired, base by base, with a complementary sequence of bases in the template DNA."

Primers can be synthesized in the laboratory. When DNA polymerase builds a new chain from such a primer, special biochemical techniques and a process called gel electrophoresis can be used to read the sequence of about 500 bases of the newly made chain.

Primer Walking

Most DNA chains are much longer than 500 bases, and one way to sequence these DNAs is by primer walking.

Once the sequence of some part of a DNA molecule is known, scientists can make a primer that will pair perfectly to the template DNA near the end of the known sequence. DNA

(continued on page 4)

BNL Lecture: Self-Organized Criticality and Catastrophes

". . . Change begets change, then feeds on its own momentum until finally the entire globe seems to be accelerating toward some kind of profound transformation.

. . . I described two kinds of changes: the slow and gradual change that is typical of our daily lives and the rapid, systemic change that occurs when a patten shifts from one state of equilibrium to another, a shift that comes as a surprise. But there is yet a third kind of change, which combines elements of the first two; one version of it is described in a new theory called self-organized criticality put forward by Per Bak and Kan Chen, physicists at Brookhaven National Laboratory. It may at first sound a bit complicated, but I think it sheds much light on the dynamics of change — both in our lives and in the world at large."

— From the conclusion of *Earth in the Balance* by Senator Al Gore, published by Houghton Mifflin Company, 1992.

To see how Bak and Chen's theory sheds light on the dynamics of change in Vice President-Elect Gore's life, read his book. To see how the theory sheds light on the dynamics of change in the world at large, come to the 283rd Brookhaven Lecture.

During that lecture, Senior Physicist Per Bak, Physics Department, will discuss "At the Edge of Chaos: Self-Organized Criticality and Catastrophes," on Wednesday, December 16. His talk will begin at 4 p.m. in Berkner Hall, following an introduction by Senior Physicist Victor Emery, Physics.

It was 1987 when Bak and Chen, then a research associate at BNL, along with then research associates Chao Tang and Kurt Wiesenfeld, began working on the theory of self-organized criticality — the theory that so intrigued Al Gore that, after a day's discussion with Per Bak in 1991, it became an integral part of his book's conclusion.

Per Bak

The theory describes a phenomenon of large systems that order themselves into a critical state. As Bak will explain in his lecture, such a system might start with a few grains of sand dropped randomly on a table. In the beginning, the grains will act individually, but as more energy is put into the system, the pile will become steeper and small avalanches will occur, then large ones — until the sandpile reaches a critical height beyond which it cannot grow.

At precisely that stationery state, Bak will show, the system will begin to communicate globally and events of all sizes will occur. And a plot of those events will invariably show a straight line. This phenomenon holds true for such varied systems as sandpiles, earthquakes and the economy — and renders each of them difficult to predict.

After receiving his Ph.D. in physics in 1974 from the Technical University of Denmark, Per Bak worked at BNL as a research associate in the Physics Department, 1974-76. Returning to Denmark, he took a research position with NORDITA, in Copenhagen, and, in 1979, became an associate professor at Copenhagen's H.C. Orsted Institute. Bak returned to Brookhaven in 1983, rejoining the Physics staff.

In 1990, Bak received the Samuel Friedman Foundation's Rescue Award, which was established in 1984 to honor outstanding Danish achievements in the arts and sciences. An editor for *Physical Review Letters* from 1986-87, he is also a fellow of the American Association for the Advancement of Science.

After the lecture, all are invited to join the speaker for discussion and refreshments. To join him for dinner at a restaurant off site, call Sandra Sanchez-Munoz, Ext. 3793.

Five Win Brookhaven Awards

Congratulations to the winners of the 1992 Brookhaven Awards: (standing, from left) Lance Junker, Robert Miltenberger, William Foyt; (seated, from left) Anastasios Soukas and Kenneth Davis. ***(See story on page 2.)***

— Photos on this page by Roger Stoutenburgh

Five Employees Honored With 1992 Brookhaven Awards

This year's five Brookhaven Award winners are: Kenneth Davis, Plant Engineering (PE) Division; William Foyt, National Synchrotron Light Source (NSLS) Department; Lance Junker, Reactor Division; Robert Miltenberger, Safety & Environmental Protection (SEP) Division; and Anastasios Soukas, Alternating Gradient Synchrotron (AGS) Department.

With this award, the Laboratory recognizes these five employees for their key contributions in support areas and their outstanding service to BNL. Each award consists of $2,000 before taxes and an engraved memento, which were presented to the winners on Monday by BNL Director Nicholas Samios.

"It is a pleasure to recognize in a meaningful way the extraordinary contributions of these five individuals," says Samios. "The fact that such outstanding effort on the part of Lab employees occurs year after year at BNL makes associating with this institution a delight."

Since the initiation of BNL's Recognition Awards Program last year, those eligible for Brookhaven Awards have included: those holding engineer/scientific associate/computer analyst schedule classifications; staff within the administrative salary grades; employees within the technical support/supervisory classifications; those on the clerical wage scale; and employees within the two lowest management salary grades. Those eligible represent about 60 percent of BNL's over 3,500 employees.

The names of the Brookhaven Award candidates from each department and division along with supporting documentation are submitted to a five-member selection committee, which includes department chairmen and division heads. The five nominees selected by that committee are then recommended to the Laboratory Director, for his final approval.

The five 1992 Brookhaven Award winners are:

Kenneth Davis

Kenneth Davis serves as General Supervising Engineer and Environmental Coordinator for Plant Engineering's Operations. He was nominated for assuming responsibilities beyond his usual duties of providing second-line supervision for PE's operational facilities.

Davis is cited for coordinating environmental, safety and health (ES&H) issues affecting PE's operations. Among his accomplishments, Davis was noted for his influence on BNL's water-conservation program, for providing increased monitoring of the Lab's potable and waste water, assisting with the commencement of the incineration of contaminated fuel oil, developing PE's ES&H procedures, and working with SEP and various regulatory agencies on compliance and permitting issues.

Kenneth Davis came to BNL in January 1983, as a senior stationary engineer in PE. Before assuming his present title, he was promoted first to Plumbing Supervisor in May 1987 and then to Water System Supervisor in January 1989.

William Foyt

Assistant to the NSLS Chairman, William Foyt received his Brookhaven Award in part for contributions that he made last year, which went beyond what was expected from him as the NSLS' then Department Administrative Manager.

Not only is Foyt being commended for developing NSLS personnel policies and managing the NSLS' large user-facility budget, but he is also being recognized for general oversight of the building of additions onto Bldg. 725, the construction of the NSLS stockroom and its automated system, and the reorganization of NSLS users facilities, including the automation of the user registration system.

Arriving at the Lab in September 1979, William Foyt began his BNL career as a staff assistant in the Physics Department assigned to the NSLS construction project, and he was promoted to a senior staff assistant in October 1980. When the NSLS became a department in February 1982, he moved there and became its Senior Department Administrator in November of that year. He served as Department Administrative Manager from October 1986 to April of this year, when he assumed his present title.

Lance Junker

Lance Junker is the Plant Manager of BNL's High Flux Beam Reactor (HFBR), and his Brookhaven Award was presented based not only on his long record of contributions to the Reactor Division, but also on Junker's role in the May 1991 restart of the HFBR following a two-year shutdown for safety analysis and upgrade, and its successful operations since then.

Junker was behind the scenes between the shutdown and start up, making improvements to the way operations are conducted at the reactor and organizing a readiness review. Both before and after this shutdown, Junker has been credited with helping maintain the HFBR's high rate of availability to the users of its neutrons and reliability for their experiments.

Lance Junker originally came to Brookhaven's Reactor Division in May 1963, as a pile-operator trainee at the Brookhaven Graphite Research Reactor. After a series of moves up the ladder, he left the Lab in May 1975 as a reactor shift supervisor. He returned to the staff in September 1980 as a nuclear standards engineer, and he was promoted to the Reactor Division's Training Manager in January 1983 and to HFBR Operations Group Leader in August 1986.

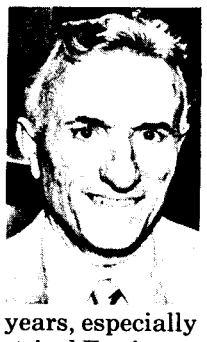
Robert Miltenberger

In receiving a Brookhaven Award, Senior Health Physics Associate Robert Miltenberger, SEP, was praised for his history of contributions to the health physics and environmental science programs at BNL.

Some examples of Miltenberger's most recent accomplishments include his obtaining discharge permits quickly for four BNL research facilities, and coordinating the identification and elimination of sources of trichloroethane releases and the characterization and remediation of contaminated soil by Bldg. 479.

Robert Miltenberger joined the Lab and the SEP staff as a health physics associate in March 1977. In October 1980, he was named a research engineer, and, in September 1983, he became a project engineer. Since October 1990, Miltenberger has held his present title. After serving as Leader of SEP's Environmental Monitoring Group within the Environmental Protection Section (EPS), 1983-91, Miltenberger was named EPS Head in April 1991.

Anastasios Soukas



In his Brookhaven Award citation, Senior Research Engineer Anastasios Soukas was lauded for his contribution to every major electrical engineering project at the AGS over the last 30 plus years, especially as the AGS Chief Electrical Engineer.

Most recently, Soukas is credited with contributing to the upgrade of the Siemens power supply for the AGS, and the design, construction and commissioning of the main magnet power supply for the AGS Booster, which came on line this spring. He is also being recognized for his achievements as a supervisor, manager and teacher who built the AGS electrical engineering staff, and for being one of very few engineers who have immersed themselves in accelerator physics and high energy physics.

Anastasios Soukas began his association with Brookhaven and the AGS in July 1960, as a development engineer III. Moving up that engineering ladder in July 1967 and November 1972, he was named to his position as Senior Research Engineer in October 1980. — Marsha Belford

Outreach Workshop

How to Talk to Your Kids

After presenting a workshop on anger this spring, psychologist Eva Feindler has been invited back by popular demand, this time to talk about "Communicating and Coping With Kids."

This Outreach workshop, sponsored by the Employee Assistance Program (EAP) of the Occupational Medicine Clinic, will be presented on Tuesday, December 15, from noon to 1 p.m. in Berkner Hall, and all are invited to attend. Audio cassette tapes of the lecture will be available afterwards in the Research Library.

Feindler will discuss the typical communication problems that arise between parent and child, and the developmental reasons for them. To overcome these, she will suggest strategies for building healthy and emotionally close family relationships using negotiation and other skills.

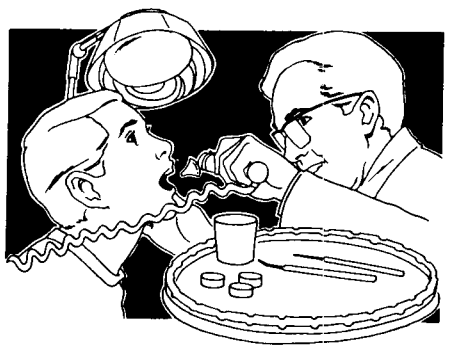
Eva Feindler received her Ph.D. in clinical psychology from the West Virginia University in 1979. At present, she is the Director of the Psychological Sources Center and an associate professor of psychology at the C.W. Post campus of Long Island University. Her publications include the books *Adolescent Anger Control* and the *Handbook of Adolescent Behavior Therapy*.

To register for this workshop, return the bottom portion of the Outreach flyer recently sent to all employees to EAP Staff Psychologist Dianne Polowczyk, Bldg. 490, by Monday, December 14.

Equipment Demo

Representatives of the Digital Equipment Corporation will be on site today, December 11, to present its new line of ALPHA AXP products. Systems runnning OSF/1 and OpenVMS will be demonstrated from noon to 3 p.m. in Berkner Hall, Rooms A and D, and the lobby. Send questions about this presentation via electronic mail to DECSUPPORT@bnlalp.bnl.gov.

New Dental Option Announced



A second option, called CIGNA Dental Care, will be added to the Lab's dental program, effective March 1, 1993. Employees will receive detailed information on the new option in January.

The new option is being made available to BNLers because CIGNA is currently expanding its network of participating dentists to include dentists in the BNL area, some of whom are already providing services for Lab employees and their families.

The CIGNA Dental Care program will offer more benefits at less expense. It will have no deductibles, no annual maximums and no claim forms while offering full coverage for preventive and most basic services.

Usually, open enrollment for the AUI Dental Assistance Plan administered by Eastern Benefit Systems would take place this month for coverage effective in January. Because of the introduction of the CIGNA option, however, this will be delayed until February 1993, when all currently covered employees can choose which dental plan to enroll with, effective March 1.

Currently covered employees who wish to drop their AUI Dental Plan coverage may do so effective January 1. However, if they do so, they will *not* be eligible to sign up for either dental option in February; they will have to wait until the next regular open enrollment in December 1994.

Employees who are not currently covered by the AUI Dental Assistance Plan have three choices: To avoid any further delay, they may enroll during December in the AUI Dental Assistance Plan, then choose between the two dental options in February; they may wait until February to sign up for one of the dental options; or they may continue without coverage until at least December 1994.

For more information, call Personnel Services, Ext. 2877.

Leaving the Lab — After 35 Years or More

The Bulletin periodically salutes employees who retire with 35 or more years of service.

Rudolph M. Sternheimer had received his Ph.D. a little less than two years before — and was still only 24 years old — when he first arrived at Brookhaven in March 1951.

The young Associate Physicist signed on permanently with the Proton Synchrotron Division on January 1, 1952, when he was assigned life number 3242. This number, of course, stayed with him when he joined the Physics Department in 1960, when he was promoted to Physicist in 1961, when he was named Senior Physicist in 1965, and when he received tenure in 1967.

And his life number stays with him today, now that he has retired after more than 40 years at the Laboratory, though he continues his association with Physics as a Guest Senior Physicist.

Born in Germany in 1926, Sternheimer and his family emigrated to France in 1935, to escape the Nazi persecution of the Jewish people — the same reason that prompted their 1941 emigration to the U.S.

Sternheimer earned his B.S. and M.S., at the University of Chicago, in 1943 and 1946, respectively. There he also received his Ph.D. in physics in 1949. His thesis advisor was Edward Teller, and, Sternheimer says, "He was a very inspiring physicist and thesis advisor, and I have enjoyed a long personal friendship with him."

After spending almost two years at Los Alamos National Laboratory (LANL), Sternheimer came to BNL to work on the Cosmotron, the revolutionary 3-billion-electron-volt accelerator that was then still in the design stages.

In contributing to the Cosmotron, Sternheimer worked with Hartland Snyder on the first application of the new strong-focusing concepts to the design of beam lines using four-poled magnets called quadrupole doublets. He also analyzed the orbit optics of external beams of pions and protons.

Further, he wrote review articles on strong-focusing beam transport and on kinematics for the book *Nuclear Physics*, edited by L.C.L. Yuan and C.S. Wu in 1963.

While Sternheimer spent about one-third of his time on calculations for the Cosmotron, he devoted the balance to atomic and nuclear physics.

His best and most well-known work was on what has become known as the Sternheimer atomic shielding and antishielding of nuclear quadrupole moments. Although he had started this work at LANL, essentially all subsequent work was done at BNL, and the first review paper of this work was published in *Physical Review* in 1966.

Rudolph Sternheimer

Sternheimer explained that his shielding and antishielding factors are essential for an understanding of the quadrupole hyperfine structure. "Experiments including my correction factors," he explained, "permit an accurate determination of nuclear quadrupole moments in many cases."

In addition to his continuing work on the shielding and antishielding factors, Sternheimer's other research included work with Sam Lindenbaum, 1956-61, on a nucleon isobar model, which explained the then available data on pion production in nucleon-nucleon and pion-nucleon collisions, and has since become a standard model for analyzing hadronic interactions. Then, in the late 70s, he discovered the k-ordering of atomic energy levels.

His calculations of the density effect for the ionization loss of charged particles in various substances piqued the interest of scientists at the National Bureau of Standards (NBS), and, in 1984, Sternheimer and his NBS collaborators extended his original calculations to 280 substances.

In his later years at BNL, he became interested in problems of number theory. Since 1977, he has published more than 30 papers on this subject, including five papers coauthored with Michael Creutz.

All in all, Sternheimer has published some 150 scientific papers. In addition, he wrote the historical physics section for the special July 1976 edition of the Brookhaven Bulletin, which described "The State of the Art Two Hundred Years Ago."

Looking back at Sternheimer's career at BNL, Physics Department Chairman Peter Bond said, "Dr. Sternheimer's important scientific contributions and his phenomenal memory are well-known by the Lab's scientific community. Within the greater BNL community, he also made a number of friends. Over the years that he lived on site during the week, he struck up many friendships and became a favorite regular at the Center and the Cafeteria."

Sternheimer retired in June because of a serious heart ailment that necessitated two hospital stays. Since August 7, he has been recovering at his New York City home, with his wife Betty, whom he had met a few weeks after he arrived at BNL, when she was a graduate student in the Biology Department, and married in 1952.

Now, he is well enough to attend Physics Department seminars at New York University, to go to concerts and movies with Betty — and to work with the Bulletin on this story.

Looking back on his years at BNL, Sternheimer said, "I would like to thank all of my friends at Brookhaven who have helped me both with physics discussions and also for helping me to get around the Lab on many occasions, since I do not drive a car — and for my making my long stay at the Lab both pleasant and possible." — Anita Cohen

Attention: Basic Readers

BNL has joined with Literacy Volunteers of America (LVA) to provide individual, private, confidential instruction to any employee, visitor, guest or spouse. Anyone who knows of someone who is interested in developing their basic reading skills may call Marilyn Pandorf, Ext. 5251; or Frances Ligon, Ext. 3709; or the local LVA office, 286-1649

Inside Info

Glenn Jennings, who is Assistant to the Director for Equal Opportunity, and **Frances Ligon,** Senior Equal Opportunity Representative in the Office of Equal Opportunity, represented BNL on October 23-25 at the 16th Annual Region II Training Conference of the American Association for Affirmative Action (AAAA).

Ligon served as moderator for the educational training workshop, "New Kids on the Block," while Jennings spoke to the conference attendees about "The Role of Affirmative Action Administrators in Private Industry."

The AAAA was founded in 1974 in recognition of the need for knowledge of the laws and practices that lead to competent management of equal opportunity/affirmative action programs. Its mission is to be the leader in fostering implementation of effective affirmative action and equal opportunity nationwide.

In Stormy Weather

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WBAB	Babylon	1440	102.3
WBLI	Patchogue		106.1
WCTO/ WGSM	Smithtown	74	94.3
WHFM	Southampton		95.3
WHLI/ WKJY	Hempstead	1100	98.3
WLIM	Patchogue	1580	
WLIX	Islip	540	
WLNG	Sag Harbor	1600	92.1
WRCN	Riverhead	1570	103.9
WRIV	Riverhead	1390	

Or call:* 282-INFO

*Dial the letter O, *not* zero!

Note to Employees:

Attendance at lectures, meetings and other special progams held during normal working hours is subject to supervisory concurrence.

Arrivals & Departures

Arrivals

Christopher J. Porretto.....RHIC
Regina K. Shea.....Chemistry
Mark Paul Sweet.....Medical

Departures

This list includes all employees who have terminated from the Lab, including retirees:

Shakti Kumar Unny.....Biology

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ANITA COHEN, Editor
MARSHA BELFORD, Assistant Editor
LIZ SEUBERT, Reporter

35 Brookhaven Ave., Upton, N.Y. 11973
(516) 282-2345

The Rewards of Giving — The United Way

Generous BNLers have donated just over $77,000 in the first two weeks of this year's United Way fund drive — but there's still some way to go to reach the hoped-for goal of $100,000.

This amount of funding will help the United Way of Long Island keep alive organizations that lend a hand to many different Long Islanders in need — from cerebral palsy sufferers, to drug and alcohol abusers, to those looking for jobs. Your contribution will make a difference, no matter what you give.

From among those who have already given, drawings for early-pledge-card prizes continue. This week, Diana Votruba, RHIC Project, won the New Your City weekend, and Donna King, Supply & Materiel Division, won the wreck-and-reef trip. Winners of dinners for two were Zaida Rosado, Plant Engineering (PE) Division; Austin McGeary, Alternating Gradient Synchrotron Department; and Gregory Hall, Chemistry Department; while Peter Thieberger, Physics Department; Frank Miller, PE; and Violet Bezler, Physics, won gift certificates to Service Merchandise.

More prizes remain. To be eligible, your pledge card must be received by Monday, December 14. So, don't wait — send in your donation today. If your pledge card did not arrive or has been mislaid, please photocopy someone else's, or get a copy from Richard Eggert, Ext. 2907.

Pictured here with Diana Votruba (center), RHIC Project, the winner of the weekend for two in New York, are BNL's United Way fund-drive coordinator Richard Eggert, Contracts & Procurement; assistant coordinator Phyllis Domenech, (left) Photography & Graphic Arts Division; and Betty Pergan, Department of Applied Science, who keeps the financial status of the drive up to the minute.

Brookhaven Breakthrough In DNA Sequencing (Cont'd)

polymerase can then extend this new primer to read the next 500 bases of sequence. Successive primers are used to "walk" down the template chain, reading about 500 bases in each step.

To date, the primer-walking method has been slow and expensive: A single primer is usually 15 to 20 bases long, costs about $50 and takes a day or two to prepare.

Short and Sweet

"Our idea for making primer walking cheaper and faster was to use shorter primers," Studier said.

For DNA sequencing, a primer must be long enough to pair at only one place in the template DNA. DNA chains primed from more than one site interfere with each other and prevent any sequence from being read.

A typical template might be a cosmid clone of about 40,000 base pairs. However, a typical primer of 18 bases would find its complement, on average, only once in 69 billion bases of random DNA sequence, very much longer than a cosmid DNA. So, much shorter primers should still be useful for sequencing the usual templates.

"A preparation of primer provides enough material to prime many thousands of sequencing reactions," Studier explained. "Shorter primers would have two big advantages. Each preparation of primer could be used many times, reducing the cost from $50 per sequence reaction to only pennies. And a manageable library of primers could be accumulated, which could immediately supply the primers needed to sequence any template."

Divide and Conquer

With funding from the U.S. Department of Energy as part of the Human Genome Project, Studier teamed with Biology Associate Kieleczawa and Senior Biochemist Dunn to make a thorough test of this approach.

Also on the team participating in the project were: Willy Crockett and Matt Randesi, who synthesized the primers; Laura Butler, who helped with the sequencing reactions; and Shiping Zhang, who handled the computer analyses.

"Our aim was to be able to sequence cosmid DNAs by primer walking using only primers from a library," said Studier. "One of the approaches we tried worked spectacularly well, allowing us to do primer walking with a library of hexamers." Hexamers are six bases long, and there are only 4,096 possible hexamers.

"The trick is to coat the template DNA with a protein called SSB," Studier continued. "Without the SSB, each hexamer would prime at many sites in a cosmid and no sequence could be read. The beautiful thing is that individual hexamers can't prime when the DNA is coated with SSB, but three cooperating hexamers can. Three hexamers that pair to the template at adjacent sites will displace the SSB, priming at that site. So the SSB allows us to use combinations of hexamers to prime exclusively at almost any site in a cosmid DNA."

"So far, we have tried over 500 hexamers," said Kieleczawa. "We've been getting useful sequence information from about 60 to 90 percent of the hexamer strings, and we expect to increase this percentage as we learn more."

Synthesizing hexamers in the Biology Department's automated DNA synthesizer are: (standing, from left) Willy Crockett and Laura Butler, (seated, from left) Matt Randesi and Judith Romeo.

Photo by Roger Stoutenburgh

Toward Large-Scale Sequencing

"Extensive testing with the complete library of hexamers will be needed to see how efficient and reliable the method can be for large-scale sequencing," said Studier. "We hope to discover and refine rules for selecting hexamer strings that will give optimal performance with any template."

Making all 4,096 hexamers is a considerable effort, but would produce enough material to make hundreds of complete hexamer libraries, each able to prime thousands of sequencing reactions. If hexamer libraries were distributed commercially, then any laboratory could have one at reasonable cost.

"If the method fulfills its promise, automating the process should be relatively easy," said Studier. "High-capacity sequencing machines based on this method might be expected to sequence DNA at more than ten times the rate and at less than one-tenth the cost of current methods." BNL is currently exploring possible licensing arrangements and partnerships for further development and commercialization of this technology.

"We want to scale up the process," said Dunn. "We are now sequencing a viral DNA that is about 40,000 base pairs long, and we plan to sequence the million-base-pair genome of the bacterium that causes Lyme disease. If that is successful, we should be ready to start sequencing the human genome."

DOE is supporting the continued development and automation of this exciting work. As David Galas, Associate Director for DOE's Office for Health and Environmental Research, commented, "The impact of this new technology will be enormous. It will enable us to fully automate the process and sequencing, and may be the key to gaining the capability we need to fully sequence the human genome and the genomes of other organisms. It is this sequence information, and the capability to obtain it, that will provide the basis for much of the new biomedical science and biotechnology of the 21st century." — Liz Seubert

A hexamer's-eye view of the BNL breakthrough in DNA sequencing.

In Memoriam

Mariette Kuper

Mariette Kuper, who was acclaimed as BNL's first employee, died on December 8 at the University of Michigan Hospital, from complications following a serious fall. She was 83 years old.

Kuper, whose job included hiring support staff, literally hired herself in March 1946 when the Lab project was first conceived by nine northeastern universities. Her first position was as Executive Aide to the Director. When she retired in December 1974 after 28 years at BNL, she was Staff Assistant.

Said Laboratory Director Nicholas Samios, "Mariette Kuper was one of the first employees of Brookhaven Laboratory. At its inception, she was instrumental in the growth and success of BNL. She was active into her very late years and was always a friend and contributor to BNL. We greatly regret her passing."

A similar appreciation for Kuper's value to the Lab was felt by former BNL Director Maurice Goldhaber, now AUI Distinguished Scientist emeritus. He said, "Mariette worked closely with me for many years. Her passing will be felt as a great loss by many who knew and admired her vital contribution to the esprit de corps of the Lab."

Kuper, who once described herself as "a glorified information bureau," arranged seminars and scientific conferences. and welcomed and guided Lab visitors ranging from troops of Boy Scouts to General Dwight Eisenhower, when, as president of Columbia University, he toured BNL for a day in 1948.

On her 25th anniversary at the Lab, Kuper was given a scroll describing her as one who "has brought to BNL imagination, intelligence, and an infinite capacity for taking pains, and who has demonstrated that while no man is indispensible — one woman can be!"

Said R. Christian Anderson, who retired as Assistant Director in 1984 and had worked closely with Kuper in the early days, "Mariette became the housemother of the scientific fraternity newly gathered at Upton. The senior trustees created the academic mold, Uncle Sam provided the financial support and threw in an unprepossessing site. But it was Mariette Kuper, who, with her acerbic wit, old-world charm, new-world optimism, style and understanding, made Brookhaven *family*."

Mariette Kuper, who had moved to Michigan two years ago, was previously a resident of Setauket. She is survived by her husband, J. Horner Kuper, who had been Chairman of the Instrumentation and Health Physics Department and retired as Assistant to the Director in 1976, but remained a consultant until 1991; a daughter, Marina von Neumann Whitman; son, George Henry Kuper III and four grandchildren.

A funeral service will be held today at 1 p.m. at the Caroline Church of Brookhaven, Strongs Neck Road, Setauket.

In lieu of flowers, contributions may be sent either to the North Shore Animal League in Port Washington or the Cystic Fibrosis Foundation.

— Liz Seubert

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Matislaus Kalinowski, who retired September 3, 1977, after 17 years as a steamfitter A in the Plant Engineering Division, died on August 27. He was 76 years old. He started at BNL on April 11, 1960. Having resided in Bellport, Kalinowski is survived by his wife Rosalie, daughter Anne, sons Michael and Paul, and three grandchildren.

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BNL retiree **James W. McIntosh** died on October 25 at the age of 68 following a short illness. He began his 19-year career in the Central Shops Division on May 1, 1965, as a production control planner. He retired on April 30, 1984, as a fabrication planning supervisor. In 1985, McIntosh retired to DeBary, Florida, and his survivors include his wife Virginia, daughter Christine, son Bruce, and two grandchildren. Contributions in his memory may be made to the Salvation Army.

See Supplement for Notices and Classified Ads.

See *Miss Saigon* On Broadway

For the perfect holiday gift and the excitement of Manhattan without the hassle of driving or taking the train, take the BERA-sponsored bus trip to Broadway on Saturday, April 17, to see *Miss Saigon*.

The cost of $119 per person includes round-trip bus transportation; a brief stop and tour at the South Street Seaport; an orchestra seat to the matinee performance of *Miss Saigon*; a full-course dinner at The Cafe 44 Restaurant in the theater district, with choices of steak, seafood, pasta and more; and all taxes and tips.

Reservations are now being taken at the BERA Sales Office in Berkner Hall, weekdays, 9 a.m. to 1:30 p.m. A $50 deposit to reserve theater tickets is due immediately, with the balance due by Friday, March 12. For more information, call Carolann Zebrowski, Ext. 3347, or M. Kay Dellimore, Ext. 2873.

Met Opera Tickets

A few tickets are still available for Family Circle seats at the Metropolitan Opera. Tickets are on sale at the BERA Sales Office in Berkner Hall weekdays, 9 a.m. to 1:30 p.m. For more information, call Carolann Zebrowski, Ext. 3347.

Hospitality News

The next meeting of the Women's Forum, which is conducted by Marion Davis-Parzen, will be Tuesday, December 15, at 10 a.m., in the lounge of the Recreation Building in the apartment area.

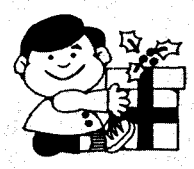
The group meets every third Tuesday of the month to discuss women's issues and to share experiences and concerns. Wives of Lab employees and guests are welcome. Bring the children.

New Gym Schedule

Effective immediately, the noontime gymnasium schedule is revised as follows:

Monday - soccer only
Tuesday - basketball & badminton
Wednesday - basketball & badminton
Thursday - volleyball & badminton
Friday - basketball & badminton

Check Out What's New At the Science Store



For an extra measure of protection from the fire hazards associated with Christmas trees, stop by the Winter Holiday Sales at the Science Store and pick up a Holiday Tree Fire Alarm.

This new item looks like a sparkling, silvery tree ornament — and it is. But it is also a fire alarm, poised to give off a loud signal at the first sign of a tree fire. You can buy safety and decoration — all for only $10.

The Science Store in the west side of Bldg. 701 is open to employees only today and next Friday, December 18, from 10 a.m. to 3 p.m. Park in the north parking lot.

BERA Toy Drive

It's not too late to bring a happy Christmas to a needy child or young teen by bringing a new toy or gift to the toy box located in the BERA Sales Office in Berkner Hall. Office hours are weekdays, 9 a.m. to 1:30 p.m. For more information, call Carolann Zebrowski, Ext. 3347.

White Water Rafters

The White Water Rafting Club has selected the Penobscot River in Maine for its only 1993 trip, June 12-14. The rafting company fee is $165, which includes two nights' lodging with a buffet breakfast and a full-day rafting trip with lunch.

A $10 deposit is required by December 21. Send a check, made out to BERA White Water Rafters, to Sue Norton, Bldg. 830. For more information, call Ext. 3492.

Local Computer Users

Peter Bond, Chairman of the Physics Department, will discuss the role of the BNL Computing and Communication Division (CCD) Steering Committee at the next meeting of the Upton Local Computer Users Group (LUG). It will be held on Wednesday, December 16, at 10:30 a.m., in Room B, Berkner Hall.

The meeting will be followed by a question-and-answer session. Members of the CCD Steering Committee, members of computer committees at BNL and all computer users are encouraged to attend. For information, send E-mail to LUG@BNL or contact Zohreh Parsa, LUG chairperson, at PARSA@BNL or Ext. 2085.

Volleyball

Standings as of 12/2

Open League		League I	
The Roofing Co.	18-6	Network News	13-2
GTeam	18-6	VolleyBallAholics	13-5
Penetrating Vollies	10-14	Upfagrabs	12-6
Me & the Boys	10-17	Rude Dogs	12-6
Farside	7-20	Underdogs	7-8
		Fornossing	3-15
		D & D Company	0-18
League II		**League III**	
Monday Nite Live	19-2	High Volley'em	9-6
Safe Sets	14-7	Jolly Vollies	9-6
Nuts & Bolts	13-8	Silver Bullets	9-6
Fossils	12-9	Upton Ups	9-6
Night Court	8-13	Volley of the Dolls	9-6
Net Wits	8-13	Nutcrackers	8-7
Just Up	5-16	Hairballs	4-11
Sourcerers	5-16	Mis-Fits	3-12

Cafeteria Menu

Monday, December 14

Soup: American bounty vegetable	.80/1.10
Entree: Fried flounder fillet platter	3.45
Lite choice: Roasted pork loin au jus	3.45
Carvery: Hot pastrami sandwich	2.95
Grill: Teriyaki chicken w/wild rice	3.35

Tuesday, December 15

Soup: Chicken corn chowder	.80/1.10
Entree: BBQ spare ribs	3.45
Lite choice: Chicken cacciatore	3.35
Carvery: Hot roast beef sandwich	2.95
Grill: Tuna steak w/boiled potato	3.65

Wednesday, December 16

Soup: Beef & rice	.80/1.10
Entree: Vegetable lasagna	3.35
Lite choice: Baked fillet of catfish	3.45
Carvery: Hot ham sandwich	2.95
Grill: Marinated chicken cutlet w/rice	3.35

Thursday, December 17

Soup: Gumbo	.80/1.10
Entree: Stir-fried shrimp w/vegetables	3.45
Lite choice: Fettucini w/basil & olive oil	3.20
Carvery: Corned beef sandwich	2.95
Grill: Monte Cristo sandwich platter	3.25

Friday, December 18

Soup: New England clam chowder	.80/1.10
Entree: Irish stew	3.45
Lite choice: Baked fillet of fish	3.45
Carvery: Hot turkey sandwich	2.95
Grill: Tuna melt	2.95

Service Awards

The following employees celebrated BNL service anniversaries during the month of November:

35 Years

Daniel F. Leahy.....App. Science
Jack Weisenbloom.....AGS

30 Years

Richard W. Allen.....Plant Eng.
Anthony J. DiSena.....Cent. Shops
Jack Fajer.....App. Science
Patrick J. Glynn.....Staff Serv.
Herbert Hildebrand.....RHIC
Milton Jones Jr......Plant Eng.
Donald R. Meany.....AGS
Gerry H. Morgan.....RHIC
William B. Sampson.....RHIC

25 Years

Robert R. Kinsey.....Nuc. Energy

20 Years

Carol A. Creutz.....Chemistry
Kenneth F. Crowe.....Plant Eng.
Rae Greenberg.....Dir. Off.
Frederick J. Usack.....AGS
Samuel P. Yamin.....Dir. Off.

10 Years

Richard A. Bernier.....Plant Eng.
John J. Cintorino II.....RHIC
Timothy Costanzo.....AGS
Joann M. Durham.....Chemistry
Anthony J. Kuczewski.....Physics
Robert W. Lamb Jr......Cent. Shops
Frederick T. Maier.....Cent. Shops
Michael J. Niewiarowicz.....Reactor
Judith A. Romeo.....Biology
Kathleen Ryan.....Nuc. Energy
Thomas Trojanowski.....Plant Eng.
Frederick L. Wahlert.....Cent. Shops
Maria Yanez.....Dir. Off.
Pamela S. Yerry.....Reactor

Bowling

Red/Green League

R. Larsen bowled a 269/223/200/692, B. Erickson 256, R. Eggert 219, S. Thompson 215, R. Mulderig 213, H. Arnesen 213, R. Wiseman 212, M. Guacci 211, D. Dawson 207, F. Griswold 203, B. Sick 201.

Purple League

Ed Sperry IV bowled a 224/588 scratch series, Ed Beadle 218, Caryl MacDougall 208/174/517 scratch, Jim Goode 199/190/546 scratch, Jim Biamonte 193, Joe Ferrante 190, Pat Manzella 190, Denise Monteleone 188, Sharon Smith 179, Maria Yanez 175.

White League

Ray Ranis bowled a 254/192/606 scratch series, Mike Meier 223/195/581 scratch, Betty Jellett 222, Irene Sperry 196, Lorraine Roecklein 195/193/182/570 scratch, Ben Belligan 194, Gerrie Riker 194/176/526 scratch, Kurt Jellett 190, Mary Grace Meier 190/189/557 scratch, Pete Wynkoop 189, and Larry Musso converted the 6-7 split.

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position. Consideration is given to candidates in the following order: (1) present employees within the department/division and/or appropriate bargaining unit, with preference for those within the immediate work group; (2) present employees within the Laboratory; and (3) outside applicants. In keeping with the Affirmative Action plan, selections are made without regard to age, race, color, religion, national origin, sex, handicap or veteran status.

Each week, the Personnel Division lists new placement notices. The purpose of these listings is, first, to give employees an opportunity to request consideration for themselves through Personnel, and, second, for general recruiting under open recruitment. Because of the priority policy stated above, each listing does not necessarily represent an opportunity for all people.

Except when operational needs require otherwise, positions will be open for one week after publication.

For more information, contact the Employment Manager, Ext. 2882, or call the JOBLINE, Ext. 7744 (282-7744), for a complete listing of all openings.

SCIENTIFIC RECRUITMENT - Candidates may apply directly to the department representative named.

POSTDOCTORAL RESEARCH ASSOCIATE - trained in microbiology/biochemistry, with a background in organic and inorganic analytical chemistry, to investigate microbial degradation of alpha-irradiated plastics and rubber under asaline and hypersaline conditions. Contact: A.J. Francis, Department of Applied Science.

POSTDOCTORAL RESEARCH ASSOCIATE - trained in nuclear chemistry/nuclear physics to join the Solar Neutrino Group. Experience in radiochemical manipulations and computer data processing, and the ability to make periodic trips to Europe to conduct GALLEX-related work are required. Contact: Richard Hahn, Chemistry Department.

POSTDOCTORAL RESEARCH ASSOCIATE - trained in pharmacology or neuroscience to conduct positron emission tomography (PET) research. Expertise in *in vivo* microdialysis, in both anesthetized and freely moving rats, and in HPLC are required. Contact: Stephen Dewey, Chemistry Department.

POSTDOCTORAL RESEARCH ASSOCIATE - trained in chemical physics, with experience in theory of chemical reactive dynamics, especially as controlled by polar condensed-phase media. Contact: Marshall Newton, Chemistry Department.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside candidates.

NS 1088. PROGRAMMING POSITION (term appointment) - Requires BS in computer science, electrical engineering or a related field, some programming experience, or an MS degree. Familiarity with object-oriented methods, C, C++, UNIX, real-time operating systems and network programming is required. Familiarity with interface hardware operation is desirable. Work will involve coding, documentation, installation and support of real-time software (VXWORKS) for particle-accelerator control using cross-development tools on UNIX workstations. RHIC Project.

NS 1087. PROGRAMMING POSITION (term appointment) - Requires BS in computer science or related field, some programming experience, or an MS degree. Familiarity with object-oriented methods, C, C++, UNIX and network programming is required. Familiarity with RPC and Motif programming is desirable. Work will involve coding, documentation, installation and support of software tools for UNIX workstations and server computers applied to particle-accelerator control. RHIC Project.

Motor Vehicles & Supplies

93 FORD ESCORT - wagon, 4-dr., h/b, p/s, p/b, am/fm cass. stereo, a/c brand-new, 4k mi., $250/mo., no down payment. Alex, Ext. 4392.

91 PONTIAC GRAND AM LE - fully loaded, sports package, mint cond., must see, must sell, $9,500. Mike, Ext. 5904.

90 HONDA ACCORD LX - blue, 5-spd., 4-dr., 12k mi., ac, am/fm, p/b, p/s, p/w, p/l, cruise, alarm, $12,000. Ext. 7797.

90 FORD BRONCO XLT - white, 4wd, 4-dr., am/fm cass., p/s, p/w, p/l, ac, cruise, tilt, rear defog., V8, 100k mi., $11,500. neg. 475-9027.

90 NISSAN 300ZX - gold pearl, a/t, leather, T-tops, loaded, clean in/out, 24k hwy. mi., sacrifice $15,300. Warren, 924-7552 or Ext. 2080.

89 PLYMOUTH SUNDANCE RS - 2-dr., a/t, black cherry, all luxury goodies, excel. cond., $5,990. Eric, Ext. 5875.

88 PLYMOUTH VOYAGER LE - 3L-V6, many extras, clean, high mi., runs well, asking 60% NADA average trade-in. Connie, Ext. 2594.

88 FORD TEMPO - white w/red int., 2-dr., p/s, p/b, am/fm cass. stereo, ac, cruise, excel. cond., orig. owner, 92k hwy. mi., $2,000. Alex, Ext. 4392.

87 TOYOTA COROLLA LE - 4-dr., a/t, ac, p/s, p/b, am/fm stereo cass., 83k mi., excel. cond., $3,900. Bo, Ext. 3537 or 341-1086.

87 TOYOTA COROLLA - blue, 4-dr., 5-spd., new tires, 70k mi., excel. cond., asking $3,900. Sharon, Ext. 5919 or 722-3010.

87 S-10 BLAZER - 5-spd., manual, 4x4, 62k mi., am/fm tape, $7,200 neg. 473-2473.

87 PLYMOUTH COLT - 38k mi., 4-dr. sedan, a/t, cruise, good tires, runs well, needs exhaust, must sell . $3,800 neg. Takeshi, Ext. 4324.

86 CHEVETTE - new brakes, tires, starter, ac, good cond., $1,100 neg. Tony, 286-9426.

86 FORD F150 TRUCK - 6 cyl., w/toolbox, great cond., $3,250 neg. John, 733-4125.

86 FORD TEMPO - good cond., 92k mi., $1,950 neg. 689-5606 after 6 p.m.

85 JEEP - 4wd, 5-spd., new tires, full cabin top, summer top, p/s, 63k mi., excel. cond., California bronze, $4,500. Nancy, Ext. 4177.

84 FORD LTD - 4-dr., a/t, p/s, p/b, ac, am/fm, runs well, body needs work. Rich, Ext. 7013.

84 DODGE OMNI - good for parts, 5 Goodyear tires, ask. $100. Ext. 3983 or 341-1039.

84 MERCURY GRAN MARQUIS - brown, full power, mint cond., $3,500. 654-5469.

83 BRONCO LTD - 302 V8, a/t, 72k mi., tan & brown w/tan int., captain's chairs, orig. owner, $3,700. Paul, Ext. 2177 or 298-4985.

83 MITSUBISHI TREDIA - 4-dr., needs transmission, good cond., good for parts, $200 neg. Bartck, Ext. 3626 or 7522.

83 TERCEL - 5-dr. h/b, 5-spd., replaced engine, clutch, radiator, tires, muffler, some rust, $2,200. Elaine, Ext. 3876 or beeper 0456.

83 CHEVROLET CITATION - w/'86 Pontiac engine, 53k mi., 4-cyl., p/s, p/b, a/t, cruise, 23 mpg, good transportation, ask. $1,200. 878-2239.

82 OLDSMOBILE SUPREME - ac, am/fm stereo, p/s, p/b, v.g. cond., moving, $1,500. Ext. 5098.

82 CHEVY CAPRICE - wagon, 9-pass., new battery, rebuilt starter, water pump, 181k mi., must sell, make offer. Charlie, Ext. 2317 or 754-2471.

80 DODGE COLT - 120k mi., orig. owner, 8-spd., m/t, green, $200. Art, Ext. 4924 or 751-8039.

80 MERCEDES BENZ 240D - no int./ext. damage, runs well, gar., carefully maint., must sell now, $4,700 or closest bid. Neil, Ext. 3084 or 732-3902.

80 GMC PICKUP - 1 ton, dual tanks, runs great, $600 neg. Don, Ext. 2694.

80 CAMARO - V6, 3-spd., ac, p/s, p/b, T-tops, am/fm cass., high mi., good cond., asking $1,200. Tirre, Ext. 3288 or 281-0360 after 6 p.m.

79 CHEVY PICKUP - runs well, fair cond. Anthony, 732-8192 after 6 p.m.

77 EL CAMINO - body clean, needs engine $800. John, Ext. 2172 or 744-4386.

74 CHRYSLER - Town & County wagon, at, ac, p/s, p/b, p/w, runs well, $200; Firestone tires, P195/75R14, $30/ea. Tony, 698-9274.

64 CHEVY BISCAYNE - 2-dr., 6-cyl., good for parts or restoration, $150. Dan, Ext. 7271.

63 DODGE DART - good tires, new exhaust & battery, $600; '57 Volkswagen panel truck, orig. eng., runs well, new batt., $500. Rudy, Ext. 2593.

UTILITY TRAILER - w/sides, storage box, 4'x10', $250. Bill, Ext. 4986 or 563-1940.

Continued on back of page.

Classified Ads (cont'd)

ROOF RACK - med. size for cars w/rain gutters, like new, $50. Siggy, Ext. 4360 or 751-5050.

CAM & LIFTER - 350 Chevy, excel. cond., matched, high perf., $35; valve covers for small block Chevy, $10. Tom, Ext. 4507 or 878-1060.

UTILITY TRAILER - 5'x7'x4', box type, see-through window, $275 neg. Rich, Ext. 7251 or 765-2847.

TIRES - 13" radials, one 15", excel. cond., $10/ea. 369-0432.

STEREO - Panasonic, am/fm, cass., $50. Donna, Ext. 2716.

CLUTCH - '80 Toyota Tercel, 5-spd., $40 neg. Bob, Ext. 7238.

PARTS - 351 Winsor, 4bbl Ford alum. high-rise manifold w/800 CFM Holley 4bbl carburetor, used, asking $150. Teri, Ext. 5800 or 289-2925.

Boats & Marine Supplies

23' CUDDY DEEP V - 260-h.p. Merc., 50 hrs. on new motor, bronze exhaust, extras, excel. cond., $3,200. 325-1439.

22' MARSHALL CATBOAT - freshwater-cooled Yanmar diesel, VHF radio, depth sounder, Danforth compass, head. Gordon, 477-2269.

16' HOBIE - double trapeze, new mesh trampoline, good sails, galvanized trailer, must sell. Wayne, 368-1480.

LIFE RAFT - Switlik, 6-person, search & rescue fg container, s/s cradle, off shore ready, orig, $4,100, sell for $2,000 firm. Richard, 732-9118.

Furnishings & Appliances

BED FRAME - for full-size futon mattress, v.g. cond., $85. Paul, Ext. 7577 or 286-7127.

BEDROOM SETS - 3; dining room set, Italian provincial, 72" pedestal table w/6 chairs, lighted china cabinet. Walter, 369-4238.

CABINET - Hoosier, oak metal retractable table top, v.g. cond., $500. Wink, 286-4291.

CLOCK - mantle, elec., Roman numerals, wood look, 14"H x 11"W, $10; ceiling fan, flush mount, 4 blades, $15. Kathy, Ext. 2267 or 395-6520.

COUCH - $50; coffee table, $20; mirror, $10; sofa bed, $100; lamp, $10; ½ cord seasoned firewood, $50; tennis racket, $25. Kathy, 744-2203.

COUCH - loveseat, chair, brown floral print, Colonial, excel. cond., $290. Patti, Ext. 3145.

DAYBED - white wrought iron, twin-size, complete w/spring support & solid brass finials, excel. cond. Marcia, Ext. 7796.

DRESSER - 8 drawers, big mirror, $25. Erika, Ext. 3403 or 399-5136.

FURNITURE - living room, Colonial, couch, loveseat, excel. cond., $300. 821-0354 after 6 p.m.

HUTCH - pine, $300; stereo tape deck, cass., headphones, $75; entertainment center, maple, w/record player, radio, 6'x3'x2', $150. 744-3842.

MICROWAVE - Kenmore, large capacity, many features, excel. cond., $200; GE refrigerator, 2 yrs. old, almond, 27"D x 28"W x 61"H, $300. 727-6775.

MICROWAVE - good cond., $125. 698-1523.

OVEN - Kenmore, $100 firm; 8 white tea cups w/saucers, brand-new. Maj Britt, Ext. 2381.

RECLINER & LOVESEAT - brown fabric, v.g. cond., $200. Bob, Ext. 5404.

RECLINER & SOFA - light brown tweed, v.g. cond., $175. 732-6569.

REFIGERATOR - small, good for camper or bar, $40 neg. Bob, Ext. 7238.

SLEEPER - sectional, almost new, blue, orig. $3,500, ask. $1,200; dishwasher, Magic Chef, less than 1 yr. old, $225. Tom, Ext. 7287 or 744-4535.

SOFA - contemporary, 7', cream, v.g. cond., $200. Ext. 4931 or 928-7571 after 6 p.m.

TABLES - coffee & 2 end tables, all wood, $20/ea. 472-3254.

TABLE LAMPS - 2, white glass, floral pattern, 3-way switches, $25/both. Joe, Ext. 2898.

WASHING MACHINE - GE, needs parts, 8 yrs. old, $25. Ext. 5750 or 929-5584.

ANTIQUE OAK DRESSER - fully refinished, excel. cond., $175. Sharon, Ext. 5919 or 722-3010.

BEDROOM - king size, headboard w/lights, mirrors, drawers below, pine, excel. cond., $125. 874-2789.

BLIND - Levelor, 5'x10"x4', alabaster, almost new, $15. Pat, Ext. 5406.

BREAKFRONT - walnut, Formica, 2 glass sliding doors, 2 solid door bottom; end tables, walnut, $125; pole light, 3 way, $50. 924-3553.

COFFEE TABLE - walnut, w/carved top, under glass, 2 end tables, excel. cond. 341-1239.

COMFORTER SETS - 3, w/queen-size comforter, dust ruffle, 2 pillow shams, excel. cond., $30/ea. Denice, 395-3485.

COUCH - Ethan Allen, 7', excel. cond. 325-0447.

DINING TABLE - solid oak, antique, 42"x30", extends to 54", asking $150. Sandy, Ext. 3369 or 286-1022.

DINING ROOM - Colonial, hardwood, hutch, 6 chairs, table w/2 leaves, pads, excel. cond., $500. 821-0354 after 6 p.m.

DISHWASHER - Magic Chef, $225; sectional sofa, w/sleeper, recliner, Stratford, new, orig. $3,500, ask. $1,200. Ext. 7287 or 744-4535.

DRYER - full size. Pam, 475-2541.

KITCHEN TABLE - Formica top, butcher block look, 4 chairs, v.g cond., $100. Pat, Ext. 3336.

LIVING ROOM - 3-piece, w/2 end tables, cocktail table, recliner, $175; sofa bed, $75. Ext. 4446.

MANTLE CLOCK - elec., Roman numerals, 14" tall, 11"W, $10; ceiling fan, flush mount, 4 blades, white, no light, $15. Kathy, Ext. 2267 or 395-6520.

REFRIGERATOR - freezer, 18 cu. ft., works well, you pick up, $50. Paul, Ext. Ext. 7135.

SOFA BED - full size, Sealy inner-spring mattress, beige, $500; TV cart, walnut, fits 19", bottom shelf, $30. Ext. 5873.

SINK/STOVE/REFRIGERATOR - combo, excel. for apt., $400. Marie, 589-3020.

Tools, House & Garden

LAWN MOWER - riding, 8-h.p. B&S, 26" cut, electric start, $225. Bill, Ext. 4986 or 563-1940.

SHREDDER-CHIPPER - new, 5-h.p. gas-powered eng., $290. 363-7032.

SPREADER - Red Devil, like new, used 1 season, $10 or best offer. Wink, 286-4291.

STOVE - Wellington, coal, 60k Btu output, black & silver, airtight, accessories, maintained, like new. Marcia, Ext. 7796.

STOVE - coal & wood, 60 Btu, excel. cond., $250 neg. Bob, Ext. 7238.

STOVE - coal & wood, auto hopper, $200; baby's carriage, $50; small bird cage, w/stand, cover, catcher, $20. Maryann, Ext. 5241 or 286-3377.

TUB - cast iron, claws, $25; boxspring & mattress, full size, $20. John, Ext. 2172 or 744-4386.

WATER PUFIFYING SYSTEM - Culligan, 2 tanks MK-89 conditioner, 1 tank acid neutralizer, auto w/all controls, make offer. 929-4173 eves.

CHIMNEY PIPE - 8", 9' triple wall, 6' stove pipe, ceiling & roof fittings, cap, $65. Steve, 722-4821.

FIREWOOD - seasoned oak. J. Scesny, 732-2849.

FIREWOOD - seas. hardwood, split, delivered, half cords avail., $115/cord. Glenn, 924-2035.

STOVE - coal, Surdiac, 36,000 Btu/hr., visible fire, 315 lbs., w/coal, $50. Tom, Ext. 4507 or 878-1060.

SCROLL SAW - 11", bench top, no motor, $20. Bill, Ext. 4986 or 563-1940.

WATER WELL PUMP - 1-h.p. deep well, 2 stage, 220 volts, still hooked up for testing, 2 yrs. old, upright. 924-8558 after 5 p.m.

Sports, Hobbies & Pets

AIR HOCKEY TABLE - 32"x62", $35. Ext. 2593.

AQUARIUM - Fluval, 30 gal., solid wood cabinet, heater, hood, light, filter system, fish, more, $99. Bill, Ext. 2378.

BASEBALL MITT - left-handed, good size, broken in, excel. cond., $25. 924-8558.

BIKE - 1990 GT Dyno Detour, mint cond., brand-new, custom-made, chrome mag rims, black access., best offer. Wegrzyn, 286-0002.

BIKE - Vortex, boy's, 20", like new, $65. Leroy, Ext. 4581 or Sean, 286-1615.

BIKE - girl's, 1-spd., 20" tires, $20. Joe, Ext. 2898.

CAMERA - Nikon F-3, w/80-200mm telephoto, 28-70mm wide angle, good cond. 924-8558 after 5 p.m.

DOG KENNELS - lg. & med.; cat carrier; Evenflo car seat; toddler riding toys; vacuum cleaner; '80 Omni for parts. Jennifer. 369-7704.

ICE SKATES - men's, hockey, size 7, excel. cond., $20. Mike, 286-2435.

PUPPIES - shelties, w/papers, shots. Ramona, 929-3889.

PUPPIES - golden retriever, AKC, vet checked, shots, have parents at home, 8 wks. old, 2 females, $350. Tirre, Ext. 3288 or 281-0360.

ROWING & LIFTING MACHINE - Columbia, complete, excel. cond., orig. $150, sell for $60. 924-3553.

ROWING MACHINE - Sears, $65; Tasco telescope, 4" reflector, $95. Ext. 5400 or 878-6098.

ROWING MACHINE - Schwinn RM1000; Medalist EX1000 exercycle, good cond., $50/ea. Ext. 4676.

SCOOTER - Yamaha, w/helmet, only 1,300 mi., both like new, $300; extra helmet, $50. Ext. 5080 or 751-1884.

SKIS - Head SC, racing, 200cm, Tyrolia 380, bindings, $50; Merrell Air Cushion hiking boots, size 11½, men's, used 1 day, $75. John, Ext. 5883.

SKIS - Head 170cm, w/Marker M36 bindings, poles, $95. 473-2473.

TRAINS - HO scale 4, transformers, 4 engines, 6 switches, many cars, 55' of track, extra layout ½ finished, make offer. Matt, 744-7406.

Audio, Video & Computers

BROADCASTING EQUIPMENT - audio mixer, comp., 2 & 4 chan. tape recorders, etc.; CDs, like new, $8/ea., lg. selection, mostly rock. 698-2498.

CD PLAYER - Sony, CDP-C705, 5-disk carousel, 185-disc custom memory, 18-bit D/A, 8x oversampling, $225. Hans, Ext. 4584 or 981-3365.

CDs - new, classical, call for list, 1 for $6 or 2 for $10. 722-3010.

COMPUTER - 386-SX, 15 MHz, 1 MB RAM, 40 MB-hd, 3.5" & 5¼" floppies, modem, mouse, IBM VGA col. mon., software, $625. Tom, Ext. 4563.

CORDLESS TELEPHONE - Southwestern Bell, 2 keypads, new battery & antenna, $50; 1 pr. tower speakers, $50; 1 pr. bookshelf, $30. 751-8240.

DISKS - 1 MB, SIMM's, 1x3, 70 ns, new, 6 total, $40 ea., also IBM DOS 5.0, new in box, $25. Tom, Ext. 4563.

DISKETTES - 360k, 25 per pack, $6; enlarging lens, El-nikkor 2.8, excel., $75. Susan, Ext. 7647.

GAMEBOY - $40, rechargeable battery, $20, 7 games, $15 ea., $40 for three, misc. Ext. 7505.

NINTENDO - complete set w/8 tapes, $100; Onkyo floor-standing speaker, like new, ask. $150 for pair. Sean, 286-1615, or Leroy, Ext. 4581.

STEREO TAPE DECK - cassette, headphones, etc., never used, cost $250, sell for $75; entertainment center, maple, $150. 744-3842.

TV/CABINET - 25" Magnavox, cable-ready, oak cabinet, excel. cond., ask. $220. Bob, 473-2496.

TV - 19" color Sanyo, $150; VCR, Panasonic wire remote, $100; TV/micro stand w/storage cabinet, $50. Nancy, Ext. 4177.

TV - color 19" Sylvania, $50 or best offer, VCR VHS, cable-ready, remote control, $150 or best offer. Miguel, Ext. 5427.

TV - 25" Zenith color, Colonial console w/swivel casters, $60. 924-3553.

The Brookhaven Bulletin is printed on paper containing at least 50 percent recycled materials, with 10 percent post-consumer waste.

Miscellaneous

AIRLINE TICKETS - American Airlines, LA-Islip, 1-way, 12/14, $25 to change date, ask. $100. Ext. 3983 or 341-1039.

BABY ITEMS - & toys, all good cond., car seat, baby swing, tricycle w/basket, girl's 12" bike, sit n'spin, more. 744-9802.

BRACELET - 14k gold, ¼" wide, ask. $65; 14k gold, 2 ct. CZ ring, new $150, ask. $70. Linda, Ext. 7187.

CRIB - oak & matching changing table w/pad, $250; TV cart, $25. baby lamp, $10. Tom, Ext. 7287 or 744-4535.

DOLLHOUSE - 8 rooms, completely furn. down to the dishes, silverware & curtains, great Christmas gift, $200. Marion, Ext. 5087.

ENGAGEMENT RING - 14k yellow gold, Tiffany setting w/center stone, approx. 0.49 ct. round, appraised @ $1,750, ask. $1,000. Pete, Ext. 4581.

FUR COAT - white mink car coat, size 10, worn twice, $2,700 new, sell for $850. John, Ext. 7039.

JACKET - pure rabbit, short, chocolate brown, size medium, used once, $40. Joann, 472-6742.

KIT - hutch box, 5½"x10", $3, metal box w/key, 4"dx11"lx7½"w, $8. Susan, Ext. 7647.

OPERA TICKETS - Met, Sat. matinee, 12/12, *Lucia di Lammermoor*, row K orch. center. Ext. 3922.

OPERA TICKETS - 2, Met, 12/21, *Die Walkuere*, 6:30 p.m., 1st row balc., $30/ea. Elliot, Ext. 3947.

NECKLACE - gold, 18" herring bone, 2 bracelets, triple-box design, below market prices, best offer. Kevin, Ext. 2350 or 878-3848.

OLD ENGLISH PRAM - blue & white, good cond., $125. John, Ext. 4028.

SUITCASE - 2 suiter, good cond., $20. Ext. 2041.

THEATRE TICKETS - 2 *Christmas Carol* Broadhurst theater, 1/2, 2 p.m., $90. Jeanne, Ext. 5843.

WATCH - man's Movado, Museum collection, new battery, worn twice, ask. $250. Theresa, Ext. 2907.

WHEELCHAIR - electric left-hand control, elevating leg rest, no charger, excel. shape, $750 firm. Helga, Ext. 2384.

Free

BICYCLES - 3, 1 men's, 2 women's, 10-spd. & 3-spd., good for parts or restoration. Ext. 4676.

Lost and Found

LOST - steel-frame glasses on Monday, Dec. 7. Joseph Harder, Ext. 3587.

Car Pools

PITTSBURGH, PA - riders to share round-trip driving expenses from BNL to Pittsburgh on weekends/holidays. Bill, Ext. 3698 or 2569 eves.

Real Estate

Real Estate advertised for sale or rent is available without regard for the race, color, creed, sex or national origin of the applicant.

For Rent

BROOKHAVEN HAMLET - 1738 restored 2-bdrm. Eng. cottage, hand-hewn beams, 2 baths, fp in d/r, greenhouse off kit., ctry. setting, $1,200/mo. + sec. & util. Sue, Ext. 2888 or 286-0422.

BROOKHAVEN HAMLET - share modern home w/2 adults on secluded street, 15 min. from Lab, walk to Carman's River & marina, priv. bdrm. & bath, all included, $600/mo. Ext. 7836.

CORAM - own room in a spacious private house, $350/single or $550/huge master bdrm. w/private bath, incl. all. Ext. 7897 or 331-0807.

EAST PATCHOGUE - 3-bdrm. house, south of S. Country Rd., mint, quiet, gar., bsmt., appl., no pets, no smokers, sec. & refs., $900/mo. + util. Ext. 3291 or 589-3020.

MASTIC - lg. 2-3 bdrm. apt., full bath, dinette, priv., end of ranch house, fenced yard, $720/mo. incl. all; also 2-bdrm. apt., kit. sunny l/r, priv. ent., quiet area, $630/mo. incl. all. Jim, 281-2849.

MEDFORD - 3½-rm. bsmt. apt., l/r, kit., bdrm., full bath, priv. ent., $550/mo. all + sec. 447-6528.

MIDDLE ISLAND - apt. to sublet, furn. or unfurn., avail. 1/93. Ext. 7663 or 744-8386.

MIDDLE ISLAND - 3-bdrm. townhouse, 2 baths, furn., w/d, ac, 5 min. from Lab, $900/mo. 289-5704 after 5 p.m.

MIDDLE ISLAND - co-op, new kit. & bath, furn. or unfurn., ac, pool, tennis, w/w, $625/couple or $600/single, heat included. Pat, 345-6114.

MILLER PLACE - 1-bdrm. apt., paneled kit., l/r, full bath, w/w, priv. ent., quiet neighborhood, $560/mo. incl. all. 928-0093 after 5 p.m.

MILLER PLACE - 4-bdrm. house on 1½ wooded acres, cathedral ceilings, l/r, d/r, full kit., 1-car gar. with w/d room, $900/mo. + util. Phil, 821-2940 after 6 p.m.

MILLER PLACE - new, furn./semi-furn. studio apt., full bath/kit., priv. ent., deck, wooded, near beach, single, mature, neat, no pets, nonsmoker, $475/mo. + 1/3 elec., sec. & refs. 473-6950.

N. PATCHOGUE - 1-bdrm. house, new refrig., furnace, $650/mo. + sec. Keith, 821-6877 eves.

PORT JEFFERSON STATION - large 3-rm. apt., full bath, kit., lg. secluded back yard, $400/mo. + util. Ext. 4094 or 751-6575 eves.

SELDEN - studio apt., priv. ent., kit., near shops, quiet, $550/mo. incl. util., 1 mo. sec. 689-1539.

SELDEN - 3-bdrm. split ranch, 1½ baths, cac, w/d, no pets, backyard, shed. 585-7438 eves.

SOUND BEACH - 2/3-bdrm. house, l/r, eik, cac, 15 min. to Lab, $750/mo. Dan, Ext. 7271.

SOUND BEACH - 1-bdrm. apt., furn., full bath, kit.-l/r combo, cable, priv. ent., $600/mo. incl. all. Ext. 2671 or 744-3284.

SOUND BEACH - 2-bdrm. contemp., great room, Euro kit., d/r, full bath, loft, skylights, deck, Andersen windows, energy effic., sit. on lg. wooded lot, $775/mo. +. Erik, Ext. 4603.

SOUTHAVEN - room for rent, complete use of house, kit., w/d, etc., $350/mo. incl. all. 286-4028.

WADING RIVER - 1-bdrm. apt. on beach, furn., util. & cable incl., single, working person. 929-8443.

YAPHANK - own room in spacious house, share living areas w/1 person, 5 min., to Lab, $300/mo., share util. Arlene, Ext. 2387.

CATSKILLS - 3-bdrm. chalet w/sleeping loft, full furn., near Windham & Hunter Mts., great for skiing. Kay, Ext. 4501, Bea, Ext. 3642.

KEY WEST, FL - condo, 4/17-24, sleeps 2-6, on water, priv. beach, pool, gym, walk to town, boat rentals, kit., hot tub, w/d. Sheryl, Ext. 7716.

SINGER ISLAND, FL - 2-bdrm. apt., 2 baths, furn., on ocean, pool, 30 min., from W. Palm Beach airport, 1 mo. minimum rental, avail. Jan.-April. Joyce or Paul, 289-5770 after 6 p.m.

HILTON HEAD, SC - 2-bdrm. condo. sleeps 6, fully furn., 2 baths, tennis, beach, golf nearby, Oct-Dec. $350/wk. for BNL employees and family members. Guy, Ext. 3147 or 689-5378.

MT. HOLLY, VT - A-frame, fully furn., 2½-bdrm., kit. bath, wood stove, deck, 10 min. to Okemo Mt., 25 min. to Killington, Pico & Stratton ski areas, $325/wknds., $495/wk. Tom, Ext. 2823.

For Sale

BELLPORT - 3-bdrm. ranch, l/r w/fp, d/r, bath, full bsmt., deck, det. 3-car gar., shy ½ acre, SCSD, city water, near village & dock, ask. $139,900. Maryann, Ext. 5241 or 286-3377 after 7 p.m.

BELLPORT VILLAGE - 2 bdrm., 1 w/sleeping loft, 2 full baths, lots of French doors & decks, outdoor jacuzzi, ⅔ acre, s. of S. County Rd., $248,000. Sue, Ext. 2888 or 286-0422 after 6 p.m.

BROOKHAVEN HAMLET - 4-bdrm. Col., 2½ baths, l/r, d/r, fam. rm. w/fp, eik, laundry rm., 2-car gar., full bsmt., lg. screened porch, on cul-de-sac, $249,000. Ext. 2881 or 286-3372.

CALVERTON - 2-bdrm. townhouse, 5 appl., carpeted, cac, fp, patio, upper deck, assum. mortg., neg. Ext. 3558.

CORAM - N. Rt. 83, mint, 4-bdrm. contemp Col., l/r, d/r, fam. rm., fp, fin. bsmt. w/nightclub, 2-car gar., 1/3 acre, $124,900. Ext. 7897 or 331-0807.

EAST MARION - 1-acre bldg. lot, adjacent to green belt, walk to Sound. 325-0447.

LAUREL - 2-bdrm. ranch, 1 bath, l/r, eik, 1-car gar., full bsmt., new heat, near beach, Mattituck SD, $124,500. Al, Ext. 5128 or 727-4417.

MANORVILLE - 3-bdrm. Col., contemporary flair, 2½ baths, master suite whirlpool, l/r, fam. rm., d/r, kit., gar., bsmt., igs, igp, satellite system landscaped, acre, $185,000. 878-9239.

MASTIC - 3-bdrm. split level, 1½ baths, l/r, d/r, kit., fam. rm., Florida rm., bsmt., gar. w/elec. opener, 2 ac, shed, fenced, extras. Joan, Ext. 2549 or 281-3797 eves.

MIDDLE ISLAND - lakefront 2-bdrm. co-op, upper unit, clean, bright, newly painted, l/r, d/r, kit., all appl., cac, gas heat, w/w, pool, tennis, clubhouse, 10 min. to Lab, $56,000 neg. 924-5282.

MIDDLE ISLAND - Coventry Manor, 3-bdrm. townhouse, 2 full baths, kit., l/r, d/r, laun. rm., cac, 5 appl., encl. patio, new carpet, ask. $90,000. Rosalie, Ext. 3160 or 289-5704 after 5 p.m.

MIDDLE ISLAND - Lake Pointe at Artist Lake, upper 1-bdrm. co-op, deck, cac, w/d, clubhouse, assume mortg., $59,000 neg. Bill, 924-1346.

MIDDLE ISLAND - Clarendon custom 4-bdrm. Col., ½-acre, 2½ baths, kit., den w/fp, 2-car gar., full bsmt., $125,000. 924-2722 after 6 p.m.

MT. SINAI - 4 bdrm. on ½ acre, N. of 25A, new Weil-McLean furnace, new windows, den, fp, l/r, d/r, bsmt., gar., excel. schools, greenhouse, all appl. R. Cohen, Ext. 3484.

NORTH SHIRLEY - 3-bdrm. ranch, 1/3+ acre, fenced yard, new boiler, HW heater, windows, renovated contemp. kit., bsmt., igs, by Southaven Park, mint, $110. Jim, Ext. 2957 or 924-7374.

NORTH SHIRLEY - 5-bdrm. ranch, 1½ baths, furn., bsmt., gar., $100,000. 399-6166.

RIVERHEAD - Glenwood Mobile Home Park, double unit, 1050 sq. ft., 2 bdrm., kit., l/r, d/r, bath, storage, jalousie patio, appl., oil heat, ac, lawn sprinkler, $45,000. Gene, Ext. 4690.

RIVERHEAD - 12'x65' mobile home, 2 bdrm. 1 bath, w/d, all appl., $315/mo. maint., ask. $27,000 neg. Beth, Ext. 4986 or 369-4295.

ROCKY POINT - 4-bdrm. Col., 2½ baths, gas heat, cac, l/r, d/r, eik, den, fin. bsmt., gar., ask. $138,990. Don, Ext. 7237 or 744-2921 after 5 p.m.

ROCKY POINT - 2-bdrm. ranch, l/r, d/r, full bsmt., wood stove, oak floors, 95'x120' fenced yard, $97,000. 744-7549 after 4 p.m.

WADING RIVER - 3-bdrm. ranch, priv. beach community, eik, fd/r, a/c, trees, bsmt., deck, lg. shed, 1½ bath, cyclone fence, ½ acre, $128,000. 744-3842.

WADING RIVER - on beach, 10-rm. year-round house, 5 bdrm., 2 baths, d/r, l/r w/fp, upper/lower decks, full bsmt. w/apt. w/sep. ent., incl. adj. lot, SWRSD, $259,000. Kathy, 929-8443.

Wanted

CAR - Saab, Model 96, V4, any condition. Jay, 286-3679.

GOOD HOME - gray & white cat, young, altered male, declawed, litter trained, indoors only, very playful, please rescue. Joe, Ext. 5131.

COMPUTER - clone or IBM comp. incl. printer & monitor for child to learn on. 924-5192 eves.

DRILL PRESS - floor standing. Bob, Ext. 7627.

LIONEL & AMERICAN FLYER TRAINS - & accessories, top $ paid. Carole, Ext. 7100.

PEOPLE - interested in flying control line model planes; also want old engines. Mike, 821-4083.

RECORDS - 33⅓ or 45 prm, polkas of any year, rock & roll from 55-65. Frank, Ext. 3120.

SEWING MACHINE - Singer portable, in good cond. 878-2239 after 5 p.m.

SKIERS - to ski Windham 1/6, send $42 for bus & lift to Augie Hoffman, 510C, by Dec. 30.

SLIDE PROJECTOR - w/auto focus, suitable for cartridge & carousel load. 924-5192 eves.

SUNFISH - sailboat in good cond. Damian, 924-9668 or 744-5079.

VIEWERS - see 2-part *Jesus* video in Snyder Conf. Rm. 911A, 12/15 & 22 at noon, join in our Christmas spirit. Frank, Ext. 2368; Pete, Ext. 3297.

Classified Ad deadline is 4:30 p.m. Friday for publication Friday of the next week.