

"Heavy, Heavy [Water] Hangs Over Thy Head?" (Tritium - A Hazard In The Environment?)

Until non-polluting forms of energy generation are available, the current projected need for additional electrical power makes it likely that the world will, by necessity, become more dependent upon nuclear power reactors. One by-product of the nuclear power industry is the generation of rather large amounts of tritium, the heaviest and only radioactive isotope of hydrogen. Tritium release from nuclear power reactors and from nuclear fuel reprocessing plants is of great concern to environmentalists and to those who control licensing of nuclear reactors.

Tritium exists in the environment due to both natural phenomena and man's endeavors. In a BNL Lecture on Wednesday, March 8, in Berkner Hall, at 8 p.m., Arland Carsten, Medical Department, will address the question "Is the amount of tritium being produced in the environment a hazard to man?"

Tritium has a physical half-life in excess of 12 years, so that once produced, it remains in the environment for a reasonably long period of time. The primary natural source of tritium is production in the atmosphere by the actions of cosmic rays. This and other natural phenomena lead to a world-wide distribution which has resulted in man's being exposed to a constant tritium level throughout history.



Arland Carsten

However, since the first accelerator production of tritium in the 1930's, man has

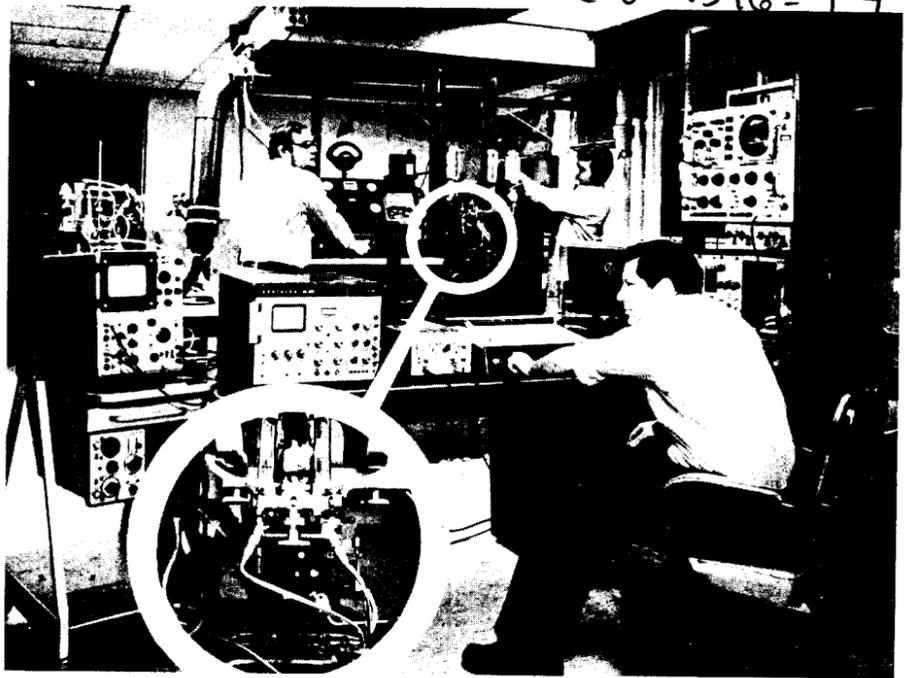
been adding to the world's load of this isotope. The amount he contributed was insignificant until the advent of nuclear weapons and atomic reactors. Considerable tritium was produced by weapons-testing during the 1950's and 60's. At the same time, the increase of nuclear reactors contributed more to the world tritium inventory. Although weapons-testing in the environment has significantly decreased, the increase in power reactors continues. Most estimates indicate that within the next 25 years, the tritium in the environment from reactors will approximately match the level produced by natural phenomena.

Some years ago the Atomic Energy Commission asked the Medical Department to examine certain aspects of tritium toxicity. For this purpose a program was undertaken involving the study of large numbers of mice maintained on water containing tritium. These mice were examined for genetic defects and changes in their blood-forming cells. To date, several thousand mice have been followed for periods of up to two years in order to determine if there is any deleterious effect from constant tritium exposure. Interim results of studies exposing mice to tritium at 100 times the allowable concentration for man indicate some deleterious effects.

Therefore, studies examining possible effects of lower concentrations are being undertaken. However, sufficient data are not yet available to make a statement concerning preliminary results. The techniques used for the evaluation of tritium toxicity are applicable to the study of non-radioactive, energy-related pollutants and continuing studies on tritium toxicity will include evaluation of other environmental pollutants. Interim results of these studies, as related to man and the environment, will be discussed in the Brookhaven Lecture.

Carsten is a Scientist in the Medical Research Center and has been associated with that department since 1966. When he first came to Brookhaven in 1957, after receiving a Ph.D. in radiation biology from the University of Rochester, he held dual appointments in Health Physics and Biology. From 1962 to 1966 he was engaged in research and teaching at the University of Rochester, Columbia University, and the Royal Dental College, Copenhagen, while maintaining a continuous association with Brook-

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In the engine lab at building 527 are (from left to right) Jeff Brateman, Jeb Barry and Bruce Klemm who are working on long-term combustion studies. The inset is a closeup of the engine head showing light from the engine flame. The light is then scanned by a spectrometer for specific species.

Looking For Other Fuels

As the world petroleum supply diminishes and the U.S. balance of payments falls even faster, the search for suitable alternative fuels becomes increasingly urgent. At Brookhaven, some fundamental investigations are being pursued by a research team in the Department of Energy and Environment under a program called Combustion Studies of Alternative Fuels. Their research is supported by DOE's Basic Energy Sciences Division.

"Alternative fuels are those which may be derived or manufactured from anything but conventional petroleum supplies," says chemist and principal investigator Bruce Klemm. "However," he continues, "our efforts are primarily concerned with those fuels which can be derived from biomass or coal, both of which are abundant in the United States. These include methyl alcohol, ethyl alcohol and synthetic hydrocarbon distillates."

The group from the Chemical Sciences Division is investigating the combustion of alternative fuels from both the performance and pollutant emissions standpoints. While Klemm and Ed Skolnik look at the basic chemistry of the combustion and pollutant formation processes in pyrex and stainless steel systems at one end of the building, Jeff Brateman, engineer, and Jeb Barry, technician, work with an ASTM-CFR engine at the other end.

The engine is a single cylinder, variable compression ratio engine which is used for determining the octane rating of gasoline and the cetane rating of diesel fuel. It has become the industry standard for fuels and combustion research.

When alternative fuels are burned in the engine, the performance is evaluated and the exhaust gas is analyzed for pollutant emissions. The engine is also fitted with two small quartz windows which permit observation into the combustion chamber. A rapid scanning spectrometer is used to identify intermediate chemical species within the combustion chamber during the combustion and pollutant formation processes.

"Species identified within the engine by *in-situ* spectroscopy suggest reaction mechanisms which might be involved in the combustion and pollutant formation processes," says Klemm. "The details of these reactions and their significance can be further investigated as part of the basic chemistry phase of the program."

The bulk of the work to date has been done with methyl alcohol. "It runs very well in the tests," says Klemm, "because in the lab we can identify and control any operational problems as they arise." Some of these problems have been known for years.

For example, methanol has approximately one-half the energy content of gaso-

line. Therefore, for the same driving range, the fuel tank would have to be twice as big and the carburetor would have to be modified to deliver twice as much fuel. It also takes more than six times as much heat to vaporize alcohol as gasoline. The net result is that the mixture is significantly cooler than gasoline.

This is a mixed blessing, says Klemm, since the cooler mixture allows more charge to be drawn into the cylinder and results in increased power. (This is one of the reasons alcohol has long been used in racing cars.) However, the cooler mixture could lead to carburetor icing and problems with corrosion.

In the course of their research, the group came up with something which was of particular interest to the engineering community. The three major exhaust pollutants from automotive engines are carbon monoxide, hydrocarbons which result from the incomplete combustion of the fuel, and oxides of nitrogen. Klemm says that this last category of pollutants was generally believed to consist overwhelmingly of nitric oxide (NO); however, BNL tests showed conclusively that at lean running conditions, nitrogen dioxide (NO₂) is the dominant specie.

One reason this has gone unnoticed by previous workers, explained Klemm, is because nitrogen dioxide is highly soluble in water. When the water vapor which is naturally present in the exhaust gas was removed to facilitate analysis, the NO₂ was removed along with it. A commercially available drying device which removes water vapor, but neither NO₂ or NO, was used in the Brookhaven study. "Half of the problem," said Klemm, "was that unjustified extensions of earlier work led to preconceptions which resulted in oversights in the analysis techniques used later."

As for the future, Klemm indicates they would like to complete some work on the formation of NO₂, then proceed to build a comprehensive data base of the performance and pollutant emissions characteristics of a variety of potential alternate fuels.

This is a long term basic research project and, as Klemm puts it, "we are a long way from the real world stage." But if they can gain insight into the details of the combustion process and how pollutants are formed, they will have made a major contribution to this industrial age.

Chart Available

The Library now has a supply of the G.E. Chart of the Nuclides (Twelfth Edition - Revised to April 1977) for staff members. Please call Ext. 3484.

Old Art And New Science

When Garman Harbottle and Edward Sayre, Chemistry Department, take off to exotic places, they are not just junketing. Their scientific expertise in art and archaeology is well known and their advice is sought in remote corners of the globe. At a seminar last week, Harbottle talked about two of their trips into antiquity.

Last year, the Mexican National Institute of Archaeology invited him to visit a recently excavated archaeological site about an hour's drive from Mexico City, at a place now called Cacaxtla. Murals discovered on the unearthed walls are considered a major discovery, not only because they are in excellent condition, but because archaeologists think they may fit into a previously "lost" time slot somewhere between 600 and 900 A.D. It is lost because there is no record of the people who lived there during this time period.

The paintings show Mayan influences, and this is unexpected because the Mayan culture flourished some 300-500 miles away. At the same time, glyphs on the paintings are symbolic of another culture, the Teotihuacan, which is some 200 years out of phase with the Mayans. Ceramic samples from this area are being analyzed by Harbottle

(continued on page 3)



Black and white sketch of a painted mural found at a recently discovered archaeological site at Cacaxtla, Mexico.

Visitors Last Week

2-1070-78



Dr. I.S. Zheludev (right) Deputy Director General for Technical Operations of the International Atomic Energy Agency, Vienna, visited the Laboratory last week, primarily to talk to some Physics Department staff members. Above, with Martin Blume, he discusses a crystal lattice of strontium titanate which has been studied experimentally and theoretically at Brookhaven.



Suffolk County Legislators visited Brookhaven on February 15 and 16 for a briefing and overview of Laboratory programs. At right, Physics Department chairman Nicholas Samios explains the superconducting magnets to some of the legislators during a stop at Project ISABELLE.

2-747-78

Reports Available

The following reports are now available to the Laboratory Staff and to Affiliates of the ERDA, AUI, and NRC. Others may purchase the reports from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. Staff members should call Ext. 3484.

- BNL 50679 \$9.00
State Legislatures and Energy Policy in the Northeast: Energy Facility Siting and Legislative Action. D. Morell and G. Singer
- BNL-NCS-50681 \$13.50
Symposium on Neutron Cross-Sections from 10 to 40 MeV (Held at Brookhaven National Laboratory, Upton, New York 11973, May 3-5, 1977). M.R. Bhat and S. Pearlstein
- BNL 50712 \$4.00
The Effect of Reduced Boiler Water Temperature on Cycle Efficiency. J.E. Batey and T.W. Allen
- BNL 50715 \$7.25
Photochemistry Relevant to Nuclear Waste Separations: A Feasibility Study. T. Gangwer
- BNL 50698 \$4.50
Flash Hydrolysis of Coal - The Design, Construction, Operation, and Initial Results of a Flash Hydrolysis Experimental Unit. P. Fallon and M. Steinberg
- BNL 50699 \$4.00
Alternate Materials of Construction for Geothermal Applications. Progress Report No. 13, April - June 1977. L.E. Kukacka, et al.
- BNL-NCS-50702 \$5.25
A Source List of Nuclear Data Bibliographies, Compilations, and Evaluations. T.W. Burrows and N.E. Holden
- BNL 50714 \$7.25
Electrolysis Based Hydrogen Storage Systems. Annual Report January 1, 1976 to December 31, 1976. F. J. Salzano

On Car Rentals

In May of 1977 Avis allowed BNL, AUI and NRAO a 30% discount. This was in recognition of our increased volume of business with Avis in the preceding year. Happily it all happens again. Starting on May 1, 1978 Avis will allow 35% on these accounts.

The full discount, 35%, is only on wet rates, i.e., those rentals wherein Avis pays for gas. The discount is 15% on normal time and mileage rates and special unlimited mileage rates, where the user pays for gasoline. Only promotional rates are not subject to a discount.

The Travel Office will continue to make reservations for car rentals in accordance with SPI-4-02. However, an employee may obtain a car at these discounts from Avis computerized Wizard locations. The Brookhaven National Laboratory Identification Card and the Avis AID number are all that is required to obtain the discounts. AID number stickers, which may be affixed to your credit card, are available in the Travel Office. It may be helpful to know that Brookhaven National Laboratory is listed as a "National Account" in the "Special Account Section" of the "Avis Counter Quick Reference Guide."

It is not necessary to be on official travel to obtain these discounts; they are available to Brookhaven National Laboratory employees for personal use.

In the latter case: Do not have charges billed to Accounts Payable at BNL as you may for official travel; use a personal charge card or cash. Make your own decision concerning the Collision Damage Waiver. The fee for this coverage is not reimbursable for official travel, but may be a wise investment on a personal basis.

Audubon Wildlife Film

The BERA Outing Club, in cooperation with the National Audubon Society, has scheduled a film and lecture presentation by Dr. Stephen Kress on Thursday, March 9, at 8:00 p.m. in Berkner Hall.

This is a very different Audubon Wildlife Film in that the mechanics involve two slide projectors, a special synchronization device and sound. The cacophony of sound and plenitude of bird life which are to be found on the ocean islands of the North Atlantic create the mood and are the subject of this interesting film study.

The program presents the life history of the gannets which nest on the cliffs of Bonaventure Island and Cape St. Mary's, Newfoundland. Detailed views of the Common Murre, Black-legged Kittiwake and Leach's Petrel illustrate the family life of these ocean species. Included also is an in-depth view of the Common Puffin and a review of the current research that is attempting to re-establish the puffin in part of its former range off the Maine coast.

Stephen Kress received his B.S. in Zoology and M.S. in Wildlife Science from Ohio State University and holds a Ph.D. from Cornell University in Environmental Education. He has held the position of Assistant Director of the Antioch Outdoor Education Center, and has taught courses in ornithology and natural history at Antioch College. He has been a staff member of the National Audubon Society for many years serving as Ornithology Instructor at the N.A.S. summer workshops in Maine and Wisconsin. He is Science Consultant to Instructor magazine and a Research Affiliate of the Cornell Laboratory of Ornithology.

An admission of \$2 for adults and \$1 for young people under 18 and senior citizens will be charged. Light refreshments will be served immediately following the program.

Arrivals & Departures

Arrivals

- Adel Alapour..... Nuclear Energy
- Judith A. Bates..... Safety & Env. Prot.
- Arleen M. Busch..... Personnel
- Alexander N. Mallen..... Nuclear Energy
- Gene O. Ueberg..... Nuclear Energy
- Kazuo Yamashita..... Energy & Env.

Departures

- Fredericka Gileta..... Personnel
- Ronald D. Judkoff..... Energy & Env.

BNL Lecture

(Cont'd)

haven. He has held appointments at the Lerner Marine Laboratory, Bimini, Bahamas and is currently Associate Professor of Pathology at the State University of New York at Stony Brook. Carsten is a member of numerous professional societies and is a Councillor of the International Society of Experimental Hematology.

A buffet supper will be served in the Brookhaven Center before the lecture beginning at 6:30 p.m. Reservations should be made in advance by calling Ext. 3541 before 5 p.m. Refreshments will be available in the lobby of Berkner Hall immediately after the lecture.

Selected Reading

- Chem. Br. 13, December 1977
Science and education: 1st Priestley lecture. S. Williams. 451-4
- Nature 271, February 2, 1978
Truth at any price. 391
- New Sci. 77, January 26, 1978
Politics of nuclear safety. B. Wynne. 208-11
- Why a woman left science. 222
- Writing a report. W. Prentice. 238
- An earthquake waiting to happen? K. Hindley. 228-30
- The limitations of axiomatics. G. Whitrow. 239

Go Gets Going On Site

When Hidehiko Watanabe departs next week after a two-year postdoctoral appointment in Biology, he will leave behind him a dedicated group of game players, in fact, one might call it a going concern.

The game is called Go. It originated in China about 4,000 years ago and has been played in Japan for 1,000 years. Watanabe says that, in his country, this game has as many dedicated followers as baseball has in the United States.

Although nearly everyone plays Go in Japan, there are about 500 people who play professionally and it can be a highly paid profession. The purse for one professional championship game can run as high as \$330,000, with the first place winner taking home about \$100,000. Newspapers sponsor most of the matches and publish tournament results daily.

The game is played two people to a board and, because he is an advanced player, Watanabe sometimes plays two or three boards at a time. Although it has a vague resemblance to chess, Go is different in many ways. While one starts out with a full board in chess, in Go it is empty. The object of the battle is not to capture the king, as in chess, but to control the most territory and capture the most prisoners in

as few moves as possible. David Krieg (Biology), who is an enthusiastic player, says "it is something like judo, in that you may, by your maneuvers, lure a player into making an excessive move." Apparently, good players not only use logic but follow their hunches.

Watanabe vowed he would get a club going here before he left and, due to his efforts, there is now a dedicated group of about 10 people who play the game every Thursday evening, from 6:30 to 10 p.m. in the Recreation Building. New members, even beginners, are welcome and anyone who wishes to play should contact Harold Berry on Ext. 4152. A handicap system is used so people of varying skills can play together.

When he leaves here, Watanabe will pursue his research on peptide hormones at the Mount Sinai School of Medicine. He and his family will live in Queens and he says this will actually be his first real experience of living in the United States, after two years onsite in a "nice, protected international atmosphere." But no matter what else is on the horizon, it is quite likely that soon Watanabe will introduce his new American neighbors to an intricate Japanese game called Go.



Hidehiko Watanabe ponders a move in the game of Go he is playing with David Krieg. During his stay at BNL, Watanabe has recruited a number of enthusiastic players to this Japanese game.

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Letters To The Editor

To the Editor:

Regarding the article "Snow and More Snow," I'm sure it was an oversight not to have mentioned the fact that a number of men and supervisors from Mechanical Utilities played an important role during that period. The following men contributed many hours: Supervisors C. Lutz, A. Slavinsky, and A. Falango were here, as were T. Dahne, T. Ross, and J. Hanson from the Water Treatment Plant. Working at the Steam Plant were B. Cappel, J. Denlea, P. Kreh, E. Rogers, W. Farrell, T. Snowden, T. Mac Pherson. And the following from the Refrigeration and Air Conditioning section were on site: P. Ratyca, R. Marlow, J. Kelczewski, J. Aurelio, and L. Dilworth.

John Scandizzo, General Supervisor
Mechanical Utilities

Art And Science (Continued)

and Sayre in their laboratory to see what parts of Mexico the sherds may match.

As one of their activities, Sayre and Harbottle are accumulating a library of ceramic analyses and, with a computer program designed by Herbert Bernstein, expect, when their library is joined with others, to be able to go through as many as 30,000 ceramic analyses in a matter of minutes.

In January, they went off to the other side of the world, this time to Saudi Arabia at the invitation of the government. The Saudi Arabians are planning to build a \$300 million museum in Riyadh, the capital city. Both Sayre and Harbottle are serving on an advisory committee based in Boston which is assisting the Saudis in the design of the museum.

As the Arabians are familiar with the Brookhaven chemists' work in the analysis and preservation of art works, they specifically wanted to discuss with them plans for an interim laboratory in an existing museum and the design of a modern facility for the new museum. Many old buildings in Arabia are constructed of mud brick, a fast disappearing architecture of the region, and they want to know how to preserve these buildings.

During the course of their discussions, Sayre and Harbottle expressed an interest in visiting a Nabataean archaeological site, the remains of a culture which existed from the fourth century B.C. to the first century A.D. Their request was immediately granted.

They were flown to the airport at the holy city of Medina (into which no non-Moslem ever sets foot) and from there were driven about 350 miles into northwest Arabia to the site at Madain Saleh. One tomb discovered there is carved in rock and is some 50 feet across and 100 feet high: there are 140 more that are smaller. There is no Holiday Inn in this part of the world and when Sayre and Harbottle were finished with their explorations, they retired to a Bedouin tent. They said it was an interesting experience, if somewhat on the chilly side.

"Nuclear chemistry techniques can be used in surprising ways," says Harbottle, "and this area of research has led us into unusual places and interaction with others in different fields."

Dance Program Tonight

An unusual program featuring the Japanese ballerina, Masako Arai, will be presented tonight at 8 p.m. in Berkner Hall. Admission is free.



Trinidad Serenaders Steel Band

The Cricket Ball

Out of the winter cold and into the warmth of a Caribbean night - the "Second Annual Winter Cricket Ball" will burst on the Brookhaven social season, Saturday, March 11 at 8 p.m. in the Brookhaven Center.

This year a true extravaganza is planned. The ticket price of \$7.50 per person includes open bar, hor d'oeuvres and incredible entertainment.

The Trinidad Serenaders Steel Band has been making intoxicating music from oil drums for two decades. They have performed with Harry Belafonte, Dave Brubeck, and Lionel Hampton, as well as on television and records. They will be playing at the Cricket Ball, with Calypso singer "Mighty Panther," and will provide all kinds of dancing pleasure, from island style to the fox trot.

As the Cricket Club is truly international they will also present the Middle Eastern dancer MOROCCO who has appeared internationally on stage and television. She has been a guest on the Johnny Carson,

David Frost and many other shows. Her performance in the outdoor Lincoln Center Dance Festival last year inspired an art critic to write "a tour de force, a shimmering study in perpetual motion... mastery of seductively motion-ful Arabic dancing... extraordinary grace, control and sense."

Is Brookhaven ready for all this?

Tickets may be obtained from the following:

	Building
Gail Thompson	490
Gail Williams	460
Grahame Williams	555
Sharon Smith	510
Don David	510
Debu Majumdar	130
Ken Batchelor	911-C
Helen Keeley	911-A
Madeline Windsor	477
Ed Beardsworth	475
John Mills	463
Linda Moreno	535
Carolyn Eterno	129
Maurice DuBois	134

Students Complete Intensive AEMT Training



For the past three-and-a-half months an Advanced Emergency Medical Technicians training course has been given at Brookhaven by the Suffolk County Emergency Medical Services. Brookhaven assisted the County with both facilities and staff for the course. Above, at one of the last sessions this week, students watch as Senior Instructor Richard Skelton (left), Medical Dept., and Gary Urbanowicz, Suffolk Emergency Medical Training Administrator, prepare for telemetry EKG procedure. Students are required to read EKG's and administer IV's on the direction of a doctor.

On Trout Fishing

A Trout Fishing Workshop will be conducted at the Connetquot River State Park on three Saturdays, March 11, 18 and 25, between noon and 2 p.m.

This program is under the auspices of Long Island Trout Unlimited and is chaired by John McCafferty. The BNL Fly Tying Club will give demonstrations of fly tying at all sessions. Reservations should be made by calling 581-1005 at Connetquot River State Park as soon as possible. Registration is limited.

Anyone interested in fly tying is welcome to join the BNL Fly Tyers who meet on Tuesday evenings on site. For information call Dick Stoner, Ext. 3601, or Charles Boulton, Ext. 4257.

Sea Cliff Concert

Great Viennese Chamber Music is the theme of the final concert in the series presented by the Sea Cliff Chamber Players in Berkner Hall, on Saturday, March 4 at 8 p.m. The program includes Mozart's Divertimento in E-flat for violin, viola and cello, the Adagio from the Chamber Symphony of Alban Berg arranged by the composer for violin, clarinet and piano and the Trio in C for piano, violin and cello of Brahms. The performers are Barbara Speer, pianist, Herbert Sucoff, clarinetist, Hamao Fujiwara, violinist, Kim Kashkashian, violinist and Hakuro Mori, cellist.

Tickets are \$5 for adults and \$3.50 for students under 21.

Cafeteria Menu

Week Ending March 3, 1978

Monday, February 27	
Rosy onion soup	
Chicken a la king on rice	1.20
Western omelet & fr. fr.	1.25
Hot deli - Pastrami (on bread)	1.15
(on roll)	1.25
Tuesday, February 28	
Chicken mushroom supreme	
Chinese pepper steak on rice	1.30
Barbequed spareribs & black eyed peas	1.40
Hot Deli - Roast Beef (on bread)	1.25
(on roll)	1.35
Wednesday, March 1	
Split pea soup	
Breaded flounder filet & fr. fr.	1.25
Spaghetti w/Italian sausages, garlic bread	1.30
Hot Deli - Baked Virginia ham (on bread)	1.25
(on roll)	1.35
Thursday, March 2	
Oxtail soup	
Beef hash & 1 veg.	1.20
Veal pattie parmigiana & 1 veg.	1.20
Hot Deli - Meatball hero	1.25
Friday, March 3	
Manhattan clam chowder	
Fish n'Chips	1.25
Meatloaf & 1 veg.	1.20
Hot Deli - Roasted turkey (on bread)	1.25
(on roll)	1.35

Scotch Doubles Tournament

The tournament is set for Saturday, February 25 from 4:30 to 8:00 p.m. at the Port Jeff Bowl.

Teams not present and ready to bowl at the start of the tournament will forfeit the team fee.

Bowling

Pink League

Linda Feierabend and Alice Trubisz are probably the only two not blaming their bowling on the snow and the two-week lay-off. Linda bowled a 371 series giving her 110 pins over average. Alice had two beautiful games (185/175) for a series of 474 and 96 pins over average.

Other possible non-complainers are: Marge Stoeckel 176, Helen Keeley 167 and Pat Oster 165.

The Lickety Splits are in first place by 7 points, followed by the Fiscal Assets, Gutter Getters, Odd Balls, Pinsplitters and Personalities.

Red League

Congrats to F. Stahman for a terrific night. He had a 624 scratch and 705 gross. Included in this series was a 255 (high game in the Red this year). Fred was 126 pins over average. Despite his scores, the Freon Loaders only managed to take 4 from the Old Timers 11. The 76'ers took the Pick-Ups 11-0. The Anachems won their match with the Designers 8-3. The Cosmos took the Got-A-Hit-Ums 8-3 with N. Fewell (626 gross) and J. Sheehan (625 gross) bowling well.

The Bubble Boys had their best night in some time. Great team bowling (3107 pins) enabled them to take the Sandbaggers 7-4. S. Kiss was 75 over average (645 gross). R. Barberich (204) had a 640 gross and W. Kollmer (218) had a 564 scratch 636 gross. R. Kiss came in with a 627 gross. For the Sandbaggers, R. Meier had a 214/561 scratch. C. Bohnenblusch had a 214/552 scratch and R. Jones a 236/547 scratch. The Old Timers had a hard night and were downed by the Sparks 11-0.

Purple & White League

All that snow shoveling must have toned the muscles up! We had some excellent bowling by Bob Jones with a 221 and high series of 607. For the ladies, Caryl Mac Dougall had a 200 and a 551 series. Other good games were Ted Erickson 206/220, Jim Griffin 200/213, Ralph Taylor 219, Dick Murgatroyd 204, Adrienne Usher 186, Carolyn Eterno 178, Lorraine Petro 171.

The Sea Gulls moved into first place with the Flounders one point behind and The Pen Mac's and Stir Up's tied for third.

Albert Szent-Gyorgyi (1893-)

The real scientist...is ready to bear privations and, if need be, starvation rather than let anyone dictate to him which direction his work must take.

—from *The Harvest of a Quiet Eye*
by Alan L. Mackay

