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BROOKHAVEN NATIONAL LABORATORY

On Biologists' Horizon: An Atomic View of Single Proteins?

The atomic force microscope has given materials scientists and industrial quality-control managers the ability to examine metals and computer chips at the atomic level. Now, it's being investigated by biologists for its possible use in observing the atoms in individual, noncrystallized proteins and single strands of DNA.

Such resolution is already possible with x-ray and electron diffraction, but only with thousands of copies of each structure in two- and three-dimensional crystalline arrays.

Two scientists in the BNL Biology Department, Senior Biologist Paul Hough and Associate Biologist Iris Mastrangelo, have already made images of a protein-DNA complex at less-than-atomic resolution using an atomic force microscope, or AFM. They adapted their usual procedures in conventional and scanning transmission electron microscopy to the new kind of microscope.

The biologists' approach has resulted in a Cooperative Research and Development Agreement (CRADA) between Digital Instruments, Inc., a California manufacturer of scanning probe microscopes, and Hough.

"So far, we've developed workhorse methods that can be used on many biological samples during the present period when high resolution has not been achieved," says Hough. "It seems to give us the best look so far at protein, and it makes DNA highly visible."

Promise for a Tabletop Tool

Atomic force microscopes use a tiny, pyramid-shaped tip of silicon nitride, invisible to the naked eye, mounted on a springy cantilever arm also made of silicon nitride. A laser beam measures the cantilever's deflection and can sense a deflection of only 0.01 nanometers (nm) or 0.1 angstroms.

Detecting a hydrogen bond between two atoms in a biomolecule, which is very important to biologists, is possible with the AFM because the bond's atomic force is enough to deflect the cantilever much more than the minimum 0.01 nm.

However, there is a Catch-22.

During examination of biological specimens under usual conditions, a thin water layer forms between the sample and the AFM's tip, producing an attractive force that swamps the force from cantilever deflection. The only way now known to keep this from happening is to scan a sample that's entirely immersed in water, but therein lies the Catch-22: No one knows how to fix the samples in place so that they are not swept away by the tip as it scans.

The BNL group, which included Kristy Horak, a Science and Engineering Research Semester student from Iowa State University, has attacked the Catch-22 by anchoring DNA under water to a two-dimensional crystal, one constructed of a single layer of molecules.

If the Catch-22 can be overcome, the only known roadblock to atomic resolution will be the coarseness of present-day AFM tips. Those tips can achieve atomic resolution for rigid inorganic specimens such as calcium carbonate, but Hough and his coworkers will soon know whether they will accomplish the same for DNA and protein under the "kinder, gentler" regime of immersion scanning. If not, Hough has ideas for a "concept tip" that may alleviate this concern.

Paul Hough, (front) Iris Mastrangelo and Kristy Horak in the Biology Department laboratory where they investigate the ability of an atomic force microscope to examine the finest details of biological specimens.

Photo by Roger Stoutenburgh

How It All Got Started

The laser-beam AFM was invented by Paul Hansma and others at the University of California, Santa Barbara, in 1989. It soon came into use in several fields: BNL materials scientists in the Department of Applied Science use one for high-resolution studies of corrosion. "When Hansma spoke last year at Cold Spring Harbor Laboratory," said Hough, "he inspired a certain conviction that the fledgling instrument could soon contribute in biological research as well."

So, Hough and Mastrangelo visited Paul and Helen Hansma and their coworkers, bringing with them samples of the protein-DNA complex whose structure they had established in 1989.

The protein component in the structure is called T (for tumor) antigen and is made by a virus called SV40. It consists of two rings made up of six copies each of the T antigen protein, and hence is a double hexamer. T antigen can cause tumors in animals and plays a vital role in viral DNA replication.

In California, the team successfully spread DNA on a mica surface, but then discovered that the AFM badly damaged the protein in the complex in even a single scan. However, when they added uranyl acetate, a stain well known to electron microscopists, the biomolecular structure became strikingly resistant to damage and DNA was highly visible.

What's in Store

What the group saw in California by AFM was direct geometrical evidence for a T antigen ring structure, and an early example of internal protein detail such as a cleft, or "valley" between two "mountain tops" of the hexamer rings' profiles. The detailed pictures will appear in *Biophysical Journal* in February, with Mastrangelo, Magdalena Bezanilla, Paul Hansma, Hough and Helen Hansma as authors.

Even with coarse tips, the AFM yields a fineness of detail comparable in some ways to BNL's Scanning Transmission Electron Microscope. With new tip designs in the works, the "carrot" of atomic resolution for biomolecules that hangs in front of AFM-using biologists is now clearly in sight. — Kara Villamil

Coming Up

Physicist Gerry Bunce, Alternating Gradient Synchrotron Department, will deliver the next Brookhaven Lecture. He will discuss the Muon g-2 Experiment, on Wednesday, January 12, at 4 p.m., in Berkner Hall.

APS Bonner Prize Awarded to Warburton

Ernest Warburton, a Senior Physicist in the Physics Department, has been awarded the Tom W. Bonner Prize in Nuclear Physics by the American Physical Society (APS) for "pioneering contributions to our understanding of the structure of light nuclei via the development and exploitation of experimental techniques in nuclear spectroscopy combined with theoretical analyses."

Warburton is the second BNL scientist to receive the prize, which carries with it a $5,000 award and an invitation to address the APS's annual meeting. Former Laboratory Director Maurice Goldhaber was similarly honored in 1970.

"The fact that I'm being recognized by my colleagues is a tremendous source of pleasure for me," said Warburton, who hopes to be able to address the April award ceremony despite an illness. "If I was allowed to have cancer *and* the Bonner prize, or *neither*, I'd have to think." He added, "I have often collaborated and believe that my colleagues, especially John Olness and David Alburger, could claim a share of the prize."

On Warburton's winning the prestigious award, given to only a few nuclear physicists, Physics Department Chairman Peter Bond said, "Ernie is certainly one of the most deserving, based on his contributions over the years. He has made major contributions to both experimental and theoretical nuclear structure investigations, and techniques he helped develop have had wide applicability in nuclear physics."

Ernest Warburton

Warburton first came to the Lab as a postdoctoral fellow in 1956, after receiving his doctorate in physics at Pittsburgh University. After teaching for three years at Princeton University, he joined BNL's Physics Department in 1961 and began a decade of work at the 3MeV Van de Graaff. In 1963, he departed for the first of two fellowships at Oxford University. Upon returning from England, Warburton received tenure and began using Doppler-shift methods to measure nuclear lifetimes.

The second fellowship at Oxford, in the late 60s, gave Warburton the opportunity to work with collaborators on the decay rates of forbidden nuclear transitions, those considered less likely to occur than other allowed transitions. He considers this one of his most important publications.

Then, in 1970, he moved to the brand-new Tandem Van de Graaff. "I spent 12 years doing the things the Tandem was designed for," he said, describing his investigation of fusion and evaporation with heavy ions. However, Warburton said, his credo has always been: "Good science is done by good scientists, not by machines."

But, when Warburton looks back on his days at the Van de Graaff and Tandem, he now remembers not just his projects, but also the experience of guiding many younger physicists as they did graduate or postdoctoral work at BNL.

"I'm proud to have worked with and helped educate a lot of young people, and the letters have been pouring in from them [since the award was announced]," Warburton said. "The thing I've liked to hear most is, 'I enjoyed working with you a great deal.' "

During that time, he also translated his love of fine wine, acquired during trips abroad with colleagues

(continued on page 2)

Photos by Roger Stoutenburgh, with special thanks to Maj Britt Hansen, Michael Herbert and Joseph Rubino.

VIPs Feted for Years of Service

There were 201 Very Important Persons (VIPs) invited to the 1993 Service Award Reception, held in the Brookhaven Center the evening of December 16. These VIPs included two employees who marked 45 years of Laboratory service during the past calendar year, six who realized 40 years at Brookhaven last year, 24 who observed 35th anniversaries, 59 who completed 30 years at the Lab, and 40 for whom 1993 was their 25th anniversary year at BNL. Other VIPs included 55 Brookhaven employees who have between 36 and 39 years of service, 13 who have been with the Lab between 41 and 44 years, and two who have attained 46 years of BNL service.

Warburton (cont'd)

and his wife, Nancy, into the spark that began BNL's first wine-appreciation group.

Warburton was appointed head of the Tandem research group in 1979, serving there until 1984. But the Tandem Van de Graaff's transition to use as an injector for the Alternating Gradient Synchrotron in 1984 spelled, for Warburton, the end of his experimental career. "I said, 'I'm going to be a theorist,' and two people taught me how: John Millener of BNL and Alex Brown, of Michigan State University."

Warburton again had the chance to take his research abroad in 1988, when he spent a year at Germany's University of Heidelberg through a Humbolt Foundation grant. There, he continued to develop his theoretical studies of the first forbidden beta decay, an unlikely transition in which the nucleus emits or absorbs an electron or positron and the outcome is used in the study of nuclear structure and, in particular, as an "observable," or marker of the exchange of mesons between nucleons.

Since then, Warburton's work at BNL has documented, for four regions of the periodic table, the extent to which the exchange of mesons between protons and neutrons in the nucleus affects the rate of first-forbidden beta decays. The last of four reports completing that study was recently accepted for publication in *Physical Review*.

All in all, Warburton said, "Brookhaven has provided a superb and highly supportive atmosphere for my career and gave me freedom to follow my nose." — Kara Villamil

Note to Employees:

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

Service Awards

The following employees celebrated their BNL service anniversaries during the month of November 1993:

40 Years

J. Keith Rowley ..... Chemistry
Sylvia S. Springhorn ..... Biology

35 Years

Henry C. Grahn ..... Director's Off.
Calvin H. Brewster ..... Adv. Tech.

30 Years

William L. Cahill Jr. ..... NSLS
Myron Strongin ..... Physics
William A. DeCaro Jr. ..... Cen. Shops
Alyce M. Daly ..... Saf. & Env. Prot.
Edward J. McFadden Jr. ..... CCD

25 Years

Warren S. Hirzel ..... RHIC

20 Years

Samuel C. Morris III ..... App. Science
Robert W. Callister Jr. ..... Plant Eng.
Jerry S. Hobson ..... Plant Eng.
Frances K. McKenna ..... App. Science

10 Years

Marsha Belford ..... Director's Off.
Cheryl S. Conrad ..... Adv. Tech.
Mary Ann Maggio ..... MIS
Iris A. Mastrangelo ..... Biology
John Castro ..... Plant Eng.
Arthur J. Anderson ..... Plant Eng.

Arrivals & Departures

Arrivals

Marcus A. Babzien ..... NSLS
Robert F. Healy ..... Comp & Comm.
Kai Hu ..... Adv. Tech.
Toan Q. Nguyen ..... Comp. & Comm.
Peter F. Piccano ..... Plant Eng.

Departures

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

Susan Y. Forbes ..... NSLS
Andreas E. Gocksch ..... Physics
Lyle L. Mason ..... Physics
Peter J. Simpson ..... Physics
Robert C. Von Der Linn ..... Personnel
Charles Zein Jr. ..... AGS

In Memoriam

Leon Green, the previous Head of the International Safeguards Project Office (ISPO) in the former Department of Nuclear Energy (DNE), died on December 8 after a brief illness. He was 70 years old.

Green came to Brookhaven on October 24, 1956, as a guest engineer. Two years later, he joined the staff of the then Department of Nuclear Engineering, as a process design engineer II. He was promoted in 1963 to a process design engineer I. By 1966, he was leader of the Evaluation and Technical Assistance Group, which made engineering and economic evaluations of new power-reactor concepts.

From 1966-68, he took a leave of absence to work in the economics section of the Department of Nuclear Power and Reactors of the International Atomic Energy Agency (IAEA) in Vienna, Austria. The IAEA had been established by the United Nations to verify that nuclear materials and installations worldwide are used only for peaceful purposes. There, he was also involved in allocating assistance to developing nations interested in establishing nuclear power.

Returning to the Lab in 1968, he joined the newly formed Safeguards Group in DNE. In 1977, he was named an associate chemical engineer first, then chemical engineer. That year as well, ISPO was established within DNE and, one year later, Green was appointed its second Head.

In 1976, the U.S. Congress had approved funds to set up the U.S. Program of Technical Assistance to the IAEA. Since then, that program has made American technology and expertise available to help improve international efforts to prevent the diversion of nuclear materials. On behalf of the U.S. Department of State, ISPO has been responsible for the technical management of that program.

"Leon Green developed the outstanding working relationship between the IAEA Safeguards Division and ISPO that continues to this day," recalls Senior Scientist Walter Kato, who served as DNE Chairman, 1988-91. "His leadership resulted in the ISPO program becoming internationally recognized for its contributions to the improvement of IAEA nuclear-materials safeguards."

In July 1989, Green received a Distinguished Service Award from the Institute of Nuclear Materials Management, "in recognition of outstanding contributions for over 30 years in nuclear-related fields."

The IAEA recognized "his 13 years of stalwart support to IAEA safeguards" in November 1991, with a signed plaque. In December 1991, Green stepped down from his leadership of ISPO, but continued to advise the office and contribute to other activities within DNE, which became the Department of Advanced Technology (DAT) last year.

"In addition to his distinguished career at Brookhaven, Leon's life was anchored by his dedication to his country, his community and his family," remembers Ann Reisman, who worked with Green in ISPO and now heads DAT's International Projects Division. "In all aspects of his life, he displayed dignity, wit, intelligence and caring."

Leon Green is survived by his children: Jacqueline, Michelle and David, and four grandchildren. Contributions in his memory can be made to either: Camp NJEDA, Saddleback Road, Stillwater, NJ 07875; Seaport Hadassah, P.O. Box 75, East Setauket, NY 11733; or The Henry Viscardi School, 201 I.U. Willets Road, Albertson, NY 11507.

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The following retirees passed away recently:

Earle O. Dickerson, who retired as a mason in the Plant Engineering Division in August 1992, died on December 13, at the age of 63. He started in the then Plant Maintenance Division as a janitor, on July 18, 1966. He is survived by his wife Virginia; three daughters, Rhoda Marchica, Ginna Beth Dickerson and Michele Hale, who works in the Photography & Graphic Arts Division; one son, Hans Dickerson; and a granddaughter, Dara Marchica, and grandson Bryan Hale.

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William J. Walsh died on December 13 at the age of 75. He had joined BNL on May 5, 1952, as a Patrolman with the Security & Plant Protection Division. When he retired in October 1978, he was a Senior Administrator Assistant in the Medical Department.

Addled Addresses

- Associated Diversities Inc.
- Brickhaven National Labs
- Reactivator Division
- Spookhaven National Labora
- Lipton, NY 11973
- Broom Haven National Laboratory
- Brookhaven Nut Labs
- Brookhaven National Bank
- Brookheron National Lab Uptown, NY
- Ociated Universities, Inc.
- Bocjhaven National Labortory
- Brouhoxen National Labs

A Grand Grand Total

BNLers gave, gave and gave some more to the 1994 United Way campaign, resulting in a grand total of $100,136, topping the goal of $100,000.

"I'd like to thank all Lab employees for supporting the campaign, especially the department and division captains for all the work they've done to bring us to our goal and over," said BNL United Way Chairman Ron Manning, Staff Services Division.

Manning also congratulated the winners of prizes in the December 6 pledge card drawing. Jack Russell, Division of Contracts & Procurement, won the grand prize, a weekend for two in New York City. Winners of Service Merchandise gift certificates were: David Comstock, Chemistry Department; Jonathan Hanson, Chemistry; Michael Cohen, Plant Engineering Division; and David Rahm, Physics Department.

Meanwhile, Financial Coordinator Betty Pergan said she is still receiving pledges, and will welcome more until mid-January to ensure brighter tomorrows for those who receive services from the 150 community organizations sponsored by United Way.

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New Statements With Next Checks

Employees are reminded that their first paychecks of the new year will be accompanied by a new Leave and Earnings statement. This represents one of the first and most visible changes resulting from the Lab's switch to a new administrative computer system, called 3P for its consolidations of payroll, personnel and personnel budgeting information.

For more information, call the Payroll Office, Ext. 2470.

BWIS Meeting: Cocaine Effects

Scientist Prantika Som, of BNL's Medical Department, will speak about "The Effects of Cocaine on the Heart," at the next Brookhaven Women in Science meeting, on Monday, January 10, at noon, in Berkner Hall, Room C.

Som came to BNL in 1975, and her research focuses on cardiovascular nuclear medicine, studying heart blood flow and metabolism in disease conditions, and the effects of cocaine and hypertension. She is also a professor of radiology at the State University of New York at Stony Brook.

All are invited; please bring your lunch.

AA Meetings

Next month, Alcoholics Anonymous (AA) meetings will be held on site after work on the following Mondays: January 3, 10, 24 and 31. There will be no meeting on Monday, January 17, due to the holiday on Martin Luther King Jr.'s birthday.

All employees, retirees and others working on site who hold current BNL identification cards, and their dependents, are invited to attend.

For meeting location and time, write P.O. Box 641, Upton, NY 11973, or call the Employee Assistance Program (EAP), Ext. 4567. Callers will not be asked to leave their names, and all calls are confidential.

1994 New York City Train Trips

This is the only time that the 1994 schedule of special discounted trips to New York City (NYC) via the Long Island Railroad (LIRR) will be published in the Bulletin, so clip and save the information below:

• **Saturday trips** - The Patchogue-Medford Library runs trips to NYC on the third Saturday of every month, starting in March. The train leaves from Patchogue at 8:15 a.m. Purchase round-trip tickets, at $7 each, at the library at least one week before the trip. For information, call 654-4700, Ext. 20.

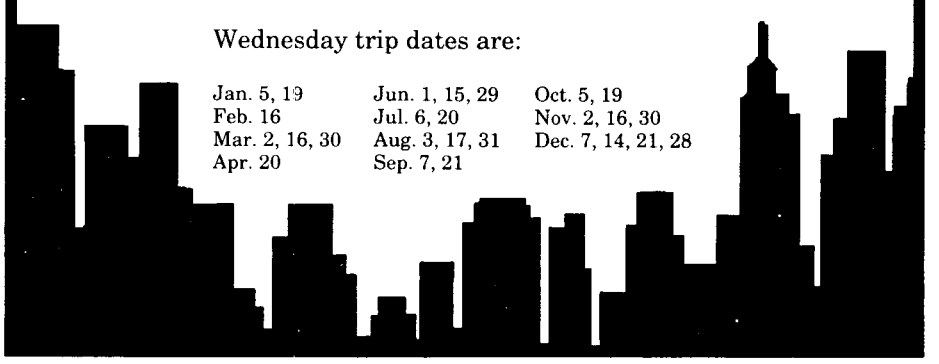
• **Wednesday trips** - Diane Weid will run NYC train trips on Wednesdays as listed below, leaving from Patchogue at 7:56 a.m. The round-trip cost is $7.50 per person.

A minimum of 30 people is needed for each trip. For reservations, send a check payable to Cash to : Diane Weid, 645 Old Medford Avenue, North Patchogue, NY 11772. Checks must be received by the Monday before a trip and should include your phone number and the trip date.

For more information, call Weid at 475-2394.

Wednesday trip dates are:

Jan. 5, 19	Jun. 1, 15, 29	Oct. 5, 19
Feb. 16	Jul. 6, 20	Nov. 2, 16, 30
Mar. 2, 16, 30	Aug. 3, 17, 31	Dec. 7, 14, 21, 28
Apr. 20	Sep. 7, 21	



Are You Ready For Ice & Snow?

Winter weather can surprise us any time. Be prepared by stocking your car with a flashlight; blanket; flares or reflective triangles; rags or paper towels; first-aid kit; extra windshield washer fluid and a spray de-icer; small snow shovel; large bag or bucket of sand or cat litter for quick traction.

In Stormy Weather:
Dial 282-INFO*
for information about BNL and the Child Development Center.
*Dial the letter O, *not* zero!

Donors Are Winners In BNL Blood Drive

A total of 452 units were donated in BNL's annual winter Blood Drive, held December 9-10.

Everyone who pledged a donation for this drive prior to December 1 was also eligible to participate in a drawing for five $50 dinner certificates. And the winners were... Harold Dorr, Central Shops Division; Evelyn Flores, Physical Review; Kathryn Hornik, RHIC Project; Darryl Kaurin, Department of Advanced Technology; and Alan Kuehner, Safety & Environmental Protection Division.

Inside Info

Arnold Peskin, Senior Scientist in the Computing & Communications Division (CCD), has been made a fellow of the Accreditation Board for Engineering and Technology (ABET), for contributions to "the maintenance of quality in engineering, engineering technology and engineering-related educational programs."

Peskin, one of five new ABET fellows, was a member of the organization's Technology Accreditation Commission from 1982 to 1992, including one year as chair. He has also served on ABET committees on policy and balance. A BNL employee since 1967, he served as Head of CCD from 1988 to 1992.

Few Tax Changes

Changes to withholding regulations for federal taxes are minimal for 1994. In some cases, however, a slight increase in the exemption allowance may result in a very small change in take-home pay.

New Pool Season

The new three-month season at the swimming pool begins on Monday, January 3, and will end Thursday, March 31. Purchase tickets at the pool during open hours:

Open Hours*

- **Monday through Friday**

11 a.m. - 1:30 p.m.	employees only
1:30 - 2 p.m.	reserved for speed swimming and training
5 p.m. - 9 p.m.	employees, families & guests**

- **Saturday and Sunday**

1 - 5 p.m.	employees, families & guests**

**The pool is closed on all Lab holidays.*

Fee Schedule

- **Daily Admission**

employee or family member	$2.00
guest	$3.00

- Season ticket (fees not prorated)

Individual	$40.00
Family	$50.00

*** Guest ruling for all recreation facilities: One guest per employee permitted. Advance arrangements for additional guests, a maximum of five at one time, must be made at the Recreation Office, Personnel Division, Bldg. 185. Guests must be accompanied by the sponsoring employee.*

Volleyball

Standings as of December 15

Open League		League I	
GTEAM	24-9	Rude Dogs	20-7
Me and the Boys	20-13	Upfagrabs	21-9
The Roofing Co.	20-13	Network News	15-12
Far Side	12-18	Underdogs	10-20
Penetrating Vollies	5-28	Fornossing	6-24

League II		League III	
Safe Sets	23-4	Silver Bullets	18-6
Nuts & Bolts	22-5	Jolly Vollies	16-8
Net Wits	18-9	Take Five	13-11
Fossils	15-12	Slow Hands	12-12
Mon. Night Live	13-14	High Volley'em	9-15
Night Court	10-17	Upton Ups	4-20
Spiked Punch	5-22		
NTTP	2-25		

Bowling

Red/Green League

E. Larsen bowled a 238/607 scratch series, E. Beadle 235/208/625 scratch, K. Koebel 233/211/626, F. Griswold 227, R. Raynis 220, C. Bohnenblusch 219, K. Riker 215, E. Sperry III 214, R. Mulderig 213, R. Mackinnon 207, J. Goode 202, N. Parrinello 200.

Purple League

Manny Dador bowled a 229, Fred Schaefer 217/246/208, George Munoz 209/207, Ray Raynis 206/203, Ken Batchelor 205, Tirre Farmer 191, Maryann Reynolds 189, Mary Addessi 188. Phyliss Fewell converted the 3/4/7 split.

Cafeteria Menu

Monday, January 3

Soup: Homemade split pea	.80/1.10
A la Carte: Broccoli pizza	2.75
Fitness: Pasta primavera	3.25
Deli: Pastrami sandwich	2.95
Grill: Reuben platter	2.95
Salad: Tomato & mozzarella cheese	

Tuesday, January 4

Soup: Beef & mushroom barley	.80/1.10
A la Carte: Flounder w/veg. julienne	3.85
Fitness: White bean & eggplant casserole	3.20
Deli: Hot roast beef sandwich au jus	2.95
Grill: Cuban sandwich	
Salad: Chef's tuna bowl	

Wednesday, January 5

Soup: Cream of broccoli	.80/1.10
A la Carte: Yankee pot roast w/veg.	3.75
Fitness: Baked lemon chicken	3.45
Deli: Virginia ham sandwich	2.95
Grill: Monte Cristo	2.95
Salad: Fresh fruit	

Thursday, January 6

Soup: New Orleans chicken gumbo	.80/1.10
A la Carte: Veal Parmesan w/veg.	3.75
Fitness: Vegetable au gratin	2.95
Deli: Corned beef sandwich	2.95
Grill: Philly cheese steak	2.95
Salad: Turkey Waldorf	

Friday, January 7

Soup: Manhattan clam chowder	.80/1.10
A la Carte: Display cooking - overstuffed omelets	
Fitness: Tomato & artichoke quiche	3.45
Deli: Hot roast turkey sandwich w/gravy	2.95
Grill: Tuna melt	2.95
Salad: Chef's	

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 - Doctorate normally required. Candidates may apply directly to the department representative named.

POSTDOCTORAL RESEARCH ASSOCIATE - Trained in inorganic chemistry or organic chemistry, with research experience in organometallic chemistry. Experience with NMR, vacuum-line techniques for handling air-sensitive compounds, and kinetic studies of organometallic reactions also required. Contact: Morris Bullock, Chemistry Department.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees.

NS 2739. RIGGING SUPERVISOR - Requires substantial pertinent experience in the field to coordinate all work of Rigging Section. Will direct employees on jobs, including assignment, training, scheduling and technical direction. Will maintain records and reports. Plant Engineering Division.

DD 8192. SECRETARIAL POSITION - (term appointment) Requires an AAS in secretarial science or equivalent, excellent organizational, communications and PC skills. Familiarity with WordPerfect, spreadsheet, graphics software and knowledge of Laboratory policies and procedures desirable. Responsibilities will include preparation of correspondence and reports, maintenance of a structured file system, arrangement of travel on IPAP system, and arrangement of meetings and conferences. Office of Environmental Restoration.

Motor Vehicles & Supplies

93 VW GOLF III - white, 5-spd., ac, am/fm cass. radio, alarm, beige int., clean, like new, 6k mi., $12,500. Amy, 924-7552.

92 NISSAN 240SX - 5-spd., 9k mi., burgundy, ac, am/fm cass., extras, one owner, excel. cond. $15,900. Sue, Ext. 4931 or 447-5557 after 7 p.m.

91 HARLEY LOW RIDER - 4.8k mi., leather snakeskin eagle on every metal part, chromed out, must see, $13,500. Tony, Ext. 7861.

91 HONDA PRELUDE Si - black, 5-spd., 34k mi., one owner, immac. cond. George, Ext. 4137.

89 VW CABRIOLET - convertible, ac, a/t, Blaupunkt, 58k hwy. mi., excel. cond., $11,500. 821-0686.

88 ESCORT EXP - fully loaded, 5-spd., 71k mi., runs well, $2,100 neg. Dan, 360-3803.

88 ISUZU TROOPER - 4wd, 4-dr., low mi., excel. cond., $6,900. 722-3905.

88 JEEP CHEROKEE CHIEF 4x4 - 2-dr., a/t, ac, am/fm/cass., p/w, keyless, $7,500. 473-2473.

87 HYUNDAI EXCEL GL - red, 2-dr. h/b, 5-spd., ac, 75k mi., excel. cond., $1,300. Jon, 395-5221.

87 ISUZU TROOPER - 5-spd., ac, hitch, silver/black, $4,500. Steve, Ext. 7236.

87 STERLING 825S - luxury sport, a/t, 72k mi., engine problems, $2,000; '78 Chevy Blazer 4x4, V-8, a/t, $1,000. E. Edwards, Ext. 4308 or pager 6158.

87 TAURUS L WAGON - 3.0 V-6, 70k mi., orig. owner, gar., very clean, $3,650. Joe, Ext. 5131.

87 VOLVO 240 WAGON - 5-spd., ac, pullout stereo, snow tires, 60k mi., excel. cond., $7,000. Fred, Ext. 7824 or 261-5735.

84 DODGE COLT - reliable, $300. Alan, Ext. 4226.

83 FORD FAIRMONT - a/t, p/s, ac, radio, 114k mi., 6-cyl., looks good, moving, $450. Li, Ext. 4472/1088.

83 DODGE ARIES - good for parts or home mechanic, make an offer. Rick, Ext. 4407.

81 PLYMOUTH RELIANT - m/t, runs well, some rust, $200. Craig, Ext. 7798.

80 TRANS AM - rebuilt 301 & trans., all power, new tires, mint cond., $4,000 neg. 475-4270.

FORD PICKUP - '82 bed on '68 chassis, new clutch/trans., cab rusty, sell parts or whole truck, $450. Steve, Ext. 4211.

DONUT TIRE - never used, GM Pontiac, 14" wheel, T125 170/D15, $20. S. Saxon, 744-3842.

TRACTOR - Ford 440, diesel, back hoe, front bucket loader, asking $5,500. Dorothy, 744-9027.

Furnishings & Appliances

ADJUSTABLE BED - single, w/mattress, excel. cond. Howard, 878-8294.

ARMCHAIR - rocking, beige, like new; Sega Mega, Atari cartridges. 423-9750.

BED - twin, child/youth, used 1 year, excel. cond., platform, headboard, 2 drawers, orig. $400, asking $200. 821-6856.

BED - twin, mint cond., $80 or best offer. Ext. 5534 or 345-2686 after 6 p.m.

BED - youth, basinet, white, w/side rails, mattress, v.g. cond., $30; girl's twin headboard, white, provincial, $10. Ext. 7707.

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

BEDROOM SET - French provincial, triple dresser, chest of drawers, headboard, 2 nightstands, $500. 654-5469.

CARPET - 6'x9', good cond., $15. Ext. 5534 or 345-2686 after 6 p.m.

CHAIR & LOVE SEAT - rust velvet, rattan sides, antiqued finish, $100/both. Ext. 4341 or 475-4005.

DINING ROOM SET - harvest type, 8 upholstered chairs, almost new, $700 firm. Howard, 878-8294.

FUTON - queen size, cotton & foam mattress w/cover, folding wood frame, $200. Mike, Ext. 2499.

MICROWAVE OVEN - Panasonic, 1.5 cu. ft.; dining table & 5 chairs; sofa & love seat; tables: center, coffee, side (glass top), computer. Shruti, 821-1963.

REFRIGERATOR - GE, small apartment size, like new, almond, $75. Chuck, 821-1525.

SOFA BED - love seat, mauve/pastels, big floral pattern, 15 pillows; cocktail table, big, glass/brass, $450/all, $400 w/o table. Vinny, 582-6241.

TRASH COMPACTOR - Sears, works well, almond, stands alone or under cabinet, orig. $200, sell for $50. Bob, Ext. 3509 or 289-9533.

WASHER & DRYER - Sears, apt.-sized, 2 yrs. old, $400. Mauro, 265-6542.

WATER BED - queen size, no-motion mattress, pine frame, heater, asking $250. Jim, Ext. 3140.

Sports, Hobbies & Pets

BIKE - boy's Huffy, 12-spd., 24" wheels, mountain bike, new, assembled. Corinne, Ext. 2675.

BIKE - girl's, 16", w/heavy-duty training wheels, $15. Phil, Ext. 5669.

ELECTRIC GUITAR - Dean, good cond., w/case, $250. Tim, 331-4683.

GOLF CLUBS - complete set, Arnold Palmer, new, used once, w/bag, $250. Ext. 5080 or 751-1884.

ICE SKATES - men's, figure, size 8, $10; roller skates, size 8, $10. I. Meyer, 929-4326.

KEYBOARDS - Yamaha YC45D, 2 manuals, RA100 Yamaha Leslie amp speakers, Carlo Rubolli super strings, $500 firm. Ext. 7340 or 732-2702.

SKIS - Head Radial, 170cm, w/Marker M36 bindings, $88. 473-2473.

SKIS - 190 Olin, w/size 8 Dolomite boots, used 1 season, $100 or best offer. Dan, 360-3803.

Audio, Video & Computer

CAMCORDER - Chinon, 8mm, 6 to 1 zoom, low light, hard case, 2 new batteries, orig. $800, make offer. Bob, Ext. 3509 or 289-9533.

COMPUTER PARTS - floppy, hard drives, modems, hard drive controllers, mouses, everything, $75/all. Vinny, 582-6241.

GAMES - Super Nintendo, $30-$35/ea., Superscope-6, $30. Ext. 7505.

SPEAKERS - Dahlquist, five-way dynamic phased array speaker system, frequency response, 37Hz-27kHz, will handle 200W. Ext. 7496.

TV - Goldstar, 13", color, w/remote control, 4 mo. old, $100. Lie Ping, Ext. 3867 or 929-3471 eves.

Miscellaneous

BABY'S ITEMS - port-a-crib, maple like, walker, baby's swing, unbrella stroller w/canopy, used 1 week, make offer. Bob, Ext. 3509 or 289-9533.

CAR SEAT - toddler's, Cosco commuter, $15. Phil, Ext. 5669.

CHEESECAKES - delicious, homemade, various flavors, various sizes, reasonable price, 2 days notice. Barbara Simpson, Ext. 7643 or 286-3425.

CHINA - Mikasa, 43 pieces, service for 8, gold trim on white, perfect cond., $95. Ext. 4341 or 475-4005.

CHRISTMAS LAWN DECORATIONS - Santa, 4 reindeer, each 3' high, $100; sleigh, antique, 1-horse, black, red tufted seat, $700. Pat, Ext. 2452.

COURSES - Dave Del Dotto's cash flow system, orig. $300, sell for $125; Anthony Robins personal power course, orig. $350, sell for $125. 737-8281.

FABRIC - African prints, many different colors & prints. Donna, Ext. 4430 or 369-5704 after 6 p.m.

MUSIC MOBILE - mint cond., $10 or best offer. Ext. 5534 or 345-2686 after 6 p.m.

PLATE - Limited Edition, Aida, LaScala Grand Opera collection, 1st ed., 1979, ivory alabaster, $45. Pat, Ext. 2452.

RUNNING SHOES - women's, Nike Air Pegasus, size 6, worn once, orig. $70, sell for $35. Elaine, Ext. 3876 or 286-8720.

TOYS & GAMES - v.g. cond., cheap, 0-6 years. 821-6856.

Free

BUREAU - 6 drawers; convertible sofa. Howard, 878-8294.

REFIGERATOR - yellow, approx. 20 cu. ft., works; also range, you pick up on Jan. 15, Sat. John, Ext. 2654 or 475-6981.

STAIRWAY ELEVATOR - 2 sections, straight up and curved, 2 chairs, shop drawings avail. for sizing, you pick up. Connie, Ext. 2594 or 727-1483.

Lost & Found

LOST - 12/20, gold chain w/crystal heart charm. Ext. 2926.

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

MASTIC PARK - 1 bdrm., dinette, l/r, study, carpeted, heat, city water, ½ block to water & marina, $600/mo. + sec., refs. 281-7844 eves.

MIDDLE ISLAND - 2-bdrm. condo, furn., 1½ baths, cac, all appl., clean, 5 min. to Lab, clubhouse, $875/mo. 751-8351.

PATCHOGUE - 1-bdrm. apt., full kit., full bath, priv. ent., $500/mo. incl. heat. Carter, Ext. 7599 or 654-1471.

PATCHOGUE - 3½-rm. apt., newly decorated, priv. ent., nonsmoker, no pets, $650/mo. incl. util. + 1 mo. sec. 289-0967 after 6 p.m.

PORT JEFFERSON STATION - lg. 3-bdrm. ranch, l/r, d/r, den, eik, 2 baths, w/w, w/d, dbl. gar., ⅓ acre, 3VSD, $1,100/mo. Jim, Ext. 4368 or 928-3371 eves.

PORT JEFFERSON STATION - 1-bdrm. apt., full bath, l/r, kit., priv. ent. Pam, 473-9114.

RIDGE - 2-bdrm. townhouse, w/w, cac, w/d, 1½ baths, 5 min. to Lab., $700/mo. + util., 1 mo. sec., no pets. Ext. 3866 or 286-0641.

ROCKY POINT - 1-bdrm. co-op, new appl., d/w, ac, priv. patio, heat incl., $650/mo. Sheryl, Ext. 7716.

ROCKY POINT - furn., l/r-bdrm. combo, eik, renovated, cable, parking, own thermostat, priv. ent., near beach, single, $475/all. Karen, Ext. 3122 or 744-2259.

ROCKY POINT - 3-rm. apt., oil heat, wood stove, near beach, single or couple pref., no pets, $525/mo. + util. 744-5282.

SHIRLEY - 1-bdrm. waterfront property, eik, l/r, full bath, fp, priv. ent., parking, furn. 1 mo. sec., $650/mo. Matthew, 399-2989.

SHOREHAM - new, partially furn. 1-rm. apt., full bath, kit., priv. ent., immed. occup. 821-4318.

SOUND BEACH - 1-bdrm. apt., full bath, eik, l/r, cable, priv. ent./parking, single nonsmoker, pref., no pets, $500/mo. incl. all, 20 min. to BNL. 744-7007.

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

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

KEY WEST, FL - 4/16-4/23, condo, sleeps 2, on water, kit., pool, priv. beach, gym, marina, boat rental, hot tub, w/d, tiki bar, walk to town. Sheryl, Ext. 7716.

For Sale

BAY SHORE/BRIGHTWATERS - 3 bdrm., cac, 2 baths, l/r, fd/r, eik, den, bsmt., shed, attic storage, nice neighborhood, agp, 35 min. to Lab., $135,000. Bill, Ext. 2762 or 665-3782.

BAYPORT - 2-story, 3-bdrm. Colonial on 1.3 acres, OHWH, d/r, 2 baths, lg. country kit., BP-BPSD, near schools, $130,000. 472-3332.

BELLPORT - 3-bdrm. ranch, l/r w/fp, d/r, bath, full bsmt., 20x16 deck, det. 3-car gar., shy ½ acre, SCSD, city water, near village and Bellport dock, ask. $125,900. Maryann, Ext. 5241 or 286-3377 after 7.

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

CENTRAL ISLIP - 2 bdrm., 1 bath, skylights, hot tub, 75x100 fenced, fruit trees, gas heat, very low util., nice neighbors, 8% fixed, assumable, $86,000. Vinny, 582-6241.

HOLTSVILLE - 2-bdrm. ranch, fp, l/r, d/r, lg. kit., partial bsmt., w/d, fenced, taxes under $1,800. Sachem SD, $89,000 neg. 289-1732 eves./weekends.

MANORVILLE - 2¼ wooded acres w/pond, good investment, $45,000. 345-3490 after 6 p.m.

MASTIC - 3-bdrm. ranch, 1 bath, l/r, d/r, eik, 80x100 fenced, Manorville SD, $85,000, will hold mortgage w/$25,000 down. Vinny, 582-6241.

MEDFORD - Blue Ridge, 5-rm. condo, 1½ baths, cac, golf, tennis, billiards, in/out pools, whirpool, sauna, clubhouse, restaurant, low taxes, $89,900. 736-8742.

MIDDLE ISLAND - Fairview at Artist Lake, 2-bdrm. condo, 1.5 baths, cac, gas heat, all appl., pool, tennis, clubhouse, 5 min. to Lab, $79,900. 751-8351.

RIDGE - 3-bdrm. ranch, l/r, den, eik, gar., new boiler, lg. fenced yard w/igs, cul-de-sac, $132,000. Doreen, 924-2298, eves./weekends.

RIDGE - 3-bdrm. townhouse, 1.5 baths, cac, w/w, all appl., new w/d, hot water heater, attic, patio, storage rm., low monthly maint./taxes, 5 min. to BNL, move-in cond., red. $68,000. Mary, 924-4328.

RIDGE - 3-bdrm. townhouse, 1½ baths, lg. l/r, 5 min. to Lab., $69,900. 924-4734.

RIVERHEAD - 2-bdrm. mobile home, adult 55+ park, Glenwood, 1989, 14x70, 2 baths + more. 447-9046.

ROCKY POINT - 4-bdrm. Colonial, 2½ baths, gas heat, cac, l/r, d/r, eik, den, fin. bsmt., gar., low taxes, ask. $119,900. Don, Ext. 7237 or 744-2921 after 5:30.

S. SETAUKET - 4-bdrm. Eaton Col., fl/r, fd/r, fam. rm., eik, 2½ baths, 2-car gar., ⅓ acre, 3VSD, $164,000. Ext. 2344 or 751-4254.

WADING RIVER - 3-bdrm. Col., 2½ baths, 2-car gar., custom kit., Jennair, gazebo, shed, igs, igp, deck, steam bath, satellite dish, S-WRSD, 1.1 acre, $239,000. 929-8323.

WADING RIVER - custom 4-5 bdrm. Victorian farm ranch, 2.5 baths, open floor plan, 3-car gar., cedar deck, ½ acre backing 8-acre bird sanctuary, S-WR schools, ½ mi. to beach, $259,000. Rich, 929-8514.

YAPHANK - 4-bdrm. Cape, country setting, ⅓ acre, wood floors, 1 bath, full bsmt., 5 mi. to Lab., must sell, sacrifice at $112,000. Steven, Ext. 4095.

YAPHANK - two ¾-acre bldg. lots, level, wooded, all permits, $59,000 ea. 924-6019.

PORT CHARLOTTE, FL - ¼ acre bldg. lot, $10,900. 929-8323.

Wanted

CAMERA BODY - Pentax MX. Marty, Ext. 3749 or 286-5897.

CLOCKS - old, any cond., cash paid, single pieces or collections. Frank, Ext. 3524, 281-4266.

COMPUTER - Commodore 64 for grade school classroom. Tom, Ext. 5275.

DESK - antique, 60", oak roll-top, any cond.; junk cars, trucks, machinery, alum. boats, will remove. Rich, Ext. 4986 or 589-9103.

GUITAR AMPLIFIER - crate, model GX60 or GX80. Tim, 331-4683.

MARINE FISH - looking for healthy, inexpensive, tropical saltwater fish. Jim, Ext. 4617.

SKIERS - to ski Windham 1/12 & 1/26, $43 for bus & lift, send payment to Augie Hoffman, Bldg. 510C.

STEREO SYSTEM - small, for under $40, dual cassettes, record player, equalizer, possible CD player, also car stereo w/tape player. Vinny, 582-6241.

TABLE - 42-48 in. dia., butcher block or oak on metal pedestal. John, Ext. 7671.

TRAINS - Lionel & American Flyer, priv. collection, pays top $. Ext. 7100 or 924-4097.

In Appreciation

Thanks to the NSLS mechanical & electrical groups, and everyone else for a great 2 yrs. at BNL and the wonderful send-off on 12/17. I'll miss you all.

— Susan Forbes