

Brookhaven's energy conservation window is flanked by Ken Hoffman (left) and Frank Salzano (right) as they talk to reporters at an energy conservation press briefing in New York last week.

BNL Meets The Press

Nineteen media representatives showed up last week at a BNL/ERDA press briefing which was held to give New York area reporters background information on the progress of energy conservation research and development.

At the briefing it was announced that ERDA has asked Brookhaven to assume management responsibility for conservation research and development in the areas of space conditioning, insulation materials and building systems controls.

The objective of these programs is to develop technology aimed at reducing the use of energy for space conditioning in residential and commercial buildings.

Work in these areas is to be contracted to industry with BNL carrying out the technical and administrative management of the programs. The Division of Energy Storage and Conversion is responsible for the technical content and technical projects. The Conservation Program Management Group will have administrative responsibility and will be assisted by the Purchasing Department.

Kurt W. Reigel, Chief of ERDA's Consumer Products & Technology Branch moderated the New York press conference and gave an outline of ERDA's nationwide program.

Ken Hoffman, Head of the Laboratory's National Center for Analysis of Energy Systems emphasized that conservation is the only immediate answer to saving fuel. He also spoke about the broad areas of energy research being done at Brookhaven, for instance, superconducting and alternate fuels.

Specific areas of conservation research were reviewed by Frank Salzano, head of the Energy Storage & Conversion Division of DAS. He singled out the oil burner testing program which has been undertaken to

improve efficiency and to examine the equipment currently available. He also talked about insulation and its effect on the cost of energy, as well as other building techniques demonstrated in BNL's energy conservation house. He stressed that, for the long term, intensive research on alternate energy sources should have the highest priority.

The journalists represented a broad range of readership as indicated by the *Scientific American*, *Newsweek* and *House Beautiful*, and included reporters from radio and television.

Besides Hoffman and Salzano, other participants at the briefing included Gerald Dennehy, head of the Conservation Program Management Group, and Robert Hoppe, Project Engineer for Energy Storage and Conversion. Representing public affairs were Bill McCann, ERDA, R.C. Anderson and Carl Thien, BNL.



Dr. Kurt W. Reigel, ERDA, talks to reporter from Columbia News Service.

Name Changes — Data Expands

Brookhaven's one-stop shopping center for neutron reaction data is being expanded and renamed. Effective March 1, the National Neutron Cross Section Center (NNCSC) will become the National Nuclear Data Center.

At the request of ERDA, Brookhaven's Center will add to its traditional responsibilities by coordinating the evaluation of nuclear structure and radioactive decay data and publish a bibliography of charged particle data. They will also begin the evaluation of charged particle data, and develop master files and retrieval capability for providing services on request to the basic and applied research community.

The NNCSC was an outgrowth of neutron data compilation activities begun at BNL in the early 1950's. This group, together with another specializing in cross section theory and data evaluation, merged in 1967 to form the National Neutron Cross Section Center.

The Brookhaven scientists are responsible for entering information into the data base from the U.S. and Canada. Through the exchange of data with other centers in France, Austria and the U.S.S.R., each having their own geographical coverage, world-wide data is available from any of the centers.

With the cooperation of representatives from industry, national laboratories and universities, a national reference nuclear data base called the Evaluated Nuclear Data File, continues to provide vital data for the development of nuclear energy sources.

The Center is under the direction of Sol Pearlstein, and is organized into four main groups: Data Evaluation (headed by Mulki Bhat), Data Management (Charles Dunford), Data Testing (Philip Rose) and Support Services (William Kropp). The total personnel now numbers about 30.

Molecules Capture Sun

Heat storage and solar cells are the applications that come to mind when we think of solar energy. But, Senior Scientist Norman Sutin and his co-workers at BNL have a new approach using an old idea.

"The work we're involved in," said Sutin, "is concerned with using chemical systems to collect and store solar energy. This is not a new idea, since more than 90% of the energy now being used is derived from the chemical storage of solar energy through green plants, and the fossil fuels derived from photosynthesis eons ago.

The chemical systems being studied by Sutin rely on electron transport. This is the same chemical reaction that allows plants to capture and store solar energy in photosynthesis.

The present rate of photosynthesis in green plants is not sufficient to meet the nation's energy needs. Sutin views basic research on electron transport in metal complexes as a viable alternative for converting solar energy into chemical useful forms.

"We're using energy faster than we can grow green plants and trees," he explained. "So now we're studying new chemical systems that will harness solar energy using metal complexes to capture and then convert solar energy to chemically useful forms."

Of course, the photochemical systems being studied at Brookhaven are only similar to photosynthesis in principle. The chemistry team at BNL is focusing on electron transport reactions in metal complexes, which they find the most adaptable.

"Metal complexes are attractive for this purpose since they are colored and therefore strongly absorb light in the visible region of the spectrum. In addition, metal complexes readily undergo electron transfer reactions to suitable acceptors and have many binding sites, which can lead to new low-energy reaction pathways," said Sutin.

Ruthenium tris-bipyridine, Ru(bipy), is one of the most promising metal complexes being studied for solar energy applications. Its features are highlighted in the sidebox.

Exciting the Complex

"When this complex, which is colored, absorbs light energy, an outer electron of the ruthenium atom is promoted to a higher energy level. Essentially this electron transfer," explains Sutin, "captures the light energy."

The ruthenium electron that is promoted to a higher energy level is actually kicked-off the ruthenium atom and is transferred to the delocalized electron cloud surrounding the entire complex.

"These bipyridine groups attached to the metal in the complex are called ligands and they have accessible vacant energy levels which will accept the electron," said Sutin. "That's sort of unique to this kind of complex with a bipyridine ring system. It is chosen for precisely this property . . . bipyridine rings to provide a site for electron capture."

This is called the "excited state" when a ruthenium electron has absorbed enough light energy to jump to the outer electron cloud of the complex. Putting an extra electron onto the electron cloud gives it a reactive negative charge and creates a "positively charged hole" in the ruthenium atom.

According to Sutin: "You've now formed this excited state by capturing the light energy and you're interested in what happens next, which is the thing that makes this system different from chlorophyll. Chlorophyll, the light-absorbing component of photosynthesis, absorbs more light, but it won't do the same kind of chemistry that the ruthenium complex will."

The electron cloud of the complex is perturbed by the extra ruthenium electron provided in the excited state. He describes the excited electron as "unhappy" and quite willing to give up its energy so that it may return to its regular place on the ruthenium atom.

"Normally, the excited state will live for only one microsecond before the electron



William Clark (left) and Norman Sutin with some of the sensitive electrical equipment they use to study electrical currents generated by the excited state of metal complexes. Sutin is holding a model of the molecular structure of the ruthenium bipyridine complex, which is described in detail in the sidebox.

drops back. Some of the energy is given up as light, which is called phosphorescence. The remainder is liberated as heat, increasing the overall temperature of the solution — the more common effect of solar energy," said Sutin.

The amount of energy given up as light or heat, when the complex returns to the ground state from the excited state, is characteristic and cannot be altered significantly. All the useful chemistry the Brookhaven scientists wish to do using the high-energy electron of the excited state must be done in the single microsecond (one millionth of a second).

Ru(bipy) Favored

The Ru(bipy) complex is part of a whole group of systems Sutin is studying, that absorbs a large portion of the light energy coming from the sun. Ru(bipy) has a broad band of light absorption centered at a wavelength of 450 nanometers, which is near the solar spectrum's peak.

Although Ru(bipy) does not absorb the sun's light energy as well as chlorophyll, it is much better suited to the other chemical manipulations Sutin is experimenting with.

For chemical reasons, scientists feel Ru(bipy) has notably high potential as a tool for harnessing the sun's energy. In addition to being more reactive, Ru(bipy) has a relatively long lifetime in the excited state, giving researchers more time to work with it.

"Although a one microsecond lifetime sounds very short on the absolute scale, it's fairly long on the time-scales of excited states," said Sutin. "Typically, the lifetimes of other excited states last only nanoseconds or picoseconds (one thousand and one million times smaller, respectively)."

During the one microsecond lifetime of the complex in the excited state, it is a powerful reducing agent in chemical reactions. This is due to the strong tendency of the complex to give up the extra electron which is in the surrounding electron cloud.

A chemical reaction giving up the electron must operate on a competitive basis, however. The new chemical system, which accepts the excited ruthenium electron, must be chemically favored over the loss of energy in the form of heat and light.

If the new reaction is not chemically favored or cannot take place fast enough, the excited electron will naturally give up the energy and return to ground state in one microsecond. Chemically characterizing the excited states of different complexes and the chemistry taking place is Sutin's

(Continued on page 2)

Solar Energy

(Continued)

primary focus of basic research.

Making Hydrogen Fuel

One of the group's most important contributions to science was to point out the possible use of the complex in the decomposition of water into hydrogen and oxygen. This was reported in the *Encyclopedia Britannica's* "1976 Yearbook of Science and the Future."

Carol Creutz came to Brookhaven as a Research Associate to work with Sutin and is now an Associate Scientist on the Chemistry Department Staff. She began the study of ruthenium chemistry with him four years ago. Their study then took an interesting direction.

Research revealed that the excited state of Ru(bipy) will act as a powerful reducing agent with the potential to liberate hydrogen gas from water, H₂O. This reaction leaves the hydroxide ion, OH⁻.

Uniquely, the Ru(bipy) complex - after losing the excited ruthenium electron - continues to react. The positive hole on the ruthenium atom inherently causes the complex to act as a strong oxidizing agent.

Now, as a strong oxidizing agent, Creutz and Sutin showed that the complex oxidizes hydroxide ion in a reaction liberating oxygen. As this happens the complex is returned to its original state and can be re-used.

Rather than a low-cost fuel alternative, their experiments show that Ru(bipy) is a catalyst. In the hydrogen decomposition reaction, 100% of the Ru(bipy) can be theoretically returned for complete reuse. None is used up. The system could continue to harness the sun's energy with no additional cost after the initial investment for the system. Ru(bipy) sells for \$12 per gram. The suggested Ru(bipy) complex solar cell for photodecomposition would never run down as long as sunlight and water were provided as fuels.

"Heat storage is not a fuel and heat is not a fuel," said Sutin. "What we want to be able to make is hydrogen, which can be used as a fuel and used to generate electricity. We essentially want to convert solar energy to a chemically useful form which is much harder but in many respects more useful than converting it to heat."

Hydrogen is a combustible gas, which is a fairly expensive fuel. One pound sells for \$12 and has been processed in some research programs to do the work of approximately one gallon of gasoline.

With the potential for developing a cell that produces hydrogen and only uses up water in sunlight, Sutin optimistically points to the possibility of making hydrogen a cost-effective fuel. This mode of fuel production is not expected to pollute the environment. In addition, the hydrogen fuel would also burn cleanly, with water as the only product.

But Sutin reminds us: "There's a big difference between regenerating something 99%, 99.9%, and 100% because if you keep cycling it, eventually the cell's components will just be used up. It's important to understand the chemistry making 100% regeneration and the side reactions which destroy it. Our interest is really understanding this system and the next level is practical application which will probably be taken up by someone else."

More Research Avenues

The work of the photochemistry research team at BNL does not stop with the hydrogen cell, however. William Clark is experimenting with special electrodes for transfer of the excited state electron in various photochemical cells. One of these is a photogalvanic cell for electric current production, which was investigated by Chin-Tung Lin, when he worked as a Research Associate with Sutin.

In the photogalvanic cell, an electric current is generated as a result of chemical reactions, similar to those taking place in a car battery. Light is allowed to bring the Ru(bipy) in one section of the cell, called the "illuminated compartment," to the excited state.

The dark compartment contains the same amount of Ru(bipy), but not in the excited state. This creates a difference in the relative concentrations of ground state to excited state Ru(bipy) in the two compartments. This difference in concentrations relies on the presence of an electron acceptor to chemically create a potential difference and cause current to flow.

A theoretical model of the Ru(bipy) photogalvanic cell was studied by Steve

Feldberg and Alicia Delgado, DAS, using a computer. The team spent approximately six months building the computer model with standard chemical equations for the system, that were adjusted to fit experimental results.

"These studies showed that relatively high efficiencies for the conversion of solar energy to electrical power can, in principle, be attained in suitably designed systems," Sutin explained. "Two chemistry Research Associates, Gilbert Brown and Mitchell Hoselton, are exploring the use of large-molecule clusters and different electron acceptors to further increase the photogalvanic cell's efficiency."

Despite the importance of ruthenium tris-bipyridine and many related complexes in generating hydrogen fuel with sunlight, there may be additional applications in the chemical industry. Sutin points out that the photochemistry of metal complexes may be ideally suited to this use also.

"Ultimately, all chemical reactions involve pushing electrons around," he said. "This is what a chemical bond is and generating excited states is one way of pushing electrons around; only at a lower cost by using light to drive the reaction instead of a furnace, boiler, or other energy consuming system."

The research in this third area involves studying the chemical action of the complexes as steps in the manufacture of useful compounds, like pharmaceuticals. Instead of expending fuel for these reactions, some might be efficiently done by simply providing an excited metal complex's electron.

And with the development of the right chemical systems, sunlight could be the only cost to run it.

—Cliff Cockerham

Retiring



Carl W. Wingard, a Storekeeper in Supply & Materiel who has been at the Lab since October 18, 1954, will retire on February 28.

—photo by Rosen

Bulgarian Pianist To Give BERA Concert

In her only Long Island appearance this year, the distinguished Bulgarian pianist Juliana Markova will perform in Berkner Hall, Tuesday, March 8, at 8:30 p.m. Her recital, the third in the current BERA concert series, will feature music by Beethoven, Brahms and Prokofiev.

Juliana Markova was born in Sofia. She studied at the Conservatory in Sofia and later at the Giuseppe Verdi Conservatory in Milan, from which she graduated with the highest possible honors. She subsequently won prizes in both the Georges Enesco Competition in Bucharest and the Marguerite Long Competition in Paris, which launched her on her career in Europe.

She has since played with leading European orchestras and has given recitals in London, Berlin, Florence, Milan and Genoa, among others.

Ms. Markova has made numerous radio recordings in Europe - in England, Germany and Italy and was featured recently on three special programs for German television.

She has been heard as a featured artist at the Festival of Two Worlds in Spoleto, Italy and has appeared as soloist with the Festival Orchestra there. Ms. Markova's American recital debut - in Chicago's Orchestra Hall in December 1973 - met with great critical acclaim and in August of 1974

ruthenium tris-bipyridine . . .

Friends Call It Ru(bipy)

Ru(bipy) is typical of the metal complexes being studied in the excited state for electron transport by Sutin's chemistry research group. Because of its unique chemical properties, however, Ru(bipy) is the most promising candidate for the lead role in solar energy-capturing systems.

This complex features an atom of the transition metal ruthenium sharing electrons in "coordinate bonds" with six nitrogen atoms. The ruthenium atom is the grey mass peering out from the center of the space-filling model shown (at right). It is literally buried in the complex. The ruthenium's relationship to the nitrogens can be seen more clearly in the diagram depicting the large metal atom, which is ruthenium in this case, in the center of a three-dimensional plane surrounded by nitrogens.

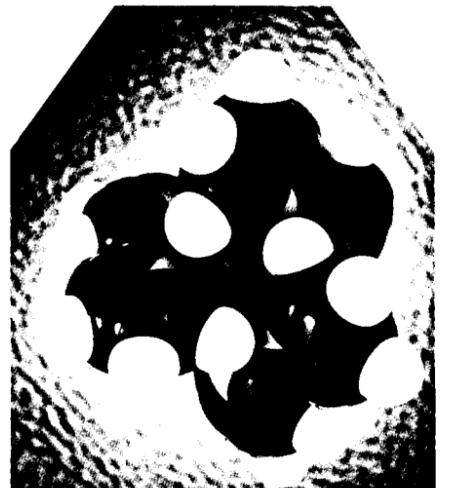
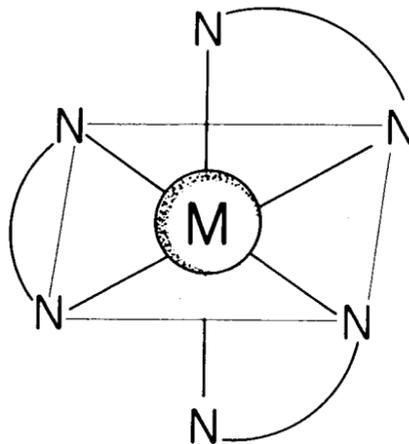
The nitrogens form an aromatic ring with five carbon atoms, each bonded to a hydrogen atom. All six pyrimidine rings are each shown in the model as five black masses (carbon atoms) in a ring with one triangular gray piece (nitrogen atom bonded also to the metal ruthenium center) and is highlighted with white hemispheres (hydrogen atoms on the periphery

of the ring).

Two pyridine rings bonded to each other form a bipyridine ring. The bipyridine ring is abbreviated in the diagram as two nitrogens, which are coming off the metal center, bonded together as part of a curved ring system and represented as the arced line linking the nitrogens. This can be graphically visualized when the model is oriented in the same plane as the diagram.

Bipyridine rings in the model can be seen as two pyridine rings connected end to end. One bipyridine ring lies in the horizontal plane, coming out from the page. The second lies partially above the plane and moves diagonally backwards into the horizon. The third ring lies partially beneath the same plane and moves diagonally forwards into the front of the horizontal plane.

The ruthenium atom is bonded to these three bipyridine rings through the pairs of six nitrogen atoms split on the rings equally. This forms an octahedral outline. Each molecular complex shares the electrons of its rings freely in a relatively spherical electron cloud that engulfs the entire complex.



—photo by Rosen

It's . . . Cricket

The Brookhaven International Cricket Club has borrowed a film from the Australian Embassy entitled "Cricket-Australian Style." It is a 24 minute, color film and will be shown during lunch in Room A of Berkner Hall on Tuesday, March 1, and Thursday, March 3 at 12:15.

All interested persons are invited to attend, so bring your lunch. Information and tickets for the upcoming gala dance will be available as well. We hope to see some new faces this year.

Arrivals & Departures

Arrivals

Kevin W. Barnes Plant Engrg.
Janet S. Davidson Director's Off.
Michael J. Kenny Physics
Eliza M. Langhorne Staff Services
William J. Leonhardt App. Science
Alan J. Smith App. Math.
Roger C. Young App. Science

Departures

Ru-Fang Chen Medical
Mary D. Hill Director's Off.



Juliana Markova

she made her American orchestral debut with the Los Angeles Philharmonic under the direction of Zubin Mehta.

During her current North American tour Ms. Markova will be appearing with symphony orchestras in Detroit, Omaha, Fort Wayne, Atlanta and Phoenix, as well as giving solo performances in Chicago, Montreal, Toronto and in the Great Performer Series in New York's Lincoln Center.

Admission	
Regular	\$4.00
Students with ID and persons over 65	2.00
Persons under 18	1.00

Audubon Night

In an effort to increase public awareness of the value of the wetlands, Thomas Sterling has explored, studied, and filmed the marsh and its life. The impressive result is "The Marsh - A Quiet Mystery." The work was filmed primarily in the Michigan marshlands, but also incorporates areas of Utah, Oregon, and Ontario, Canada - and the wildlife of those areas.

The Outing Club of BERA will present this interesting film and lecture program, with the cooperation of the National Audubon Society, on Thursday, March 10, at 8:00 p.m. in Berkner Hall. An admission of \$2 for adults and \$1 for senior citizens and those under 18 will be charged. Light refreshments will be served immediately following the presentation.



Thomas A. Sterling - National Audubon Society field naturalist, film maker and lecturer.

BROOKHAVEN BULLETIN

Published weekly
for the employees of
BROOKHAVEN NATIONAL LABORATORY

BERNICE PETERSEN, Editor
DOUG HUMPHREY, Photo-Journalist
CAROL PETRAITIS, Editorial Assistant

40 Brookhaven Ave., Upton, N.Y. 11973
Telephone (516) 345-2345

CARL R. THIEN, Public Relations Officer

Letters To The Editor

Dear Sir,

I'm sure the recent article "Self Improvement - the Distaff Side" in the Feb. 4th issue was intended to strike a consistently positive note but the content and phraseology of the second paragraph imply attitudes (unfortunately quite common) on the part of the writer that warrant immediate comment.

A lot of "screaming and yelling" (your words) reportedly generated by feminist activists has in fact been gleefully amplified, distorted and in some cases essentially generated by the media (whose primary and efficiently exercised function is to attract and retain an audience). For psychological and historical reasons, the feminist movement is today more commonly attacked by snide remarks and purportedly good humoured ridicule than by the hysterical and occasionally violent opposition (screaming and yelling, perhaps?) that was - lest we forget - quite commonplace in our grandparents' time.

Certainly it takes "patience, stamina . . . and a willingness to explore opportunities" to expand the realm of freedom of choice, and certainly these are admirable qualities, but those same opportunities would not exist today to be explored without the work of uncounted women (most of them bitterly condemned in their day) who did one hell of a lot more than exercise "patience and stamina." Anyone who thinks otherwise may be displaying a touching faith in the inherent altruism of human society but is, also, so far out of touch with historical and psychological reality as to constitute an unwitting social obstruction.

In closing, one might remark that loud, unremitting and emotional voices, when raised against religious, political or racial inequities, are, typically, extolled as courageous clarion calls for Freedom or, alternatively, disparaged as mere extremist screaming and yelling, depending on whose ox is being gored.

Very truly yours,
Arthur D.S. Harris

EDITOR'S NOTE: You have a good point. The Bulletin story was not meant to disparage the more vociferous in the feminist movement, but was written simply to point out two Laboratory programs that the more conservative among us might consider. Not everyone has the makings of a revolutionary. Just for the record, Mr. Harris, the editor is a "Ms.," not a "sir."

Cafeteria Menu

Week Ending March 4, 1977

Monday, February 28

Cream of mushroom soup
Cheese omelet 1.10
Chicken a la king on rice 1.00
Hot deli - pastrami

Tuesday, March 1

French onion soup
Chinese pepper steak on rice 1.25
Roast Fresh ham & 1 veg. 1.30
Hot deli - sloppy joe

Wednesday, March 2

Chicken noodle soup
Breaded flounder & fr. fr. 1.15
Hot deli - baked Virginia ham

Special

Cup of soup
¼ Roast L.I. duck w/stuffing
glazed carrots, mashed potatoes w/gravy
plain jello or ice cream, small beverage
\$1.87 plus tax

Thursday, March 3

Split pea soup
Beef hash & 1 veg. 1.15
Veal pattie parmigiana & 1 veg. 1.20
Hot deli - meatballs

Friday, March 4

Manhattan clam chowder
Broiled filet & 1 veg. 1.15
Meat loaf & 1 veg. 1.15
Hot deli - roast beef



Who Says Cricket Is Boring?

You may have been laboring under the delusion that cricketers were a stuffy lot and that they plan to do the minuet at their upcoming Winter Ball. Not so. On the playing fields they may adhere to strict formal rules, but on March 12 at the Center, they have planned a lively party to snap you out of the winter doldrums.

The MJB four-piece band will play everything from the waltz to the hustle. This group, with singer Jean Sells, is well known on the Westhampton summer scene. In between dances, you may visit the bar and sample the hors d'oeuvres.

The highlight of the gala will be the performance of three talented belly dancers who have much to recommend them. As indicated above by dancer Zeraya and cricketer John Millener, cricket will definitely be playing second fiddle this particular evening.

Dress is optional which, of course, doesn't mean sweat shirts and blue jeans, as the Committee is struggling to maintain some measure of decorum.

The festivities will get under way at 8:00 p.m. and will continue until 1 a.m.

The \$6 ticket price includes your drinks, food, everything. Tickets are moving fast, so buy yours now from anyone of the following, or at Berkner Hall at lunchtime.

Gail Thompson	Bldg. 197-C
Gail Williams	Bldg. 460
Grahame Williams	Bldg. 555-A
Sharon Smith	Bldg. 510-A
Linda Moreno	Bldg. 535
Don David	Bldg. 510
Debu Majumdar	Bldg. 130
Ken Batchelor	Bldg. 911-C
Helen Keeley	Bldg. 911-A
Carolyn Eterno	Bldg. 129

Selected Reading

Am. Sci. 65, January-February 1977
Does peer review work? J.W. Symington and T.R. Kramer. 17-20

Nature 265, February 10, 1977
Keeping in touch with Soviet colleagues. M. Reid. 484-5

Chile: Three years after Allende. A. Eades. 486-8

New Sci. 73, February 10, 1977
Beware of the general-purpose microprocessor. S. Hurst. 322-4

To salt or not to salt? J. Thornes, L. Wood and R. Blackmore. 326-8

Evaluating the evaluators. M. Gordon. 342-3
Colossus: Godfather of the computer. B. Randall. 346-8

Science 195, February 18, 1977
Radioactive wastes: Some urgent unfinished business. L. J. Carter. 661-6
Ousted Seaman no fan of Schlesinger. 665

Speaking Locally In March

Mar. 1 - Meyer Steinberg (DAS), American Society of Mechanical Engineers, Long Island Section, on *Synthetic Fuels Using Nuclear Power*.

Mar. 6 - Maxwell Small (DAS), St. Anne's Episcopal Church, Sayville, on *BNL's Water Recharge Program*.

Mar. 9 - Martin Plotkin (Accel.), Hewlett High School, on *Careers in Science*.

Mar. 24 - Bill Wilson (Reactor), Nuclear Society, Merchant Marine Academy, Kings Point, on *HFBR Operations*.

Bowling

Red League

The 76'ers knocked down 3020 pins taking 11 points and jumped into first place. R. Larsen (212) had a 592 scratch game.

W. Kollmer was throwing strikes (210/203) 586 scratch pins, but the Bubble Boys only came away with 4 points.

E. Sperry knocked down some wood (203/200), but the Designers were shut out.

The Old Timers took 8 points and jumped into second place. H. Frei bowled a 200.

C'mon Red League, lets throw some strikes and get more than 4 men bowling in the 200 range for the evening!

Black & Blue League

The league standings tightened up with the top teams losing ground to the bottom. High games were Budd Pollock 221, Ed Sperry 210, Ellie Kristiansen 170 and Dot Pollock 160. High gross pots were won by the Pollocks.

Pink League

2/8/77: The Gutter Getters are still in first place followed closely by the Med Squad and the Pinsplitters. C. Beckner had a 507 series 651 gross series. L. Boyd had a 214/258 gross game 507/639 gross series.

2/15/77: The Gutter Getters are holding their first place lead by 1 point. High games for the night were F. Brown 182/243 scratch 641 gross series, M. Stoeckel 182, B. Jellett 157, J. Gazzola 155. L. Boyd had a 486/612 gross series. M. Stoeckel converted the 6-7-10 split.

Purple & White League

2/10/77: The Penthos are in first place by four points. Second place is held by the Sea Gulls and only one point behind them are the Woodchucks and Odd Balls.

Dick Murgatroyd was high for the men with a 222. Other high games were Gene Hassell 210, Ken Asselta 209, John Usher 208, and Ben Belligan 204/204.

Liz Bull was high for the women with a 168 and Wilma Eriksen had a 161.

Runners Corner

Propriety On The Footpaths

The BNL runners are privileged to have the opportunity of running in the uncrowded environment of the Lab. The many miles of roads and forested paths provide pleasant conditioning and racing conditions.

There are certain responsibilities that runners must accept in order to assure our continued access to the available facilities. During the winter, several close calls involving runners and cars have occurred. This is a very serious situation.

As the good weather swells the ranks of joggers, everyone must make an effort to stay well to the side of the roads and be extremely cautious, independent of who has the right of way. We all know the results of a scattering event involving a car and a runner.

We are one of the most visible of the Lab activities since runners can be seen on site almost any time of day. It should be emphasized that considerate behavior and proper attire is expected.

The runners club wants to encourage many more women to run and jog for health and beauty. If any women needs information on how to start, they can contact Jean Burt, extension 2902. Maps of the Lab site with mileages marked on them can be obtained from Jim Guppy, extension 2698. Additional information is obtainable from Bill Thomlinson, extension 3978, or Gus Prince, extension 2901.

The next general runners meeting will be held at noon on March 9 in Berkner Hall, Conference Room A. Anyone interested in running is urged to attend. The runners awards policy and the spring race will be discussed. No involuntary servitude will be demanded of those who attend.

— Bill Thomlinson

Hospitality News

A morning coffee will be held Tuesday, March 8, from 9:30 to 11:30 a.m., at the Brookhaven Center. A discussion on "Care and Feed of Roses" will be presented by Jane Love.

Please come and bring the children. Babysitting will be provided at no charge. It is suggested that you bring along a toy or two for your children to play with.

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position, with consideration given to candidates in the following order of priority: (1) present employees within the department, with preference to those within the immediate work group; (2) present employees within the Laboratory as a whole; and (3) outside applicants.

Each week, the Personnel Office lists new personnel placement requisitions. The purpose of these listings is, first, to provide open placement information on all nonscientific staff positions; second, to give employees an opportunity to request consideration for themselves through Personnel; and, finally, for general recruiting purposes. Because of the priority preference policy stated above, each listing does not necessarily represent an opportunity for all candidates. As a guide to readers, the listings are grouped according to the anticipated area of recruitment, as indicated below. Except when operational needs require otherwise, positions will remain open for one week following publication date.

For further information regarding a placement listing, contact the Personnel Placement Supervisor, Ext. 2874 or 2882.

LABORATORY RECRUITMENT: Opportunity for present Laboratory employees.

84. SENIOR ACCOUNTANT - BA degree or equivalent in accounting or business administration. Progressively responsible work record in design and management of accounting systems. Payroll experience desirable. Fiscal Division.

85. TECHNICAL SPECIALIST - AAS degree or equivalent in electronic or electro-mechanical technology. Competence in solid state instrumentation design, construction and de-bugging. Instrumentation Div.

86. TECHNICAL SPECIALIST - AAS degree or equivalent in electronics. High level expertise in design, construction, checkout and trouble shooting of electronic equipment required. Familiarity in low voltage logic, high voltage equipment desirable. Accelerator Department.

87. TECHNICIAN - AAS degree or equivalent with emphasis in engineering or physical sciences. Radiation monitoring experience desirable. Rotating shifts. Safety and Environmental Protection Division.

88. MECHANICAL TECHNICIAN - Requires background in construction and maintenance of chemical testing equipment. Department of Applied Science.

OPEN RECRUITMENT: Opportunity for present Laboratory employees and outside applicants.

89. DEVELOPMENT ENGINEER - MSEE or equivalent with good knowledge of electro-magnetic theory. Competence in design, construction and testing of HF/VHF/UHF components and high power or high voltage circuitry desired. Accelerator Dept.

90. DEVELOPMENT ENGINEER - BSME or equivalent. Familiarity with design and fabrication of high vacuum equipment required. Accelerator Dept.

91. TECHNICIAN - Should have experience in animal care and breeding. Four-month position. Medical Department.

92. OFFICE SERVICES ASSISTANT - Excellent typing required. Department of Applied Science.

93. OFFICE SERVICES ASSISTANT - Experience in payroll processing desirable. Fiscal Division.

94. CLERK TYPIST - Supply & Materiel Division.

Autos & Auto Supplies

73 VEGA HATCHBACK - Auto, ac, snow tires, excel cond. \$1395. Richard, Ext. 4501.

69 BUICK LESABRE - 350 V-8, ps/pb, air cond, elec windows, positrack, new tires and brakes, like new. Richie, Ext. 4254 or 734-7342.

72 SAAB 99 cm - 2 dr, std trans, rebuilt engine, 30 mpg, am/fm stereo, good cond. \$1985. 924-4237.

STEREO - Audiovox am/fm, in dash. \$70. Ext. 4060.

2 RIMS - With tires good for spares for Datsun or small car. \$25. Ext. 4060.

66 MUSTANG - 8 cyl, low mileage, new snows & battery, damaged right door. \$200. McGearly, Ext. 4767.

70 TOYOTA CAROLLA - Good transportation. \$475. Ext. 3659, 878-4268.

73 CHEVY SPORTVAN - 8 pass Beauville, 8 cyl, std trans, PDB, no ps. \$2500. George, Ext. 4769.

72 SUZUKI - TS 185, Enduro, knobbies, good cond. \$400. Mike, 473-2608.

75 YAMAHA - RD250B, bought new June 76, 55 mpg, 1600 mi, luggage rack, cond like new. \$750. Ext. 4019.

68 VW FASTBACK - 4 dr with extra parts. 724-0659 up to 9 pm.

71 VEGA HATCHBACK - 4 spd trans, radio, ac, options, extremely good cond. Asking \$850. 549-6041 days, 269-6344 eves.

2 CHROME RIMS - 15x6 Ford slotted dish. \$50. C. Whiting, 585-7780.

FUSE KIT - Opel, Mercedes, Audi, BMW, Porsche, NSU, VW. 604/kil; VW tune-up kit 64-67. \$2. Ext. 3609.

66 CHEVY NOVA - Auto, 4 dr, sedan, ps/pb, runs well, new engine. R. Horwitz. Ext. 4134.

75 PORSCHE 914 - am/fm stereo, 5 spd, steel belted radials. 21,000 miles. Bob, 399-0327.

70 MONITOR TRAVE TRAILER - 16 ft, sleeps 6, elec refrig, toilet, 3 burner gas stove, etc. Excel cond. \$1200. 585-3869 after 5 p.m.

75 RABBIT - Excel cond, auto, many extras. \$2000. Call after 5:30, 286-0398.

70 VW BUG - Rebuilt engine, good cond. \$850. Ext. 3155 or 732-3145 after 5:30.

73 DUTCH CRAFT TRAILER - 15½ ft, self contained, sleeps 6, excel cond. Call 589-9217.

66 CHEVY PICKUP - 8' bed having 72 low mi 307 eng, very good cond. 589-4531 after 6.

VAN WINDOWS - 1 pr heart shaped, \$35; 1 pr gem shape, \$45; snack tray for Dodge van, \$10. Bill S., Ext. 4434.

2 CHROME SPOKE WHEELS - 15x7 w/G78 tires for Ford truck, or Dodge van, 5 lug, \$60. Bill S., Ext. 4434.

1 TAN HIGH BACK SEAT - W/adj swivel base, new \$75; spoiler for Dodge van, \$15. Bill, S., Ext. 4434.

74 GREMLIN - 23,000 mi, auto, ps/pb, package radio, roof rack. Dick, 286-8906.

70 CHEVY NOVA - R&h, at, ex 307 eng. Call after 6, 475-0364.

69 FIREBIRD - Low mi, many extras, must sell. \$1200 firm. 289-3598 after 5.

70 MAVERICK - 2 dr, a/t, r&h, high mi, runs good, body good. \$800. 929-4413 after 6.

WHEEL RIMS - 15" from Merc, had H78-15 on them, \$4 each or 2/\$7. John, Ext. 3292.

73 BUICK ELECTRA 225 - 4 dr, hard top, all power, very good cond. \$2575. 727-5478.

62 MERCEDES-BENZ 220B - Original 58,000 mi, excel cond, ps/pb, standard, radial tires, dark blue w/red interior. \$1800. 928-1075.

72 CHEVY NOVA - 34,000 mi, std trans, 6 cyl. Asking \$1450. Tom, Ext. 3525.

68 PONTIAC SPRINT - 6 cyl, o.c., 4 bar carb, 2 dr, Herst trans. \$200. 878-4883.

Boats & Marine Supplies

20' MAKO - With twin 65 hp Johnson's & trailer. \$6,500. John, Ext. 3354.

75 CRUISER ENDURO - 19'6" "Deep Vee," 115 hp Johnson, p/t, tach, compass, bilge pump, cockpit lights, w/w, full canvas, sleeps 4. \$4800. 821-0695.

30' RICHARDSON CLASSIC 1929 - New bottom planking, ribs, floors, eng beds, inside bare, Chrysler Ace. \$800. Paul, Ext. 3277.

23' MARBLEHEAD - Trunk cabin, 2 bunks, sink, stove, head, open cockpit N.T., 115 Palmer FW, monel tk, excel cond. \$3600. Paul, Ext. 3277.

15' ORLANDO CLIPPER - Full navy top, Teenee trailer. \$350. Marty, Ext. 2547.

74 CHRYSLER OUTBOARD - 10 hp, never used. \$400. 878-2704.

70 FIBERGLASS TRI-HULL BOAT - 40 hp Johnson, with 76 Shoreline galv. boat trailer. \$1500. 878-2704.

8' WOOD PRAM - Very strong, needs some work. \$30. 744-7861 after 6.

Miscellaneous

SUITCASE - White vinyl lined with green silk, 18"x25" with key. \$7. Helga Pirozzi, Ext. 2384.

19" ZENITH TV - B&W portable. Perfect, \$30. John, 281-7043 after 5.

INSULATED BOOTS - Felt lined, waterproof, boys size 5, excel cond. \$10. C. Economos, Ext. 2594.

ANGELICA ACOUSTIC GUITAR - 6 mos old. Excel cond, must sell. \$125. 864-2615.

PIANO - "Winter" Spinett with bench (Mahog), excel cond. \$450. 878-1030 after 6.

TWIN BEDS - W/2 dressers male & female plus 1 full size maple bed. Call 727-4515 up to 9 p.m.

CHILD'S TABLE - 30" dia, round formica top, very sturdy, 2 chairs, maple finish. \$25. Call Joan, 744-3919 or Jack, Ext. 4447.

BIKE 20" - Huffly Stingray, 5 spd, blue. \$35. 289-1754.

BABY CARRIAGE & STROLLER COMBO - Like new, \$50. Richie, Ext. 4254 or 734-7342.

POLAROID CAMERA - Model SX-70 II. Brand new, purchased for Christmas. \$75. Audrey, Ext. 3489.

CASEMENT WINDOW - Metal, 8'5"x4½", 24 panes, \$20; ½ hp motor, \$20. John, Ext. 3675.

SUPER-8 MOVIE CAMERA - And projector, very good cond. 722-4925 after 6.

GREAT DANE PUPS - AKC reg w/papers, good blood line, 3 black female, 1 (rare) blue female. 924-4789 after 4.

CLOTHES WASHER - Portable Hoover, like new, \$80. Grace, Ext. 4464, 286-8374 after 5:30.

NEW & USED - Electronic equip, bought & sold. Joe, 286-3775 eves.

GUITAR AMP - Small portable, good for beginner or instructor, good sound, new. \$65. Rich, Ext. 4172.

STEREO FISHER - 3500 amp, C-20 Ttb, 8 tr tape, MS-10 spkrs. \$150. Ron, Ext. 2621.

GOLF CLUB SET - Tennis rackets, used, very reasonable. 924-3066.

VENDING MACHINES - Brand new, still in crate. 924-3066.

CANVASES - Artist's, new, 6x8, 7x9, 50/pk of 3. Men's slacks, excel cond, some wool, mostly cotton, 34-30, 5\$-\$7. Ext. 3609.

SKI BOOTS - Humantic, 5 buckle men's size 10-10½. \$25. Walt M., Ext. 3256.

STUDENT DESK - Formica, \$10. Bill, Ext. 4526.

AMPEG - B-18 bass amp w/dolly & cover, excel cond. \$225. 581-0932.

BASS AMP - Lafayette, w/15" speaker, needs some electronic repair. \$20. 581-0932.

JEWELRY - Hand crafted coin, pendants, bracelets, earrings, reasonable. 924-3236.

WEDDING GOWN - Pearls, heavy lace over organdy, long veil, detachable train, size 12. \$225, asking \$75 or best offer. Louise, 924-5422.

DESK CALCULATOR - Marchant, make offer. Ron, Ext. 4082.

15" SPEAKER - Tannoy coaxial; turntable, connoisseur w/Hystersis motor; tuner radio. Ext. 4727.

BOOKS RECOVERED - Like new, Morocco or imitation leather. 727-5912.

TAPE RECORDER - Tandberg model 64, open-reel 4 trk deck, excel cond, \$275. Ext. 3828, 751-7250.

PHONO CARTRIDGE - Shure V15 Type III, used about 20 hrs, excel cond. \$35. Ext.3828, 751-7250.

BABY SEAT - Pak-a-poose, \$5. Ext. 3828, 751-7250.

BABY CRIB - With mattress, very sturdy, \$30; Porta crib with mattress, \$10; stroller, \$10. Larry Arnold, Ext. 2021, 281-2136.

MACRAME COVERED - Ship bumpers, great for nautical motif wall decor. Ideal for home, restaurant or antique store. \$100 ea. Must see to appreciate. 928-1127 after 6. Mt. Sinai area.

EARTH SHOES - Never been used, high boot, size 10½, 1 yr old, light tan, \$30. 928-1127 after 6.

CHRISTMAS-WEDDING GIFTS - Never been used. Wok, elec, red, 12", \$30; Fondue, elec, red, 1½ qt, \$20. Ext. 2948, 928-1127 after 6.

ARCHITECTS - Paoli Saleri's ARCOLOGY book, large format, \$20. 928-1127.

WEDDING GIFTS - New dinner ware, 45 pc Kensington Ironstone, olive green, service for 8, \$40; also 32 pc semi-vitreous, white with floral pattern, service for 6, \$35. 928-1127 after 6.

SPRING/FALL COAT - Size 12, melon, \$8; blue blazer, size 12, \$4; rabbit fur coat, size 16. \$30. Ext. 3609.

SPRING/FALL COAT - Size 14, green check, \$8; brown jeans, 32-30, \$5; light fixture, \$3; plant holders, \$2-\$3. 744-5871.

MUZZLE - \$1; new men's shoes, \$12, 9 m; 3 sport jackets, good cond, size 38, \$6, \$5, \$1. Ext. 3609.

FURN - 8' contemp corner sectional, \$150; bench couch w/built in end tables, \$100; driftwood lamp & driftwood coffee table, \$75 ea. Ext. 3121, 744-5261.

ENCYCLOPEDIA BRITANICA - Junior set, 5 yrs old. \$50. Robert Fuller, Ext. 8937.

PIANO - Betsy Ross spinet, excel cond, \$450 firm. Pat Fox, Ext. 2939.

HAND-CRAFTED COIN JEWELRY - Pendants, rings, earrings, also buckles. Call 924-3236.

SKATES - Men's ice, size 9, \$4; child's roller, size 13, \$1. Thorner, Ext. 3382.

NEW UPRIGHT FREEZER - Excel cond, \$850. 286-0398 after 5:30.

KING SIZE HEADBOARD - And frame; dining room set, chairs, etc. Bob, Ext. 3312.

UNDERWOOD TYPEWRITER - & table. \$25. Sharon, Ext. 3312 or 924-5077.

WOODEN IRONING BOARD - \$1. Sharon, Ext. 3312 or 924-5077.

HAVAHART ANIMAL TRAP - For squirrels, chipmunks, etc, excel cond. \$3.50. 727-3608.

20" BIKE - 3 spd, fair cond, boy's model. \$15. John, Ext. 3292.

16" BICYCLE - Boy's, good cond. John, Ext. 3292.

CAST IRON STOVE - Wood burning, Beacon Windsor, circa 1900's. \$200. 286-3623.

BOWLING BALL - \$5. 727-5912.

PEDESTAL TABLE - Solid black pine, round 42", 2 capt & 2 mate chairs, 14" glass top, orig price, \$900. Will sell for \$400. 722-4784.

CHILD'S TRICYCLE - AMF junior, brand new, never used. \$15 or best offer. S. Spark, Ext. 4111.

PROJECTOR - Kodak, shows pocket instamatic slides only, case, tray, zoom lens, all new. \$25. Fred, Ext. 4613.

Ads left out of this issue because of lack of space need not be re-submitted in order to run in next week's issue.

Real Estate

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

For Rent

PATCHOGUE AREA - Off So. Country Rd, 4 rms, 2 bedrms, kit, liv rm, (bath), \$250/mo (incl heat). Walt, Ext. 2907, 698-0576.

PINE HILLS COUNTRY CLUB APT - 10 min from Lab, 1 br, f/p, a/c, carp, dishwasher, privileges. Call Fri, Sat, Sun and eves, 878-4794.

HOLBROOK - Condominium, 2 levels, w/w carp, appliances. \$350/mo + util. 732-5711.

SHOREHAM SUBLET - 3 wks in March. Lovely/comfortable furn apt with f/p. \$100. Al, Ext. 3535, 744-1942.

MASTIC - 4 rm furn apt. \$265/mo, all util incl. 281-6116.

MT. SINAI - Person to share exp 2 bedrm waterfront, f/p, approx \$200/mo/person. Ext. 2008, 928-5875.

2 BEDRM DUPLEX APT - 5 min to Lab, 1 bath, lvg, dining rm, full basement, \$320/mo incl heat. 581-2909 or Ext. 3312.

For Sale

MIDDLE ISLAND - Townhouse, 4 bedrms, 2 baths, storage area, all appl, central a/c, w/w carp, clubhouse, swimming pool, tennis crt, extras, 1 yr old. \$29,500 or best offer. 924-5457.

NEW MODERN RANCH - 3 bedrms, mod appl & conveniences, landscaped, \$33,000, low taxes, East Patchogue. 286-0398 after 5:30.

MILLER PLACE PARK - 4 bedrm, 2 complete baths, den living, dining, laundry rm, 2-car garage, ½ acre, 3 blocks school, 2 bl Sound. \$47,000. Ext. 4622.

COMMACK - 3 bedrm ranch, finished basement, ac, landscaped, fenced, eat-in-kitchen, garage, all appl. P. Newhouse, Ext. 2042, 864-2536 after 6.

CLEARWATER BEACH - 100'x140' bldg plot near Gardiner's Bay, E Hampton Twship, walk to beach, marina rights. Asking \$12,500. Steve Marino, Ext. 3469, 281-4371.

Lost & Found

FOUND - Fur trimmed brown leather women's gloves outside PR office, 40 Brkhnv Ave, Ext. 2345.

FOUND - Necklace, women's locker room in the gym. Karin, Ext. 4398.

Car Pools

FIFTH DRIVER - Needed for existing four man car pool, Bayport/Blue Point area. Jerry, Ext. 3434.

RIDE WANTED - From Bellport, 8:30-5 for approx 1 mo. Will pay. Bill S., Ext. 4434.

Wanted

USED TV - Portable only, any cond, will pay. 281-7043 after 5.

GAS B-B-Q - With tank and double burner. Norman, Ext. 3354.

BEATERS - For Sunbeam Mixmaster Model 12, 7 inches long, wide flange 1¼ in from end. AT6-8724.

ODDS & ENDS - Of 4 ply yarn (if possible). Making afghan for benefit of Church. Contact Betty Barnes, Ext. 3379.

STEREO (3D) CAMERAS - Viewers, projector or any other equipment pertaining to 3D photog, working or broken. Rich, Ext. 4172.

REWARD - \$5 to 1st person supply info leading to purchase of film cutter for a Viewmaster "personal" stereo camera. Rich, Ext. 4172.

VIEWMASTER VIEWERS - (Old type with glass lens) prefer focusing model; projector (100 watt regular or stereo model). Rich, Ext. 4172.

14' WHEEL RIMS - For 71 Valiant Duster or Dart. Rich, Ext. 4172.

PERSON TO TEACH - Me today's dances such as hustle, robot, etc. Will pay for lessons. Please call Noreen, 281-7873.

HONEST HORSE LOVER - To rent trustworthy quarterhorse for one month. \$50 unlimited riding, free board. Intermediate rider. Margie, 744-3661.

PHONE NUMBER - Or address of former employee, Bob Hodge. Call 286-0376.

BABY CARRIAGE - Good condition. Prefer 3-way convert (car bed, stroller). Import okay. Daly, 363-2497.

HIGH SCHOOL STUDENT - Looking for ride to and from Florida for Easter vacation 4/7-4/15. Contact 722-3671 for info re cost & sharing. Nancy, Ext. 2119.

BABYSITTER - Mature person exp. with infants. Call Vinita, Ext. 3111.

HOME(S) FOR 2 ADULT CATS - One male, one female, neutered, all shots. Bob, Ext. 3312.

Services

CONSUMER REPORTS - At group rate, \$8/yr. Group has openings. Alyce Daly, Ext. 2902.

AUTOMOTIVE REPAIR - 8 yrs exp, free pick up and delivery. All work guaranteed. 8 am to 6 pm. 744-2725.

GUITAR LESSONS - Beginners/intermediate. Your home or mine. Reasonable. Nick, 475-0897.

CREATIVE DESIGNS - Cartoon drgs on wood or canvas, business signs, custom work. Reasonable. Robert, 744-5871.

SCUBA LESSONS - International Certification (P.A.D.I.) Equipment provided. Get ready for summer recreation. Call after 6 pm. 281-5448.

ANTIQUÉ CARS - Available for hire for weddings, special occasions. Reasonable. Mike, 281-3460.

BABY SITTING - For working mother, 5 days, Mastic Beach Area. Esta, 281-7043.

EXPERT PLAQUIING - Any subject, photos, announcements, diplomas, etc. Priced by size. 744-8148.

ELECTROLUX OWNERS - Have your cleaner tested for suction & power, free of charge, also sales & service. 475-8456.

TUTORING - In my home. Expert certified teacher in Math, French, German. \$10/hr. 941-4328.