FERMI NEWS

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Interdependent Sciences: Physics and Medicine 2

Photo: Lawrence Berkeley National Laboratory

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INSIDE:

Interdependent Sciences:
Physics and Medicine

by Michael S. Witherell
Fermilab Director

Photo by Reidar Hahn

Steve Holmes (left), Fermilab Associate Director for Accelerators, assists Mary Catterall, M.D. in cutting the ribbon to open the exhibit "PULSE: Accelerator Science in Medicine." Dr. Catterall was a pioneer of neutron therapy in England in the early 1970s, and her published results strongly influenced Fermilab in establishing the Neutron Therapy Facility. The ceremony marked the beginning of the celebration of NTF's 25th Anniversary.

Cover: Ernest O. Lawrence was the father of the science of particle accelerators. In 1930, he built the first circular accelerator, or cyclotron, at Berkeley, California. Lawrence often operated the Berkeley cyclotrons all night to produce medical isotopes for research and treatment. In 1938, Lawrence's mother Gunda became the first cancer patient to be treated successfully with particles from cyclotrons.

Many diagnostic and therapeutic techniques that have revolutionized medicine are also symbols of the interdependence of the physical and biomedical sciences. Magnetic Resonance Imaging and Neutron Therapy are just two of the prominent examples of the successful collaboration among innovative medical researchers, physical scientists and engineers. Electron storage rings first developed for high energy physics evolved into synchrotron light sources; they are now so important to medical research that the National Institutes of Health is putting millions of its own research money into building more beam lines at synchrotron facilities.

Harold Varmus

Harold Varmus, the president of Memorial Sloan-Kettering Cancer Center, former director of the National Institutes of Health and recipient of the 1989 Nobel Prize in Medicine, wrote an Op-Ed article for the *Washington Post* about a year ago discussing this interdependence of the physical and medical sciences. He noted that support for the physical sciences has been falling for a decade, at the same time that support for medical research almost doubled in real dollars. Dr. Varmus wrote:

> "I first observed the interdependence of the sciences as a boy when my father—a general practitioner with an office connected to our house—showed me an X-ray. I marveled at a technology that could reveal the bones of his patients or the guts of our pets. And I learned that it was something that doctors, no matter how expert with a stethoscope or suture, wouldn't have been likely to develop on their own.
>
> "Of course, the X-ray is routine now. Medical science can visualize the inner workings of the body at far higher resolution with techniques that sound dazzlingly sophisticated: ultrasound, positron-emission tomography and computer-assisted tomography. These techniques are the workhorses of medical diagnostics. And not a single one of them could have been developed without the contributions of scientists, such as mathematicians, physicists and chemists supported by the agencies currently at risk.
>
> "Effective medicines are among the most prominent products of medical research, and drug development also relies heavily on contributions from a variety of sciences. The traditional method of random prospecting for a few promising chemicals has been supplemented and even superseded by more rational methods based on molecular structures, computer-based images and chemical theory. Synthesis of promising compounds is guided by new chemical methods that can generate either pure preparations of a single molecule or collections of literally millions of subtle variants. To exploit these new possibilities fully, we need strength in many disciplines, not just pharmacology.

Fermilab CELEBRATES 25th anniversary of Neutron Therapy Facility and OPENS EXHIBIT "PULSE: Accelerator Science in Medicine."

Photos by Reidar Hahn

Former NTF patients came from across the United States to attend the 25th anniversary celebration on Saturday, September 8 at Fermilab.

"Medical advances may seem like wizardry. But pull back the curtain, and sitting at the lever is a high-energy physicist, a combinational chemist or an engineer. Magnetic resonance imaging is an excellent example. Perhaps the last century's greatest advance in diagnosis, MRI is the product of atomic, nuclear and high-energy physics, quantum chemistry, computer science, cryogenics, solid-state physics and applied medicine.

"In other words, the various sciences together constitute the vanguard of medical research. And it's time for Congress to treat them that way. Sens. Christopher Bond (R-Mo.) and Barbara Mikulski (D-Md.) have just proposed to double the budget of the National Science Foundation over five years. This admirable effort should be vigorously supported and extended to include the Department of Energy's Office of Science, which funds half of all research in the physical sciences and maintains the national laboratories that are central to biomedicine.

"Scientists can wage an effective war on disease only if we—as a nation and as a scientific community—harness the energies of many disciplines, not just biology and medicine. The allies must include mathematicians, physicists, engineers and computer and behavioral scientists. I made this case repeatedly during my tenure as director of NIH, and the NIH has made significant efforts to boost its support of these areas. But in the long run, it is essential to provide adequate budgets for the agencies that traditionally fund such work and train its practitioners. Moreover, this will encourage the interagency collaboration that fuels interdisciplinary science. Only in this way will medical research be optimally poised to continue its dazzling progress."

I cannot improve on such an eloquent statement. I will simply add that in most of these important medical developments, the new technology was a result of research that was not directed at developing medical technology. The scientists did not envision this most beneficial use of the research they were carrying out. The physicists who first built a laser could not have imagined the many ways that it is used in medicine today. Science is not a collection of many disciplines, advancing independently. It is rather an interlocking web. If we ignore the deep connections between the many individual fields of science, we miss the importance of the whole.

On the Web:

Pulse—Accelerator Science in Medicine: www.fnal.gov/pub/pulse

Fermilab Director Michael Witherell (right) presented a special award to physicist Arlene Lennox, director of the Neutron Therapy Facility since 1985.

Tools for Diagnosis

Advances in technology for medical diagnosis have created extraordinary new capabilities for imaging the human body. Many of medicine's most powerful diagnostic tools incorporate technology that physicists originally developed to explore the fundamental nature of matter.

Magnetic resonance imaging uses technology that began as a tool for physicists to accelerate protons to the highest energy in the world.

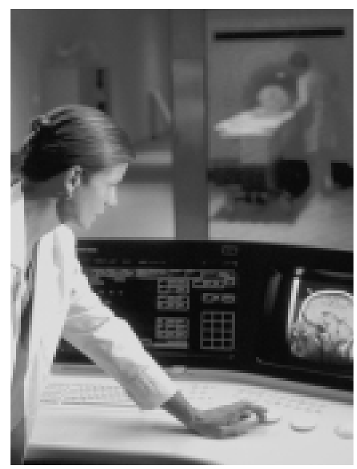


Photo: Will and Deni McIntyre / Photo Researchers, Inc.

MRI is a technique used to produce high quality images of the inside of the human body. MRI is based on the principles of nuclear magnetic resonance, a technique used by scientists to obtain microscopic chemical and physical information about molecules.

At the heart of MRI technology are powerful magnets made of superconducting wire and cable first developed in the 1970s to build Fermilab's Tevatron.

To build the Tevatron, Fermilab brought together experts in superconductivity, physics, engineering, materials science and manufacturing. Their collaboration made superconducting magnet technology ready for a full-grown role in the new diagnostic capability created by MRI.

A new generation of superconducting magnets will give physicists more powerful accelerators to unlock the deepest secrets of the universe. And a new generation of high-field superconducting MRI magnets will help unlock the secrets of the human body.

Photo: Simon Fraser / Photo Researchers, Inc.

MRI scans through a human head showing a healthy brain. In each scan, the folded cerebellum, responsible for conscious thought, makes up the largest area of the brain.

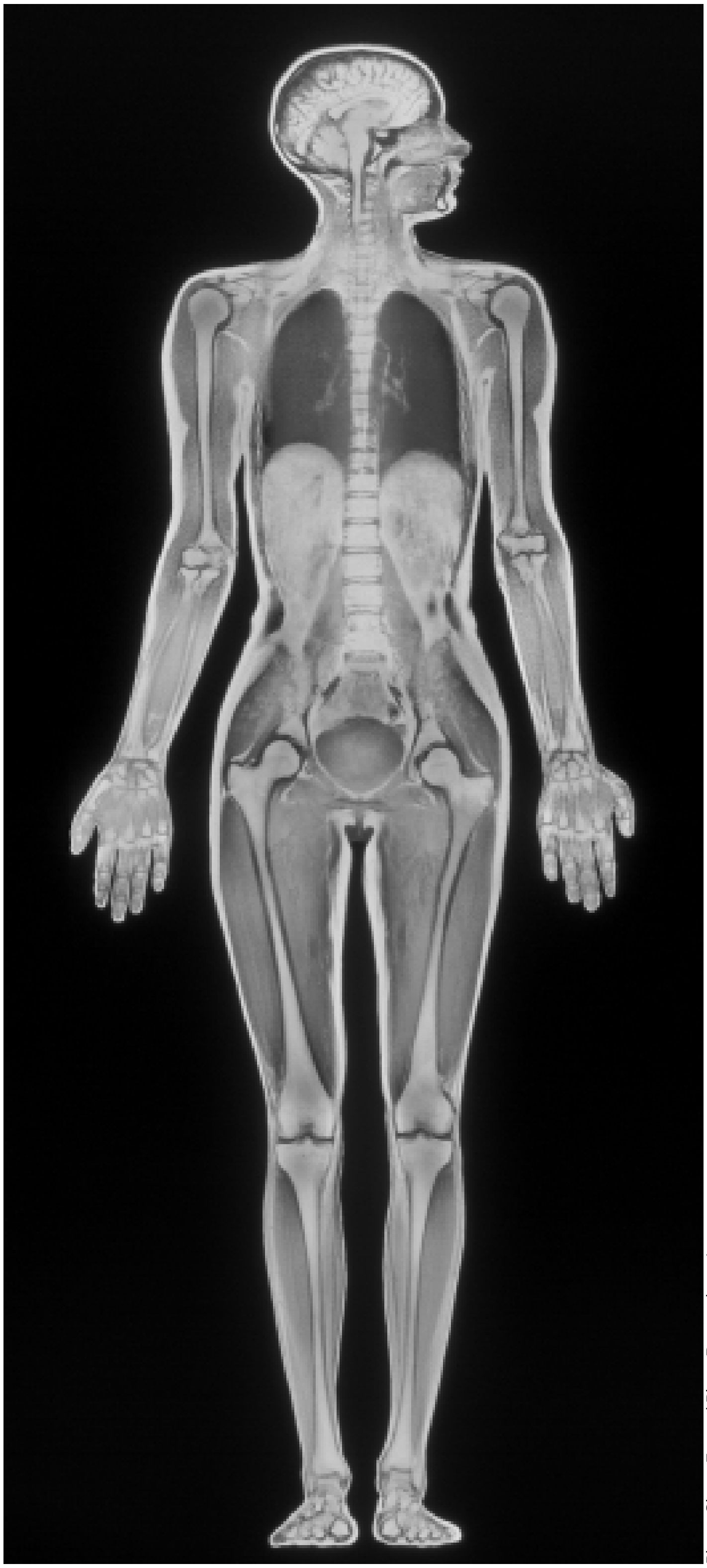


Photo: Simon Fraser / Photo Researchers, Inc.

Colored MRI scan of the whole body of a woman in coronal (frontal) section. The head is seen in side (sagittal) section. This whole body image is the product of a number of MRI scans made along the length of the body and combined.

Oxford Instruments

The ongoing development of high-field superconducting magnets, an understanding of the properties of atoms, and advances in high-speed computing combine to make magnetic resonance imaging an increasingly powerful tool for medical diagnosis and research.

Photo: Intermagnetics General

A large-bore superconducting magnet, built by Intermagnetics General Corporation, destined for a magnetic resonance imaging system.

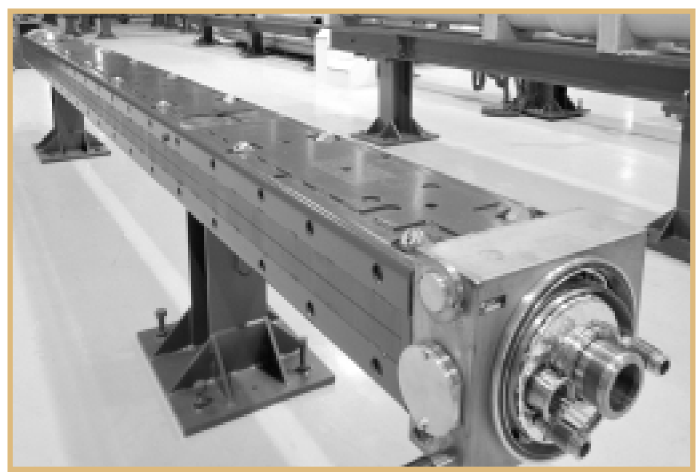


Photo by Reidar Hahn

Fermilab's Tevatron accelerator is a four-mile circle of 1,020 superconducting magnets, 224 quadrupoles, like this one, and 796 dipoles. Building the Tevatron took enough superconducting wire to circle the earth 2.3 times—and created a new industry, ready to supply superconducting wire and cable for the emerging medical technology called magnetic resonance imaging.

"Every program in superconductivity that there is today owes itself in some measure to the fact that Fermilab built the Tevatron and it worked."

Robert Marsh, former CEO of Teledyne Wah Chang, in Albany, Oregon, world's largest supplier of superconducting alloys.

Tools for Healing

Discoveries in physics have helped forge dramatic advances in cancer treatment for over a century. In 1950-54, according to the National Cancer Institute, the five-year survival rate for all cancers was 35 percent; by 2000 it was 59 percent. With early detection and treatment, the five-year survival rate for screenable cancers is now 80 percent.

Loma Linda University Medical Center

Radiation oncologists view an MRI of a tumor to determine their treatment strategy.

When Ernest Lawrence and his brother John, a physician, treated their mother's cancer with neutrons in 1938, they were taking a new path just as others had with other forms of radiation. Within months of the discovery of X-rays in late 1895, therapists began treating countless ailments with Wilhelm Roentgen's "new light." By January of 1896, Emil Grubbe in Chicago was already treating two cancer patients. By trade, Grubbe was an electrician and metallurgist.

Reprinted with permission of the American College of Radiology, Reston, Virginia.

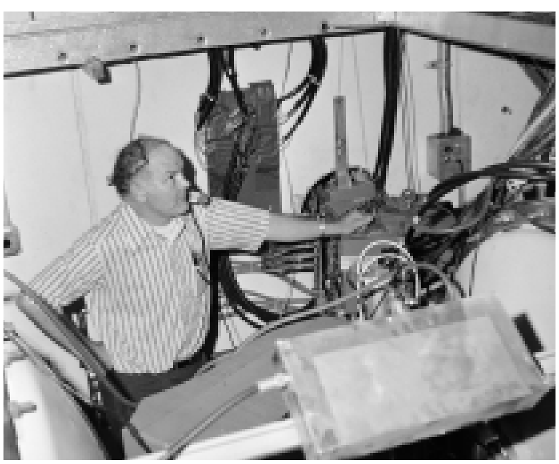
Now, accelerators producing X-rays and electrons for radiation therapy can be found at virtually every major medical center in the U.S.—planned and operated by medical physicists, with treatment administered by radiation oncologists. Once an experiment, then a treatment of last resort, radiation therapy has evolved into the treatment of choice for many cancers. Particle accelerators have an integral role in today's cancer therapy.

Fermilab Photos

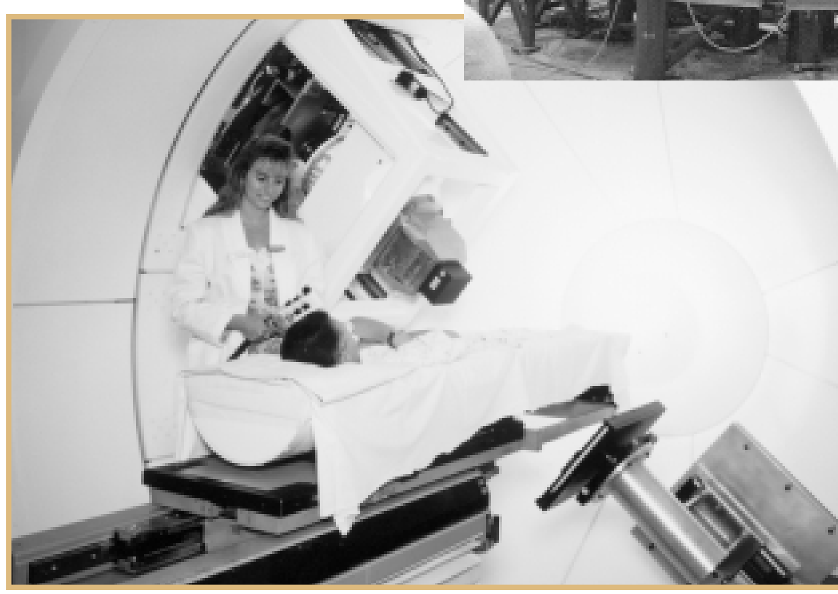
Robert R. Wilson, Fermilab's founding director, first proposed using protons for cancer therapy in a 1946 paper, "Radiological Use of Fast Protons" (*Radiology* 47:487-491, 1946). Wilson, then at Harvard's Research Laboratory of Physics, wrote: "The range of a 125 MeV proton in tissue is 12 cm., while that of a 200 MeV proton is 27 cm. It is clear that such protons can penetrate to any part of the body."

Fermilab's Neutron Therapy Facility has the highest energy and the deepest penetration of any fast neutron beam in the United States. Fast-moving neutrons are effective against large tumors. Chicago-area radiation oncologists Lionel Cohen and Frank Hendrickson worked with Fermilab Director Robert R. Wilson to build the Neutron Therapy Facility. Cohen served as the first NTF director, and the first patients were treated on September 7, 1976. More than 3,100 patients have been treated in 25 years.

The proton accelerator for Loma Linda University Medical Center in California was assembled and tested at Fermilab, then dismantled and shipped to Loma Linda.



One of Fermilab's first employees, Don Young, helped plan and build the Neutron Therapy Facility. When he was diagnosed with prostate cancer in October 2000, he chose neutron therapy over surgery. "Knowing and understanding the neutron treatment method, the facility at Fermilab, the people here and the number of patients they've treated, it was an easy decision to make," he said.



Loma Linda University Medical Center

Loma Linda University Medical Center uses the world's first proton accelerator built specifically to administer proton therapy in a medical environment. The synchrotron accelerator was built at Fermilab and shipped to Loma Linda, where the first patients were treated in 1990. Since then, more than 6,000 patients have been treated. Loma Linda researchers are now intensifying their efforts to apply proton therapy to breast cancer.

Tools for Biomedical Research

At the forefront of biomedical research, medical scientists use particle accelerators to explore the structure of biological molecules. They use the energy that charged particles emit when accelerated to nearly the speed of light to create one of the brightest lights on earth, 30 times more powerful than the sun and focused on a pinpoint.

Deciphering the structure of proteins is key to understanding biological processes and healing disease. To determine a protein's structure, researchers direct the beam from an accelerator called a synchrotron through a protein crystal. The crystal scatters the beam onto a detector. From the pattern of scattering, computers calculate the position of every atom in the protein molecule and create a 3-D image of the molecule.

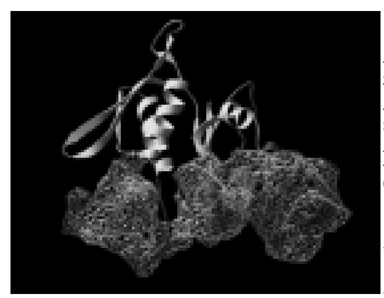


Image: Lawrence Berkeley National Laboratory

Physicists originally built synchrotron accelerators to explore the fundamental nature of matter. At first, they looked on synchrotron radiation as a troublesome problem that sapped electrons' acceleration energy. However, they soon saw the potential to use this "nuisance" energy to create ultrapowerful beams to study biological molecules and other materials.

Now, researchers at synchrotron light sources use dedicated particle accelerators to explore the molecules of life with matchless power and precision. Future accelerators will create still higher-energy beams for both particle physics and biomedicine.

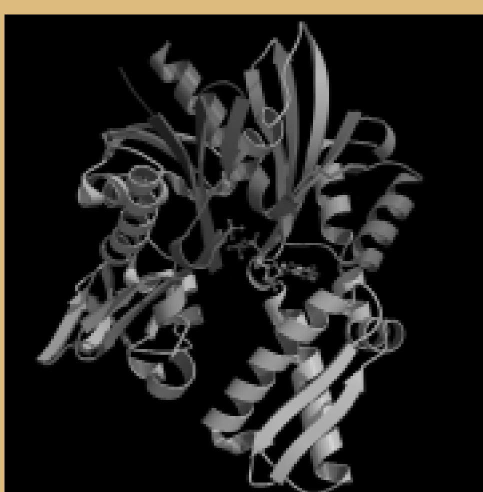


Image: Argonne National Laboratory

Scientists at DOE's Argonne National Laboratory's Structural Biology Center used light from Argonne's Advanced Photon Source to create this image of the Human Heat Shock Protein 70 (hsp70). Human hsp70 is important in cell folding and binding, and is created in large quantities when the body is under stress.

Photo: Lawrence Berkeley National Laboratory

A researcher at the Advanced Light Source at DOE's Lawrence Berkeley National Laboratory.

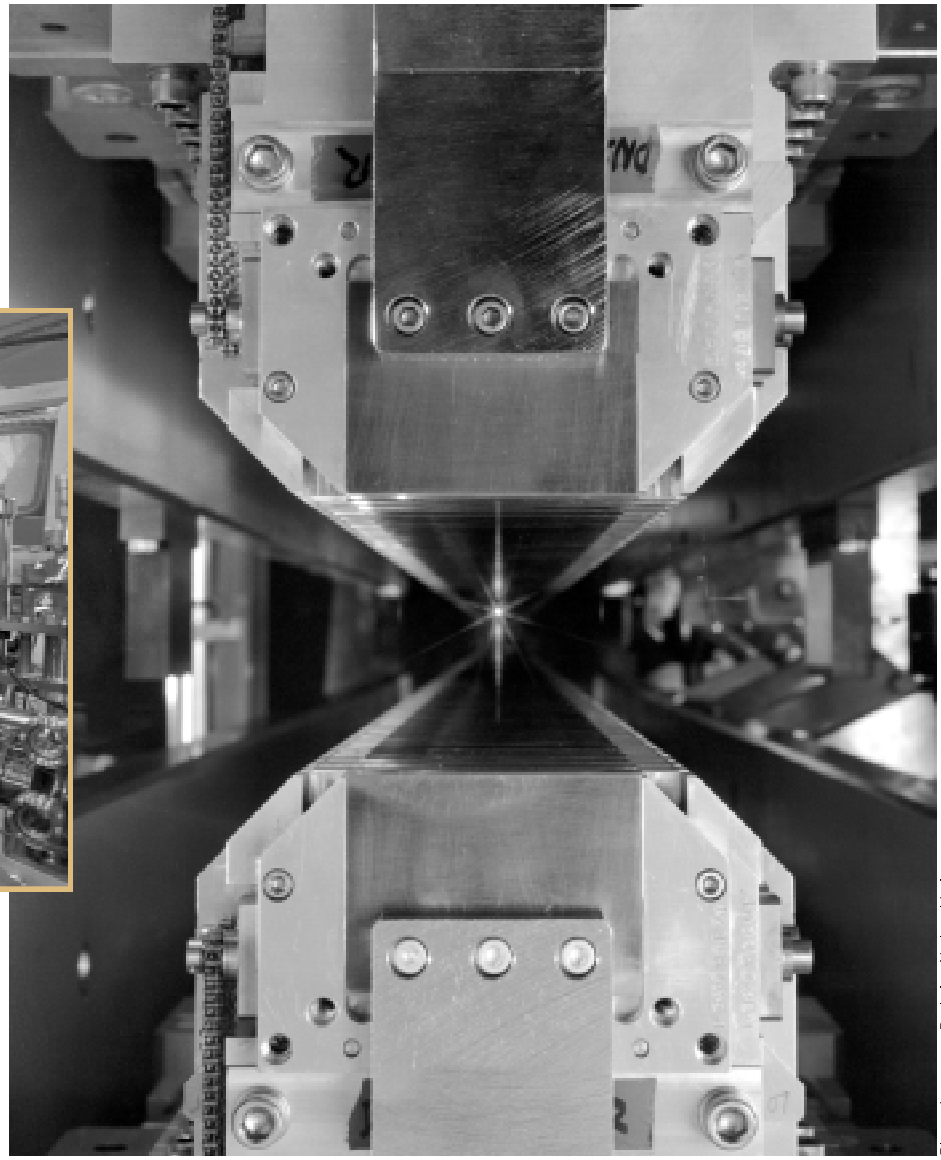


Photo: Lawrence Berkeley National Laboratory

An undulator, in use at the Advanced Light Source at DOE's Lawrence Berkeley National Laboratory. Each undulator contains two 4.55-meter-long arrays of permanent magnets with alternating polarity.The arrays are supported by a superstructure capable of resisting the force of their attraction—up to 42 tons (the weight of a 38,000 kg mass). As an electron beam passes through a vacuum chamber between the arrays, the magnets cause the beam to curve back and forth and thus to produce synchrotron radiation. Undulators produce light brighter than that from other types of synchrotron radiation sources, with the added characteristics of partial coherence and linear polarization. In this photograph, a strobe light emulates the electron beam.

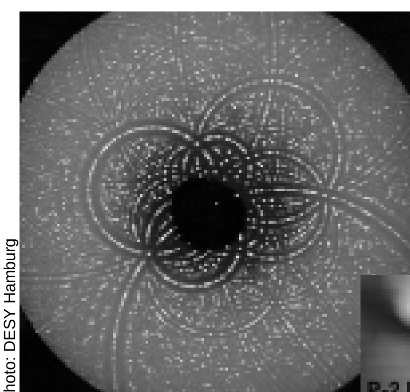


Photo: DESY Hamburg

Diffraction image of a biomolecule. Beams from a synchrotron light source pass through crystals of protein to create images like this one. Using this diffraction technique, scientists can use light sources from particle accelerators to decode the internal structure of complex protein molecules such as enzymes.

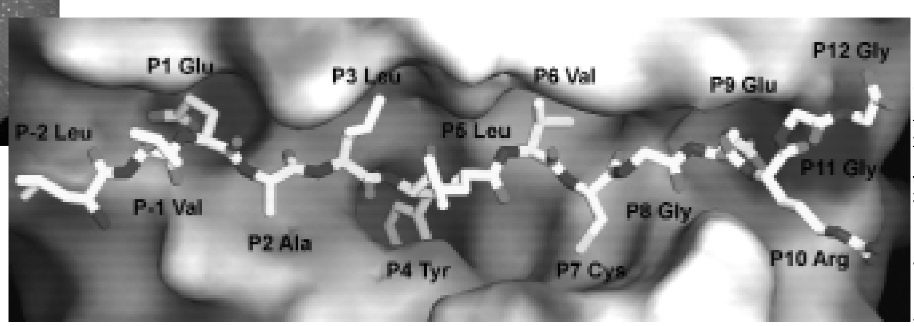


Image: Argonne National Laboratory

Researchers using a beamline at the Advanced Photon Source at DOE's Argonne National Laboratory have discovered clues that promise a better understanding of the prevention of juvenile diabetes. Here, an insulin molecule binds to a human glycoprotein found at the cell surface.

Tools for the Future

The future of accelerator physics isn't just for physicists. As in the past, tomorrow's discoveries in particle accelerator science may lead to unexpected applications for medical diagnosis, healing and the understanding of human biology.

fermilab Photos

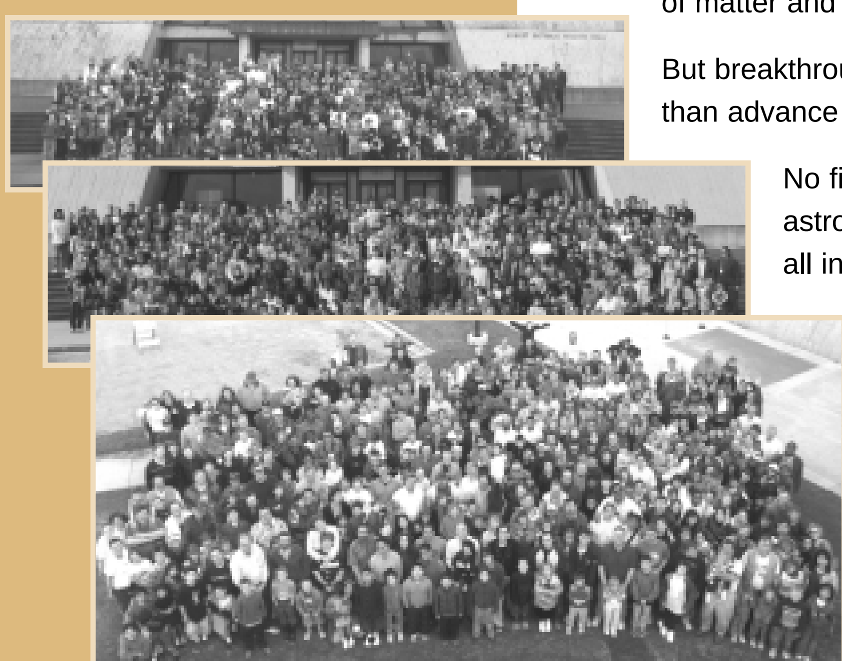
Breakthroughs in the technology of superconducting magnets, nanometer beams, laser instrumentation and information technology will give high-energy physicists new accelerators to explore the deepest secrets of the universe: the ultimate structure of matter and the nature of space and time.

But breakthroughs in accelerator science may do more than advance the exploration of particles and forces.

No field of science is an island. Physics, astronomy, chemistry, biology, medicine—all interact in the continuing human endeavor to explore and understand our world and ourselves. Research at high-energy physics laboratories will lead to the next generation of particle accelerators—and perhaps to new tools for medical science.

National laboratories build particle accelerators for physicists. The results belong to everyone.

Each year, on Daughters and Sons to Work Day, Fermilab's children spend the day with their mothers and fathers, getting a firsthand look at life at an accelerator laboratory. Breakthroughs in accelerator physics, with applications in medical science, may mean healthier lives not only for Fermilab's children but for future generations of children everywhere.



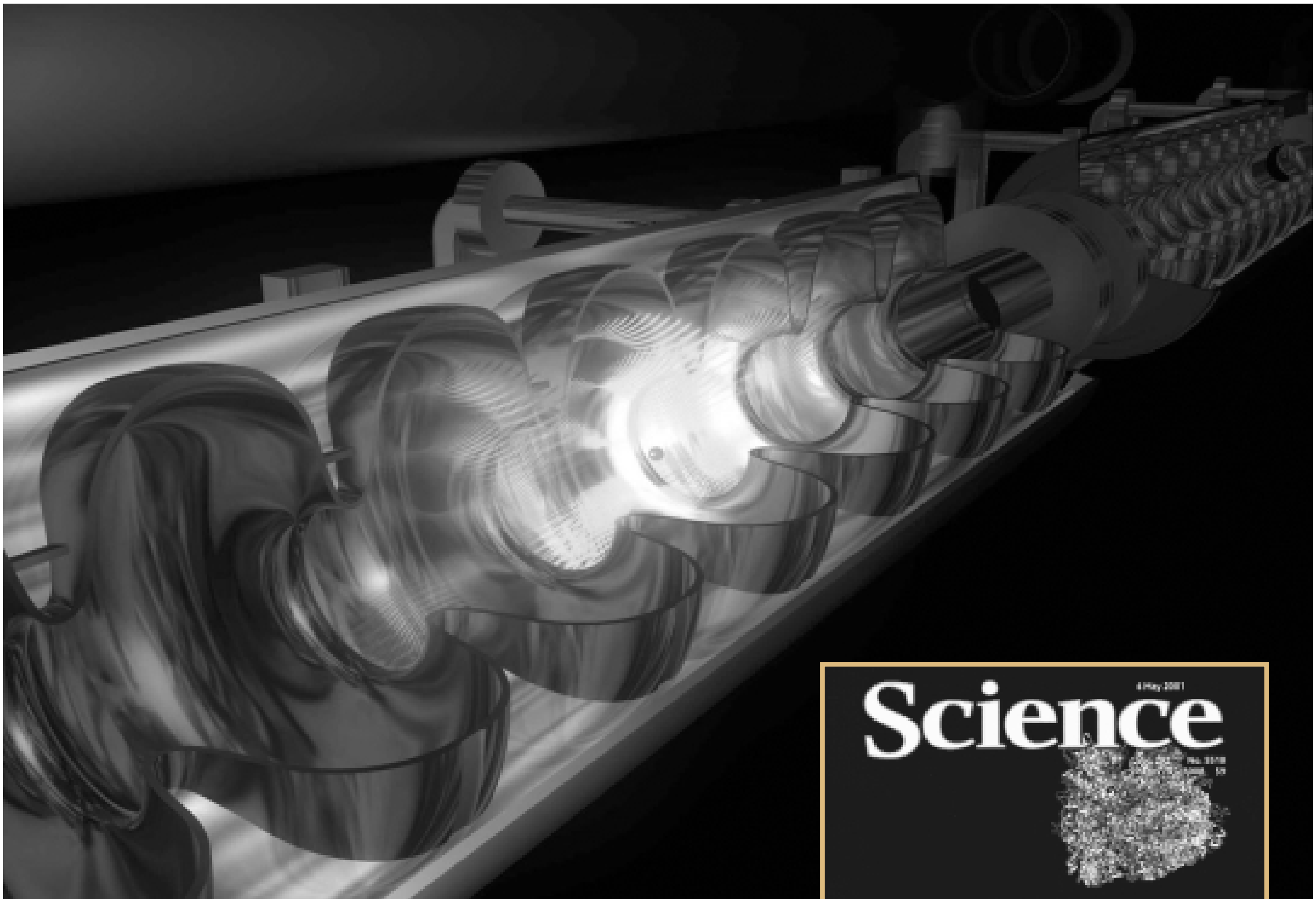


Image: DESY Hamburg

New technologies, such as these niobium superconducting structures designed to accelerate electrons to nearly the speed of light, promise to take particle accelerator science to an unprecedented level. The R&D for particle accelerators takes place at national high-energy physics laboratories, including Fermilab, the Stanford Linear Accelerator Center in California, CERN in Switzerland and DESY in Germany.

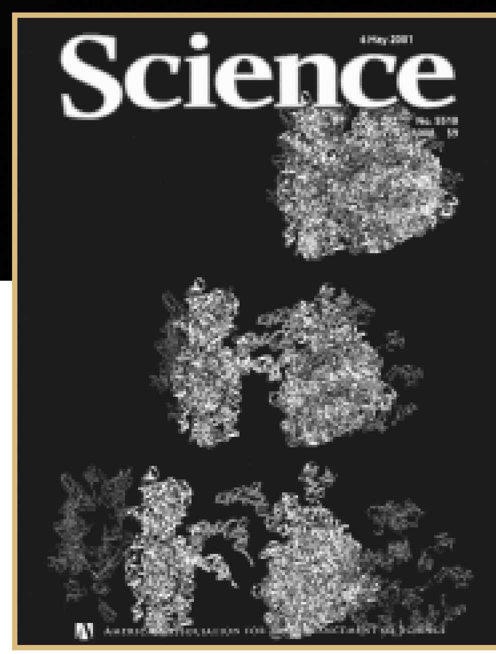


Image: Lawrence Berkeley National Laboratory

The next generation of super-powerful accelerator light sources will play a key role in advancing the understanding of how genes function—how the human genome translates into the human being. This image of RNA, the intermediary between DNA and the structure of proteins in the cell, came from research at the Advanced Light Source at DOE's Lawrence Berkeley National Laboratory.

Image: UIC MR Research Program

An architect's drawing shows a new Center for Magnetic Resonance Research at the University of Illinois at Chicago. The Center will house not only the latest 3.0 Tesla whole body scanner but also the world's first 9.4 Tesla whole human body scanner. The Center for Magnetic Resonance Research will provide leadership and resources for the continued development of magnetic resonance imaging technology for research and medicine. It will provide unique post-graduate education opportunities, and, ultimately, improved medical care for the citizens of Illinois.

Neutrons Against Cancer

25 Years of
Neutron Therapy
at Fermilab

Frank Hendrickson, M.D. (left), one of the founding oncologists of the Fermilab Neutron Therapy Facility, received an award from physicist Don Young, who led the team building the neutron beamline in 1975. The awards were part of a ceremony in Wilson Hall marking the 25th Anniversary of the Neutron Therapy Facility on September 8, 2001.

by Kurt Riesselmann

More than 150 people, including former patients from across the United States, came to Fermilab on September 8 to celebrate a true success story. Twenty-five years ago, the Neutron Therapy Facility at Fermilab treated its first cancer patient.

The idea to build a medical facility at Fermilab developed in the early 1970s when physicians and physicists shared a vision: to wield accelerator technology to combat cancer. Today, more than 3,100 patients have come to Fermilab in the hope of finding a cure for some of the worst tumors known in the medical field.

Former patient Rahel Kent, who came to NTF in 1996, shared her story with the audience, recalling how it all started.

“First it felt like a sore throat,” she said. “Weeks later, half my throat was blocked.”

Physicians didn’t immediately recognize the growing tumor. Soon, however, Kent learned the shocking truth. At age 34, she had developed salivary gland cancer, a rare disease usually associated with older people who chew tobacco, a habit she had never practiced.

She was offered a devastating solution to the problem: Surgery that would remove large parts of her jawbone, two-thirds of her tongue and hopefully the entire tumor. It was unclear whether Kent would be able to keep her voice—or even stay alive.

Photos by Reidar Hahn

Physicist Arlene Lennox, here viewing CT scans, has become the heart and soul in the day-to-day operations of Fermilab’s NTF in the last 16 years.

“My articulation is the essence of what I do,” said Kent, who works as a criminal defense attorney in Los Angeles.

She decided to look for treatment alternatives and used the Internet to find more information. After a few unsuccessful searches, she finally made the right decision.

“I typed the words salivary gland cancer,” she said. “I had eighteen hits, nine from Fermilab.”

She called Arlene Lennox, the head of Neutron Therapy Facility at Fermilab. Learning the details of Kent’s disease, Lennox asked her to send copies of her medical records to Dr. Jeffrey Shafer of Provena Saint Joseph Hospital, which operates NTF. Soon Kent received a phone call from Shafer, and she talked to him for three hours. Eventually she received an appointment for neutron treatment - and she was cured.

Physicist Miguel Awschalom (left) and physician Lionel Cohen, here with engineer Max Palmer and designer Jim Edwards standing in the freight elevator that would eventually become the treatment room, were key members of the early NTF team.

With the help of Fermilab physicists, Hendrickson soon devised plans for a new medical facility.

"In our first proposal, we wanted to do everything: protons, neutrons, pions," recalled Hendrickson. "But it was considered much too big by the National Cancer Institute. We then submitted a scaled-down project with just neutrons."

The neutron proposal didn't require the construction of a new building that would have cost more than a million dollars. Instead, it relied on the conversion of a freight elevator, which technicians had used to lower equipment into the accelerator tunnel, into a treatment room in which patients could be lowered into a new neutron beamline to be built. The National Cancer Institute approved the plan and provided funding.

"Dr. Shafer is not only one of the finest physicians, but also one of the finest human beings I know," Kent enthusiastically described her encounters with the physician. "He has a heart of gold."

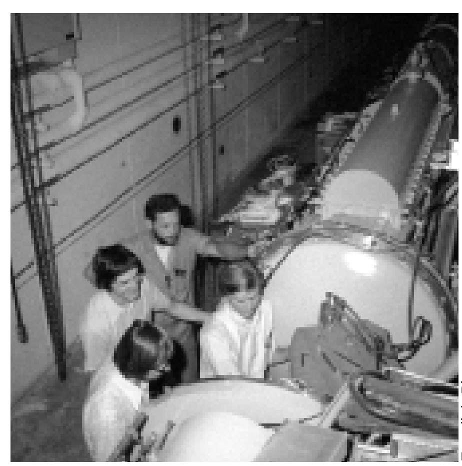
Shafer is one of several physicians who treat patients at NTF and continue to build upon a quarter century of beams for healing. On September 7, 1976, Frank Hendrickson and Lionel Cohen were the first physicians to treat a patient at NTF.

"Hendrickson took a leadership role," said Lennox. "He had to address three constraints. First, neutron treatment could not interfere with the high-energy physics program. Second, he had to get his own money. And finally, the doctors had to head the [medical] research and make the final decisions."

Hendrickson initially worked with Fermilab physicists Cy Curtis and Don Young, who were very supportive of the idea to use a fraction of the high-energy proton beam for medical purposes. After it became clear that the Linac could accelerate and deliver more protons than needed for the Main Ring accelerator, the Universities Research Association, which operates Fermilab, provided 75,000 dollars of seed money and encouraged Hendrickson to obtain more money from charities and other funding organizations.

To create the neutron beam, Young and his colleagues designed and constructed two magnets to divert a fraction of the Linac proton beam, bend it around a ninety-degree curve and direct it toward a beryllium target outside of the freight elevator. The 66-MeV protons interact with the beryllium atoms and produce fast neutrons that travel in the same direction as the original protons, eventually entering the treatment room through a collimator, a concrete cylinder with a hole at its center.

Positioning a patient in front of the hole and choosing a collimator with the right hole size, NTF specialists can deliver neutrons to a tumor of any size while minimizing the exposure of healthy cells to the beam. Because the neutrons damage cancerous cells much more than any other form of irradiation, NTF patients only need to receive one third of the number of treatments compared to patients of photon or proton treatment centers.

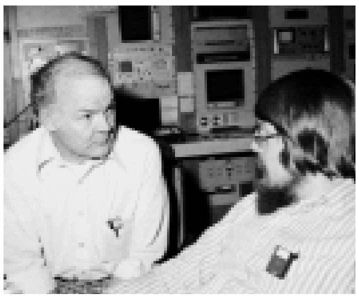


Fermilab Photos

Scientists had to install a magnet in the beamline of the already existing linear accelerator to extract proton beams and direct them to the neutron production target.

To explain the differences in the various therapies, Hendrickson compared photon (x-ray) and neutron beams of equal energy.

"The effect of photons is like one thousand ping pong balls entering a room and bouncing around," he said. "Now put the same amount of energy into one bowling ball. That's the neutrons. If they strike a part of the DNA, it cannot be repaired by the cells. The damage done by photons can often be repaired."



Don Young, here shown in 1975 with Al Jones (right), was the first head of the linear accelerator group. He strongly supported the idea of neutron therapy at Fermilab and led the design and installation of the new neutron beamline.

Because of cost, photon treatment is still the preferred form if doctors decide to use irradiation. For tumors located near critical nerves like the spinal cord or inside an eye, proton treatment has proven to be very effective. The Loma Linda University Medical Center, for which Fermilab built a proton accelerator in the late 80s, treats about one thousand patients a year, one third of all proton patients in the U.S. But for some types of cancer, referred to as radioresistant tumors, both photon and proton therapies fail. Only the more powerful neutron treatment provides the chance of eliminating these tumors that are often inoperable and too large for chemotherapy.

"The first NTF doctors went after those patients that had no other options," said Lennox, who has worked at NTF since 1985. "Photon treatment applies to about seventy percent of all cancer cases treatable with radiation. In fifteen percent of cases, tumors are small and close to critical structures, and proton beams are the most effective. The final fifteen percent present hard to treat cases of cancer. That's where neutrons are the treatment of choice."

To honor the work of the early pioneers, Lennox, who received an award from Fermilab director Mike Witherell for her "vision, commitment and compassion," presented on behalf of NTF an award to Frank Hendrickson, who retired from NTF in 1995, as well as a posthumous award to Lionel Cohen, who died in 1999.

"Hendrickson and Cohen took the medical program from research to an accepted choice of treatment that Medicare and health management organizations would pay for," Lennox said.

Lennox also presented a posthumous award to medical physicist Miguel Awschalom, who had greatly contributed to the development of NTF during its first ten years, and she announced that the Honorable J. Dennis Hastert, Speaker of the U.S. House of Representatives, would receive an award for "his support of the Neutron Therapy Facility." Hastert, who had to cancel his ceremony participation on short notice, has helped NTF to upgrade its facilities with a computerized tomography scanner and secured funding for additional improvements.

The NTF now has the only vertical CT scanner in the U.S. "We now can do CT scans of people sitting or standing, in exactly the position in which they will receive neutron treatment," Lennox said, explaining the significance of the new instrument.

Accelerators, however, remain one of the most important tools in the battle against cancer. Former patients like Kent are proof for the successful partnership of physics and medicine.

"Fermilab saved my life," she said.

Fermilab Photos

In November 1995, Larry Narum, CEO of Provena Saint Joseph Hospital (sitting in the treatment chair) and medical physicist Brian Pientak posed for reporters in the NTF treatment room as Provena assumed operation of the facility.

On the Web:

Neutrons Against Cancer:
www-bd.fnal.gov/ntf/neutrons_against_cancer/NAC_index.html

Fermilab NTF homepage
www-bd.fnal.gov/ntf/ntf_home.html

Streaming video: A Neutron Therapy Retrospective
vmsstreamer1.fnal.gov/VMS_Site_02/VMS/NTF/index.htm

Neutron therapy facilities worldwide:
www.medrad.nac.ac.za/faciliti.htm

CALENDAR

Website for Fermilab events: http://www.fnal.gov/faw/events.html

Fermilab Arts Series Presents:

OPENING NIGHT

Saturday, September 15, 2001 $17
($9 ages 18 and under)
Ramsey Auditorium, Wilson Hall 8 p.m.
Carol Wincenc, Flute & Nancy Allen, Harp

ONGOING

NALWO

Free English classes in the Users' Center for FNAL guests, visitors and their spouses. The schedule is: Monday and Friday, 9:30 a.m. - 11:00 a.m. Separate classes for both beginners and advanced students.

DANCING

International folk dancing, Thursdays, 7:30-10 p.m., Village Barn, newcomers always welcome. Scottish country dancing, Tuesdays, 7:30 - 10 p.m., Village Barn, newcomers always welcome. For information on either dancing group, call Mady, (630) 584-0825 or Doug, x8194, or email folkdance@fnal.gov.

BARN DANCES

Fermilab Barn Dances, featuring traditional square and contra dances in the Fermilab Village barn. Admission $5 for adults, $2 for age 12-18, and free for under 12 years old. The Sunday evening dances will continue October 14 and on the second Sunday evening of each month through next June. The Sunday afternoon dances resume November 18, at 2:00 PM, and will continue on the third Sunday of each month through April. Contact Dave Harding (x2971, harding@fnal.gov) or Lynn Garren (x2061, garren@fnal.gov). Check our Web page (http://www.fnal.gov/orgs/folkclub/) for schedule updates.

LABNOTES

TAI CHI

Tai Chi Classes will be held at the Recreation Facility from September 24 to November 14, Monday and Wednesday evenings from 5:30 to 6:30 PM. See the Recreation Web page or http://fnalpubs.fnal.gov/benedept/recreation/classes.html

ENTERTAINMENT BOOKS ON SALE

Entertainment Ultimate books with major discounts are now bigger and better for the same low price of $25. Available in the Recreation Office, WH15W (sample books on display).

RECREATION MEMBERSHIPS

Year 2002 memberships are available n the Recreation Office, WH15W, from 8:30-5:00 Monday-Friday. Regular Membership - $70. Student Membership - $40. (visiting graduate students only) New members purchasing their memberships at the beginning of September receive 13 months for the price of 12. Year 2001 memberships expire October 1. For more information contact the Recreation Office, X2548, 5427.

FRENCH-LANGUAGE GROUP

■ *Parlez-vous français?* Join a group of parents with young children for playgroup and conversation in French. Contact Anne at 879-0995 or aheavey@fnal.gov.

PET WEEKEND

■ Homes for Endangered and Lost Pets Annual Household Pet Weekend is being held at the Kane County Fairgrounds in St. Charles. Dog Show Saturday, Sept. 29, and Cat Show Sunday Sept. 30. Bake sale, cash and prize raffles, pet-related crafts & vendors. General admission $1. Pre-registration required for both shows. Call 630-897-7427 for more information or see our website at http://www.geocities.com/help_the_animals/. All proceeds benefit the animals in our care.

MILESTONES

BORN

To Sharon Seales and Manuel D. Seales Jr. (ID 13057N, PPD-Technical Centers, CATV group), a son, Manuel Lenell Seales III, 3 pounds 2 ounces, August 1 at Rush Copley hospital.

AWARDED

To Joseph Angelo Formaggio, a Ph.D. degree by Columbia University, for his thesis: *A Search for Massive Exotic Particles at the NuTeV Neutrino Experiment* (E815).

RETIRING

Michael May (ID 552, BD/AS Mechanical Support Dept.), September 19, 2001.

Robert Gorge (ID 1971, BD/AS Electronic Support), September 30, last day of work was August 31st.

Chez Léon MENU

Lunch served from
11:30 a.m. to 1 p.m.
$10/person

Dinner served at 7 p.m.
$23/person

For reservations, call x4512
Cakes for Special Occasions
Dietary Restrictions
Contact Tita, x3524
http://www.fnal.gov/faw/events/menus.html

Lunch
Wednesday, September 19

Oriental Flank Steak on Jasmine Rice
with Pea Pods and Mushrooms
Coconut Cake

Dinner
Thursday, September 20

Goat Cheese Stuffed Chiles
with Roasted Tomato Fennel Sauce
Pork Tenderloin with Balsamic Glaze
Orzo with Grilled Vegetables
Toasted Coconut Soufflé
with Chocolate Rum Sauce

Lunch
Wednesday, September 26

Roast Pork Loin
over Chipotle Sauerkraut
Garlic and Green Onion
Whipped Potatoes
Poached Pears with
Chocolate Sauce

Dinner
Thursday, September 27

Booked

FERMI NEWS

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The deadline for the Friday, September 24, 2001, issue is Tuesday, September 14, 2001. Please send classified ads and story ideas by mail to the Public Affairs Office, MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include your name and daytime phone number.

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CLASSIFIEDS

FOR SALE

■ '99 Forest River Windsong Class A Motor Home 32-1/2 ft. Excellent condition inside and out. 15,000 miles. Also have a tow car if interested (1998 Chevy Cavalier). Call for details. 630-893-2911.

■ '96 Dodge Intrepid, green, 4dr, 3.5L ES engine, dual airbags, AM/FM/cass, 87K miles. Good condition, no rust, mechanically sound and reliable, no A/C, $3,950. Contact T.J. @ X-3299 or sarlina@fnal.gov.

■ '95 Ford Taurus GL 4D sedan, V6-3.0 L, auto., front wheel drive, air, power steering, windows, door locks, keyless entry, tilt, cruise, AM/FM/cass., dual air bags. 83,500 miles, new front tires, new battery. Very good condition. $3800. barb@fnal.gov, x4136, 630-365-5275.

■ '93 Dodge Grand Caravan, white, auto., airbag, 3.3L, AC, ABS, power steering, locks, and windows, cruise, cup holders, tilt, child locks, AM/FM/cassette, built-in child seats and roof rack, runs well, 77k miles, $5500. Email kaplan@fnal.gov, x3916, 708-488-9884.

■ '92 Mazda 626LX, 4 dr sedan, air, auto., power steering, power windows and locks, AM/FM/cass., cruise, power moonroof, 86,000 miles, one owner, good condition, $3,100, o.b.o. Contact gvanz@fnal.gov, x 4754, Gary Van Zandbergen.

■ '92 Mazda MX3 GS V6, 97k mi, good cond., well maintained, drives great, one owner. $3,000 obo. Call x6736 or 630-692-1701, leer@fnal.gov.

■ '91 Corvette Conv, turquoise, 350, auto, 17K mi. Leather sport seats, AM/FM/CD/tape Bose system, climate control. Asking $19,500. Call Don 630-406-6941 or dccarpenter@prodigy.net.

■ '90 Buick Skylark 4dr. sedan, blue 57k mi., automatic, PS, PB, A/C (works great). Senior citizen-owned $1500 obo. Ken x2083 or sievert@fnal.gov.

■ '84 Ford Bronco II XLT, 4X4, 76,000 miles, 5 speed with overdrive, motor runs great. New manifold pipes. Some rust. $1,200 obo. Call Jim 630-254-7277.

■ Yakima bike rack - 4-bike roof mount, 2 sets of towers both with locks, 1 for cars without rain gutters and 1 for cars with rain gutters, Over $600 new, Asking $250; Tunturi stationary exercise bike - $50; Precor Model 614 exercise rower - $50. Call Carmen Rotolo at 630-529-0135

■ Truck tires: 4 Firestone Steelex radial tires, LT 265/75 R 16, load range E, M/S . About 1/4 inch of treads left on tires, in good condition. $100 for all four. Please call Bud at 630-584-1263

■ Tires & wheels... (4) 17″ KMC Evolution wheels with 225/45 ZR17 tires. Locks and lugnuts included. Less than 10K miles on tires. $1,000 obo Call Ed Dijak x6300 or dijak@fnal.gov, or 630-665-6674.

■ Boat propellers, (1)Michigan Wheel Stainless Steel 14″ x 19 RH, 3 blade, Fits Alpha I & Bravo I, '86 thru present, and 135hp thru 300hp Merc outboards '78 thru present $150. (1) Mercury Aluminum 15.25″ x 21 RH, 3 blade, fits most Mercrusier... $100. Both props are in excellent condition, contact Ed Dijak X6300, 630-665-6674, dijak@fnal.gov.

■ Air compressor, Sanborn (made by Coleman) 3.5 hp, single stage, 11 gallon tank, $100, contact Ed Dijak X6300, 630-665-6674, dijak@fnal.gov

■ Humidor, oak lined with Spanish cedar, humidity gauge, 33″x 32″x 19″ holds hundreds of cigars. Greg 630-557-2523 x3011.

■ 2 years new master bedroom set (head board, 2 night stands, dresser and mirror for king or queen size) made in Italy, only $600. 2 years new TV center, black, fits 27″ TV and sound sys. $55. Folding table and 4 chairs like new $35. Full mattress and box $20. Call 630 355-1253.

■ Bar chairs $35 each, girl's bikes 16″ & 18″ $25 each, misc. animal cages, 18.5 cu ft chest freezer $100, 630-557-2835.

FOR RENT

■ Apartment in St. Charles. Two bedroom all new appliances and carpeting. Large living room, AC, includes water and gas, optional garage. $795. Barb 630-584-4686.

HOUSES FOR SALE

■ Geneva, 2 story townhome on wooded cul-de-sac with mature trees, 2 BR, 2-1/2 baths, 1800 sq. ft., 2 car gar., hobby room and laundry room on garage level, private patio, central air, wood-burning fireplace in family room, brick exterior, all external maintenance, lawn care, and snow removal provide by association, 2000 year taxes $2700, association dues $80/month. $189,900. 630-232-0672.

■ Victorian style home in Hinckley, with loads of charm. Only 25 minutes to the lab. 3BR, 2 baths, woodburning stove in family room. More than 1/2 acre, with fruit trees and garden area. Eat-in kitchen with large walk-in pantry. Formal dining room, living room with restored woodwork. New roof, wiring, bathroom and more. $156,900 Motivated sellers! Scott X4083, hawke@fnal.gov.

WANTED

■ Tree seeds: Burr Oak, Red Oak, White Oak, Shagbark Hickory, Bitternut Hickory for Fermilab's Roads and Grounds Department to plant. Seeds should be separated by species, dried and kept cool. Drop seeds off at Roads and Grounds or call Bob Lootens x3303 for a pickup. The donated seeds from last year are growing beautifully.

■ Used wooden swing set and/or play structure in good condition. Willing to dismantle and haul away. Call Anne at 630-469-2247 or e-mail anne_hengehold@prodigy.net

■ Outboard motor, 5hp to 8hp, short shaft, for inflatable boat. Contact Ed Dijak X6300, dijak@fnal.gov, 630-665-6674.

■ Renters wanted for Fermilab Cooperative Education Student employees. Prefer inexpensive, short-term arrangements (5 to 8 months in duration) that do not require a lease. Great oppty. to rent single room in private residence with shared amenities. To list or for more information, please contact Shelley Krivich, Employment Dept., at krivich@fnal.gov or 630/840-5809. Serious inquiries only.

SENIOR RESEARCH ASSOCIATE, Cornell University, Superconducting RF Research and Development

Cornell University Laboratory of Nuclear Studies has an opening for a Deputy Leader of the Superconducting Radio Frequency Program at the Senior Research Associate level. Cornell is a leading institution in the development of RF superconductivity (SRF). Our program covers SRF systems for the Cornell Electron Storage Ring (CESR), as well as development activities with the International TESLA (superconducting linear collider) and the international Muon Collider collaborations, and we anticipate the launching of new SRF projects in the immediate future. Our program has a strong basic R&D component to address limitation mechanisms in SRF cavities. The Laboratory of Nuclear Studies provides an academic environment with opportunities for supervising graduate students and teaching SRF related courses.

This is a continuing appointment subject to availability of fund under our NSF contract. A PhD in physics is required with at least seven years related experience in RF superconductivity. Further information about SRF activities at the Laboratory of Nuclear Studies can be found on http://www.lns.cornell.edu/public/CESR/SRF. Please send an application with curriculum vitae and three reference names to:

Prof. Hasan Padamsee, Cornell University, Newman Lab, Ithaca, NY 14853-5001, e-mail to search@lns.cornell.edu

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