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The Discerning Eye

Minnesota Innovators



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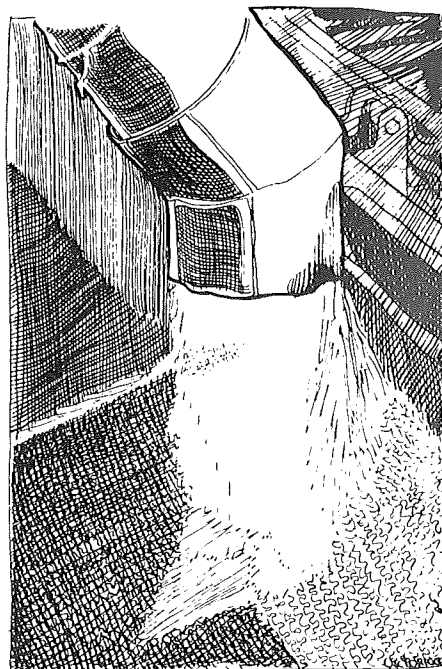
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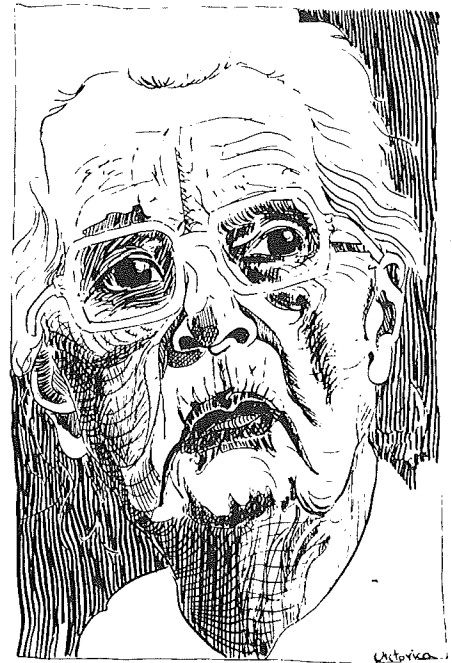
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Introduction

"I do what other fellas don't do," Martin Jopp says. "Fellas say they can't do it, and that's when I get involved."

Martin Jopp has a curious mentality for a man of 72. He is drawn to a dare the way a 12-year-old is drawn to a cigarette, and for many of the same reasons: he is obstinate, arrogant and muleheaded.

All his life Martin has defied convention, and this defiance puts him in the same league as the men and women society has always held in the highest esteem. Whether they are called innovators, pathfinders, sodbusters or pioneers, they are the people who change us and our world. They may be dressed in cassocks, skins or frocks, depending on the particular age and the particular challenge. Regardless of dress, they have always been with us, and they have always made the greatest impression on society. They do it by being troublesome, by bulling their way through their own limits, and those of society--by doing what other fellas don't do.

Martin Jopp hand-built his first car, for instance. He made the pistons, the engine block, and even the mold for the engine block. He finished the car while listening to the news of Lindbergh's landing, on May 21, 1927, coming over the radio that Martin had built, in the machine shop that he and his father had built together.

That radio was the first in the area around Princeton, Minnesota, and Martin found a way of turning his cunning into a pecuniary reward. He ran wires from his radio to his neighbors' houses. For five cents a month, they could listen to Martin's radio through their own speakers.

Martin Jopp did not reap enormous profits from being one of the first inventors of piped-in music. Nor did he get rich from his battery-charging business, his wiring business, his motors, nor his windmills. Martin was too busy to worry about making money; he was learning what had not been provided by his eight years of formal education, and testing what he had learned, and what he sensed was possible.

It is perhaps that sense of the possible that is the bloodline linking Martin Jopp with Charles Lindbergh with Father Hennepin with the others in this magazine. They have all perceived the possible and imposed that perception on the world. It is this that distinguishes them from the simply arrogant and muleheaded. They possess that strength of will, undoubtedly, but it is inspired by something else: a discerning eye.

--Leslie Roberts

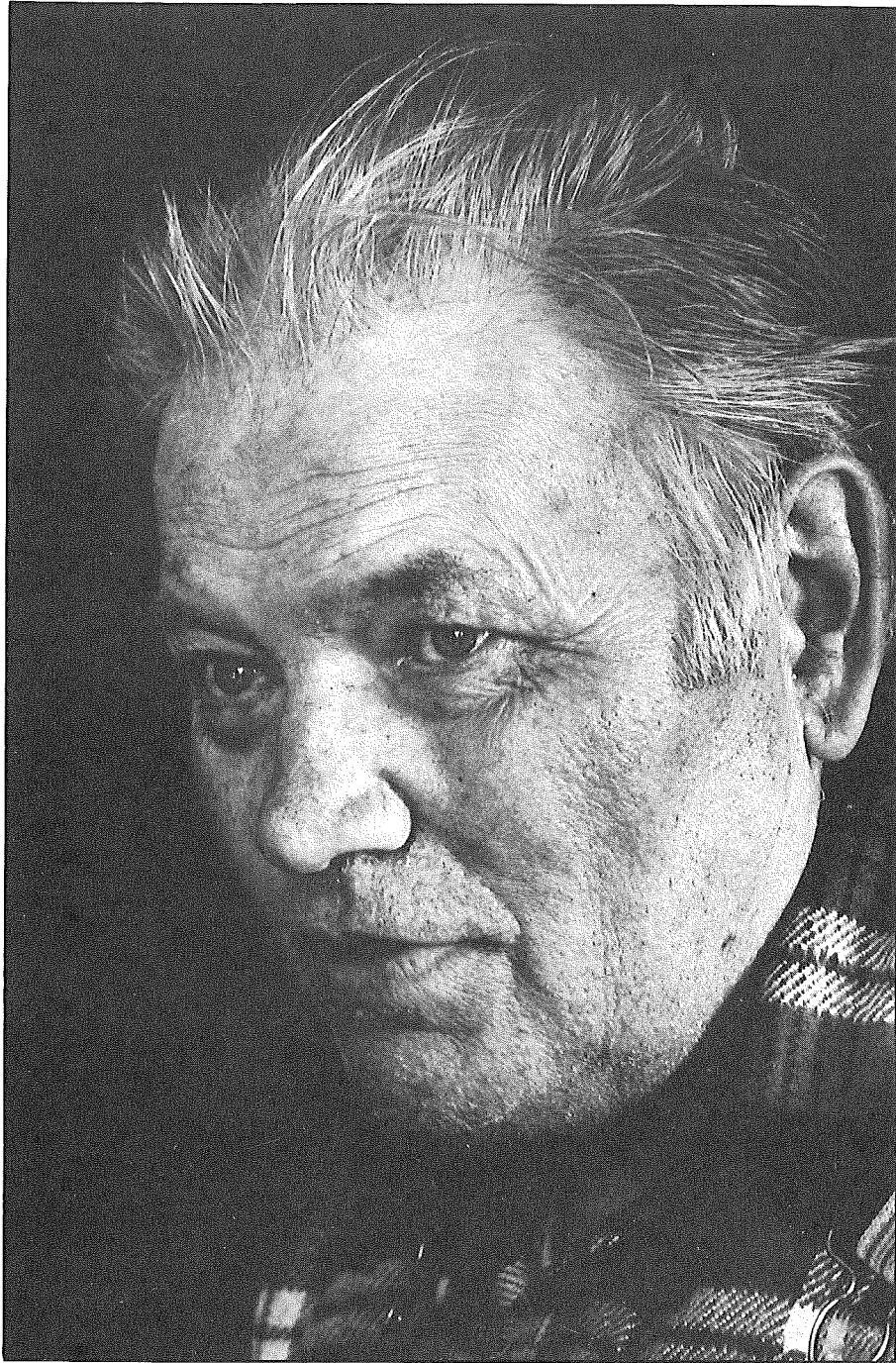
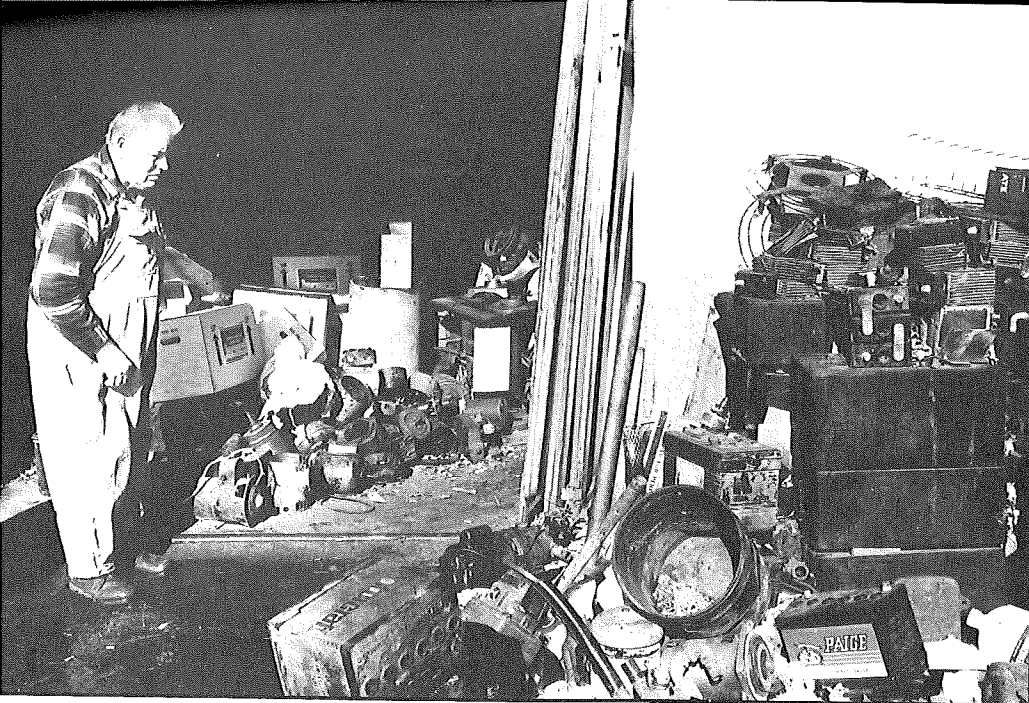


Photo by Rich Beckman

Energy



Photos by Rich Beckman

He quietly and confidently followed his own mixture of instinct, insight and sense, producing exactly what he needed with the materials and energy at hand.

The Wind

By Leslie Roberts

For almost six decades, working out of his cluttered machine shop in Princeton, Minnesota, Martin Jopp has been a world leader-in-waiting. During that time he quietly and confidently followed his own mixture of instinct, insight and sense, producing exactly what he needed with the materials and energy at hand. Unfortunately, it has taken the world all that time--and vast quantities of oil, coal and natural gas--to discover him.

When Martin was a boy, factory-made appliances and ready energy were the exceptions. Soon, however, the Midwest discovered the wonders of mass production and mass consumption. Prices dropped, wages rose, and products became varied, plentiful and enticing. Yet Martin held to his ideas, even as they grew more out-dated. When the utility companies brought gas and centrally-generated electricity to rural Minnesota in the 30s, Martin continued to draw heat from wood-burning stoves, and his electricity from the windmills he had built years before.

He still does. Martin's windmills supply all the electricity for his house, corner store, machine shop and barn. The wind powers his television, his lights and his lathes. In 72 years, Martin has never paid a utility bill.

And that is why he is now being looked up to as something just shy of a messiah.

There was a time when Martin's insistence on self-reliance and conservation made his neighbors think he was mad, or at least laughable. His children were taunted at school about their peculiar lifestyle. Yet Martin persisted.

Lately, the laughter and taunts have stopped. Along with his neighbors who bring their broken appliances for repair, other visitors are coming to Martin's shop. They are coming for advice. Though Martin has not changed his habits in 60 years, society has elevated him from the status of fool to visionary.

The visitors are interested homeowners, reporters, curiosity seekers, and the federal government, which, through the Community Services Administration (CSA), has awarded Martin and a group of alternative energy pioneers a \$100,000 grant to explore the possibilities of wind-generated electricity.

With their portion of the grant money, Martin and the 20 workers on his farm will construct six windmills that will be installed at low-income homes in central Minnesota. Researchers from the University of Minnesota at Morris will then monitor how efficiently the windmills provide domestic electricity.

Even though the low level of funding indicates that the grant is more of a gesture than a serious commitment to wind power, Martin is delighted with the belated recognition.

"The CSA approached us," says Don Marier, who will be working with Martin on the project. "They'd decided to do a wind demonstration project, then they heard about Martin and he was the logical choice." Martin is the logical choice. He was one of the first experimenters to convert wind into electricity. Although he performed his experiment on a small scale--with a battery and a flashlight bulb--it was still electricity, Martin says. He was ten years old at the time.

"At that age," Don says, "he had the concept."

After that early coup, Martin started building windmills. He does not say how he learned this craft; instead, he offers his advice on education: "You do things first, then read about them later."

"I was a boy and so was the windmill business," Martin says, explaining why he entered the field.

He did not need much encouragement to enter: the wind was there--the sensible thing to do was harness it. Long before anyone predicted an energy shortage, Martin was exploring the use of renewable fuels. Before the word for it arose, the idea of recycling was as ingrained in Martin's mind as the oil in the creases of his hands.

Wind is abundant, and as enduring as the sun that creates it by the uneven heating of the earth's surface. Wind energy is free, clean, and invites use. For centuries, people have built windmills to help with mechanical chores, like pumping water or grinding grain. Some of these old, mechanical models, with their many short, fat blades that turn in the slightest breeze, are still scattered over Minnesota farmlands.

Windmills designed to generate electricity are more complicated and less picturesque. These wind generators have two or three long skinny blades that

resemble airplane propellers. For the generator to produce a continuous electric current, these blades must turn at a high, steady speed. Wires conduct the current to deep-cycle batteries where it is stored for use on windless days.

Windmills were commonly used in the 1920s and 30s until the power companies penetrated the rural areas. The windmills Martin made at that time were quite similar to those made by the Jacobs Wind Electric Company--"the Cadillac of windmills," Martin says--though he reached his design independently.

In 1953, when the Jacobs Co. stopped manufacturing, Martin bought the company's plans and equipment. He modified the Jacobs model, incorporating the best features of his own design, and started producing windmills for sale. But this was the dawning of the era of cheap power, and before he had completed his fourth windmill, the demand had virtually ceased. He put his equipment away.

With the 1973 energy crisis came a resurgence of interest in wind power. People around the country began building new windmills and refurbishing the old models. Martin brought out the Jacobs equipment and tried again.

Just as he did 50 years ago when building his car, Martin makes everything his business demands, including the molds for the various parts. In manufacturing, he does not use any new materials or energy sources. For metal,



Martin smelts old beer cans, tea kettles, and some of the other discarded junk metal he has piled around his shop. He never throws anything away. A small path winds through his shop, among mountains of old batteries, generators and motors on the floor, and cables hang from the rafters. Eventually, it all finds a use in one of Martin's endeavors.

As the heat source for smelting the metal, Martin uses the drain oil usually discarded after a car's oil change. The lights and tools in the shop, of course, are powered by the wind. "This is the only place," Martin says, "that makes windmill parts with the power of the wind."

Martin's two windmills supply all the electricity he needs for his many efforts. According to Jim Tucker, who is studying with Martin on the farm, each windmill provides about \$15 to \$20 worth of electricity per month, converted into Northern States Power terms--enough for a small house, says Martin, if the power is used sensibly.

Windmills like Martin's cost approximately \$6,000 commercially. Most people are shocked by the price, according to Martin. But before they decide it is too big an investment, he says, they should realize that they spend that much on a car that falls apart in a few years. A windmill lasts forever.

Martin thinks a windmill is a sensible investment for farmers or other people living in the country, especially if they make the windmill themselves. Although building windmills is not easy, it can be done. With Martin's help, Don Marier

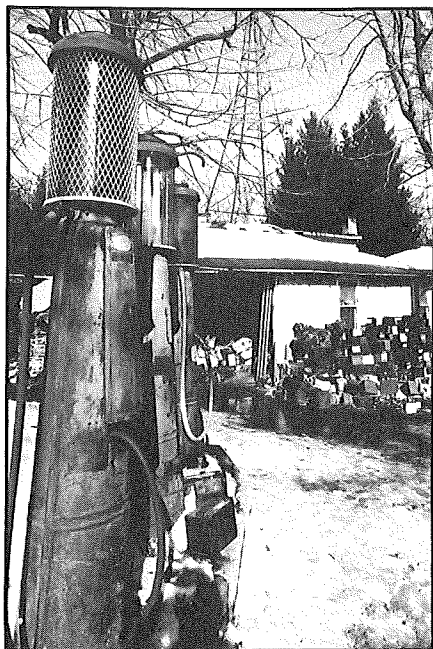
built his windmill for about \$300.

Despite their practicality in rural settings, windmills are not a viable alternative for generating electricity in urban areas. To function efficiently, a windmill must be at least 20 feet taller than surrounding trees and buildings. Zoning regulations restrict the height of urban structures, yet even without these regulations, the base of a windmill tower might require more space than is available on a cramped city lot.

Another disadvantage to windmills in urban areas is their need for maintenance. Darryl Thayer, technical director for the Center for Local Self Reliance in Minneapolis, and a friend of Martin's, says that in the city, "Most people aren't ready to go back to a lifestyle that involves increased maintenance on their structures." Because farmers understand the need for maintenance, and have time to schedule their own repairs, windmills are ideal for rural lifestyles, he says.

With the CSA grant, the challenge for Martin and the others working with him on the project will be to build windmills that demand minimal upkeep and that are not prohibitively expensive.

This new project will undoubtedly draw more visitors to the machine shop where Martin has worked quietly for almost sixty years. Glorifying in his new-found fame, Martin boasts that the Soviet Union is the only country that has not sent a representative to talk to him about his windmills. And his explanation is simple: "If you build a good mousetrap, people will beat a path to your door."



Abby and Don Marier

Rural experimenters

By Leslie Roberts

Don Marier has spent much of the last three years on Martin's farm, learning Martin's craft. In that time, Don has almost completed a wind generator that will provide electricity for his remarkable, energy-efficient house in Milaca, 15 miles from Princeton. He will be building windmills with Martin for the CSA project.

Tales of Martin's talent drew Don and his wife, Abby, to Milaca. Dissatisfied with their urban lifestyle that seemed to ignore today's energy constraints, Don and Abby left Chicago. Yet, once in the country, Don did not want to merely chop wood and till fields; he wanted to use his electrical engineering skills to develop new technologies appropriate to available energy resources. He thought Martin could teach him how to reconcile his former skills and his new concerns.

Three years ago, Don and Abby came to learn. Now they are teachers. The house they designed and built is a model of energy efficiency. And the mimeographed newsletter Don started in Chicago in 1972 is now a bimonthly magazine with 5,000 subscribers.

Alternative Sources of Energy (ASE) magazine began as a mouthpiece for small-scale researchers--backyard experimenters--who wanted to share their ideas about alternative technologies in energy, architecture and transportation. Now it is a non-profit organization dedicated to education in appropriate technology.

Success has not spoiled ASE magazine. Despite a growing number of subscribers, the magazine has not become "professional." ASE is still a forum for ideas in every stage of development; for ideas that would not be communicated otherwise. In articles like "Railroad Bike," and "How to Maximize Your Wind Generator's Output," writers describe their latest experiments, exchange technical advice, applaud each others' triumphs, and commiserate over failures.

As program director, Abby has been expanding the role of ASE, looking for new ways to teach people about appropriate technology. She is currently working with staff from Community Action Programs, helping them incorporate ideas for do-it-yourself projects, such as solar water heaters and greenhouses, into their weatherization program for low-income people.

Abby has also applied for a grant from the Minnesota Energy Agency (MEA) to develop educational workshops for county agriculture extension agents. If ASE receives the grant, in the workshops extension agents will learn techniques of energy conservation that they can teach farmers in their counties.

When they embarked on this energy-efficient lifestyle several years ago, Abby, Don and their seven-year-old son, Steve, were confirmed city dwellers--their transformation to alternative energy pioneers was not easy, Abby admits frankly. When they moved to Minot, Wisconsin--"a little town of 460 people, six bars and two churches," as Abby describes it--they had no sophisticated philosophy or skills for rural living, just the naive "let's-live-in-the-woods" urge.

This urge sufficed in Minot, yet when they decided to build their own house on

80 acres of land, it proved inadequate. Abby laughs as she describes the life they envisioned at the time, "I was going to be the little woman and make cheese." Bugs thwarted their plans--hundreds of bugs that swarmed and buzzed and bit every time they ventured outside. Faced with such adversity, they retreated to Abby's father's rural home and began a serious study of "country skill."

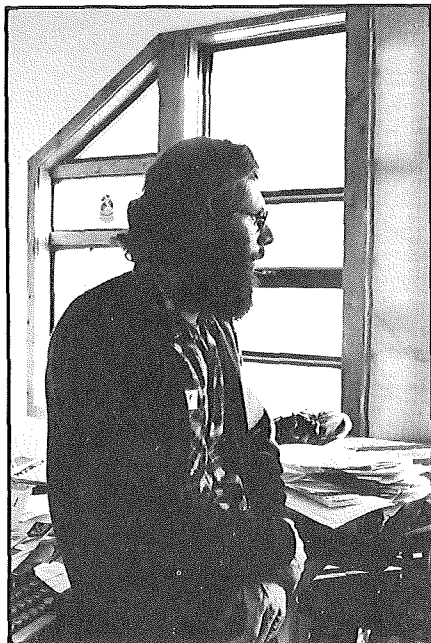
The Marier's studies paid off. Don met Martin, they bought 130 acres in Milaca, and with their newly-acquired skills, began building their house.

The Marier's house is a solar house without solar collectors; a wind-powered house temporarily without a windmill. While Don has been working on the windmill, a tractor hooked up to a generator has provided all the electricity for the house. Six 20-volt golf-cart batteries constitute the makeshift, but efficient, storage system.

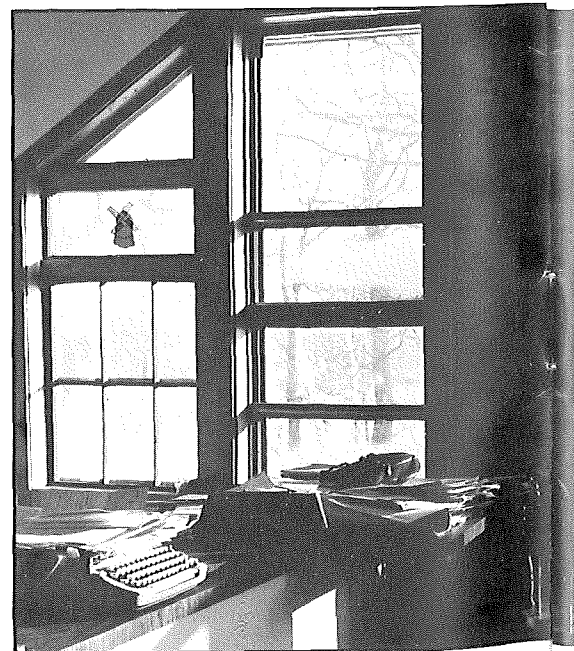
Solar-heated homes usually have collectors that gather the sun's energy, and a storage tank in which it is stored for sunless days. Not the Marier's house: the windows are the solar collectors, Don says, and the house is the storage tank.

Sunlight pouring through the wood-framed south windows heats the entire house. They use a conventional wood-burning stove to supplement the solar heat when the outside temperature falls below zero.

In their house, the Mariers modified the design of French architect Trombe. In a Trombe house, sunlight entering through south windows heats a brick wall



Photos by Rich Beckman



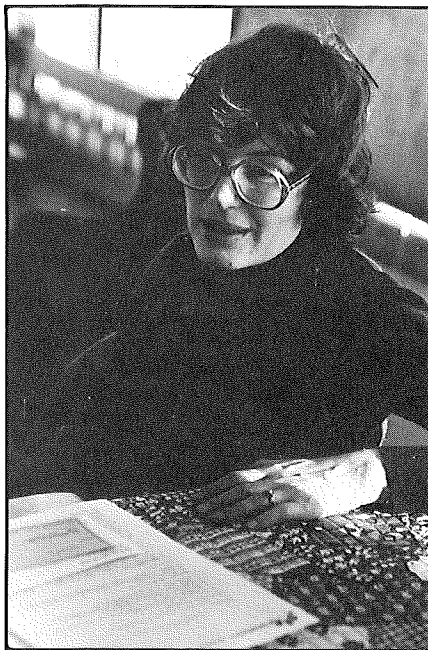
in the living space, which serves as a storage tank.

The Marier's design eliminates the brick wall. Except for those enclosing the bathroom, the house has no walls on the upstairs floor. "Before, we had lived in some pretty small and dark places, so when we wanted to build our so-called 'ultimate' house, we wanted a lot of air and space," Abby explains. This striking, contemporary design contributes to the home's energy efficiency because warm-air circulation is not blocked by walls.

Downstairs, the bedrooms are divided by walls, yet even these walls contain glassless windows that let through the light and heat from the south windows.

The windows are double-paned for insulation. They work by the "green-house effect"--after passing through the glass, some of the light waves are converted to infrared waves that are unable to pass through the glass again. Thus, the heat is trapped inside. At night, the windows are covered with thermal curtains, stuffed with a down substitute, that Abby is making with a grant from the MEA. During the summer, excessive heat is no problem because the sun sits higher in the sky, thus only striking the lower windows in the south wall.

Insulation, as well as design, is crucial to keeping the house warm during Minnesota winters. Twelve feet of dirt piled against the north side of the house protect it from the wind. Windows exposed to the north wind are small. All the walls are well insulated: the front wall



has six inches of arctic foam insulation, the side walls have three-and-a-half inches, and the roof has eight inches. Even the basement is insulated with two inches of styrofoam.

A gas water heater is the Marier's only concession to non-renewable energy. Their dependency on it will be reduced when Don installs a tempering tank over the wood stove to preheat water. Eventually, Don will build a solar collector to heat domestic water.

Water consumption is minimized by a composting toilet that Don built, modeled on the Swedish Clivis Multrum. The toilet works without water, turning human and kitchen waste into high-quality fertilizer in about two years.

At first glance, the toilet looks no different from those in most bathrooms, even though it sits on a cylindrical box instead of a bowl, and has no tank. Waste falls onto a dirt hill in an enclosed chamber below the house, then gradually

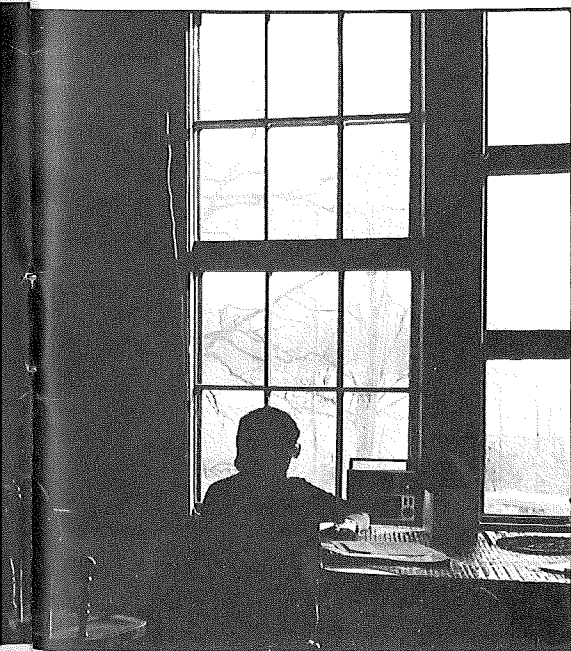
slides down the slope toward the storage chamber. By the time it has reached the chamber, soil bacteria have destroyed any disease organisms in the waste.

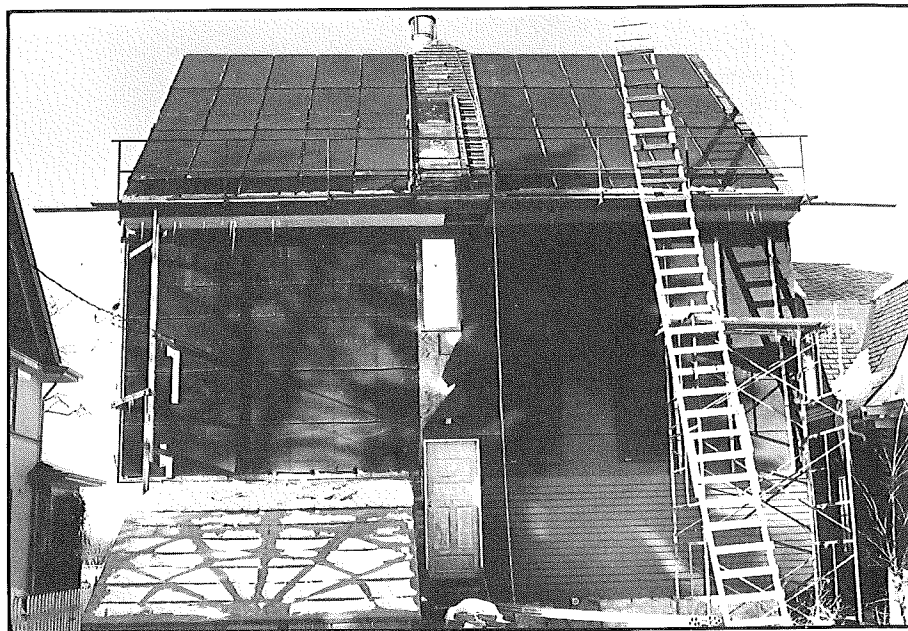
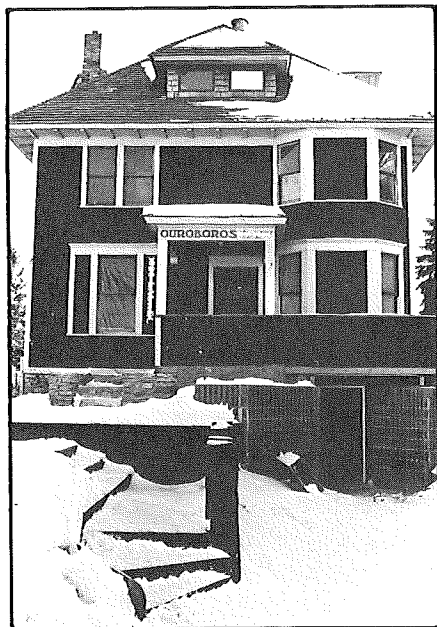
The toilet is odorless, unless there is trouble with the system, just as a flush toilet is odorless unless it overflows. According to Don, composting toilets can be temperamental in the beginning. They must be fed with grass, weeds and other organic matter to establish the optimum environment for bacteria. Without the proper ratio of carbon and nitrogen, the bacteria will not compost the waste.

And the functioning of even well-established composting toilets can be disturbed by their owners' alcoholic indulgences, according to Ned Hoffmann, an industrial arts professor who is using a Clivis in a University of Minnesota project. If the fluid balance is upset, the system will not work well. "A beer party will screw it up for a month," Hoffman says, "while a chili party would help." Such are the prices people must pay for energy self-sufficiency.

The Marier's evolution to an energy-efficient lifestyle is almost complete. When the solar water heater is installed, and the windmill working, the house will need only two motors--one for the refrigerator, which they use only in the summer, and one for the water pump.

Yet autonomous living is just the beginning. Don and Abby have learned about appropriate technology; now they will concentrate on teaching others. Most people have not been exposed to these ideas, Abby says, and some of those who have been exposed think the new technologies are difficult. Not so, she says, "All you need is a little upstairs--all you need is to be able to look at plans and hammer nails. These things are simple to build." And they are not worried about the apparent apathy of the majority of the population. Most people are not interested in appropriate technology now, Abby admits, "but they will be as their fuel bills keep going up and up."





Photos by Rich Beckman

Ouroboros East

A house/museum to meet urban energy needs

By Leslie Roberts

Dennis Holloway is a translator, rendering the appropriate technology developed by rural experimenters into urban language. As energy supplies become increasingly scarce, says Holloway, a professor of architecture at the University of Minnesota, we need to develop some practical alternatives for the people who will be affected most: the urban poor.

Under Holloway's direction, 150 pre-architecture students are retrofitting, or rebuilding, a turn-of-the-century house in a low-income St. Paul neighborhood to meet new standards of energy efficiency. When complete, the house will be a student residence and a community museum and workshop.

"This project is a way of informing people that we have to start conserving... It's a big step if we show people there are some alternatives. The vast majority of people are pretty unaware--80 per cent of the people in the state think the energy crisis is a hoax," says Holloway, citing a recent poll.

In redesigning the house, called Oroboros East after a mythical serpent that regenerates itself by eating its tail, the students have applied techniques of both energy collection and energy conservation. They have installed solar collectors that will provide space and water heat for the house. For conservation, they have restructured the use patterns of the rooms so that heating will require less energy, modified the domestic water system, and installed a variety of insulation materials.

Ouroboros East is an experiment, Holloway stresses. Students will monitor the performances of its various innovations, and those that fail will be changed or replaced.

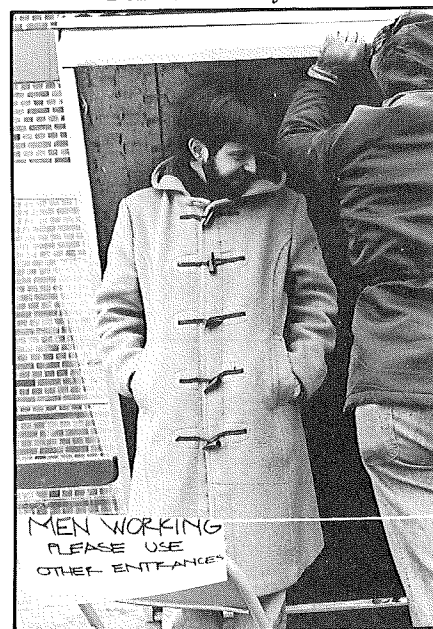
"The goal is education," Holloway says--for the students who have worked on the house, for those who will live in it, and for the public.

Designed with the public in mind, the house was built entirely with materials that can be purchased off the shelf. In workshops offered by the student resi-

dents, interested people can learn how to apply some of these energy-saving techniques in their own homes. Yet Oroboros East will be primarily a museum, not a practical model: few people have the time, money or inclination to completely retrofit their homes.

In Oroboros East, Holloway and his students have modified some of the innovations used in the first house built by the Environmental Design class--Ouroboros South.

Dennis Holloway.



The Ouroboros projects arose from the 1973 energy crisis. Focusing the class on energy, Holloway asked his students to draw up plans for an autonomous, energy-efficient house. Impressed with the plans, Holloway asked himself, "Why not build one?"

Money was the only obstacle, and Holloway soon perfected the persuasive art of fund raising. Within one quarter, Holloway raised \$30,000 from local businesses, and found a site for the house at the University's research center in Rosemount, 25 miles from Minneapolis. The location is far from ideal, but the land was free. Except for the abandoned WW II army compound buildings that house the research center, Ouroboros South is isolated.

Instead of one quarter, as Holloway expected, construction lasted three years--and students are still modifying the house. The entire project has cost \$95,000, including supervision wages and transportation costs for the students who built it. Since completion, two different couples have lived in the house, conducting tours and monitoring the problems that inevitably arise in an experimental system.

And this unique house, with a solar heating system, a solar greenhouse and a sloping sod roof, has had its share of problems. Several attempts to build a windmill to supply electricity have failed, though the idea has not yet been abandoned.

Three different types of solar collectors have been installed at Ouroboros

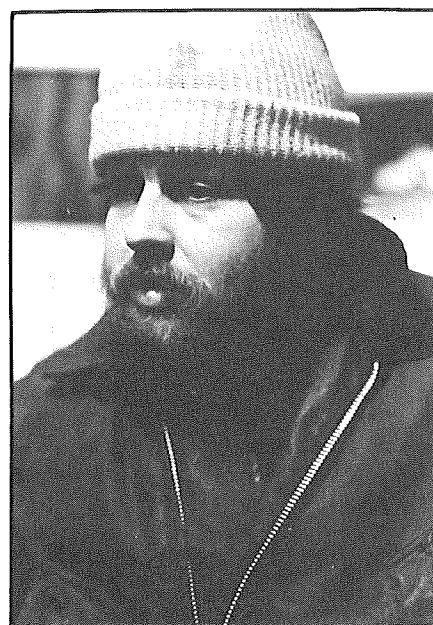
South. The first two collectors did not provide adequate heat for Minnesota winters. The third system, designed by graduate student John Ilse, functioned beautifully until one of the pipes burst this winter in -30 degree F. weather.

"It never should have happened in the first place," says Ned Hoffmann, an industrial arts instructor who is coordinating the Ouroboros East project. "But it did, and other mistakes will, primarily because of the workers." There is nothing wrong with the Ilse collector, he says; it failed because the workers are students who sometimes make mistakes.

"The miracle of that house is that it was done without any plans, just some sketches," Hoffmann says. "When I heard that I almost died." Yet without plans, and despite some problems, the house works. It's an evolving laboratory, says Holloway: students will keep experimenting until they find the best solutions.

"Our first intent was to build this house in the city," Holloway said in an article in *Solar Age*. "My feeling is that the future isn't going to see a lot of new construction out in rural areas, an extending of suburbia. It's going to see a rebuilding and revitalizing of the central city, because land and transportation are going to have to be much more consolidated."

Guided by those ideas, Holloway and a new class of students in 1974 decided to rebuild an urban house for the second Ouroboros project. Rebuilding is more sensible than new construction, Holloway thinks. "We really have to retrofit," he



Ned Hoffmann.

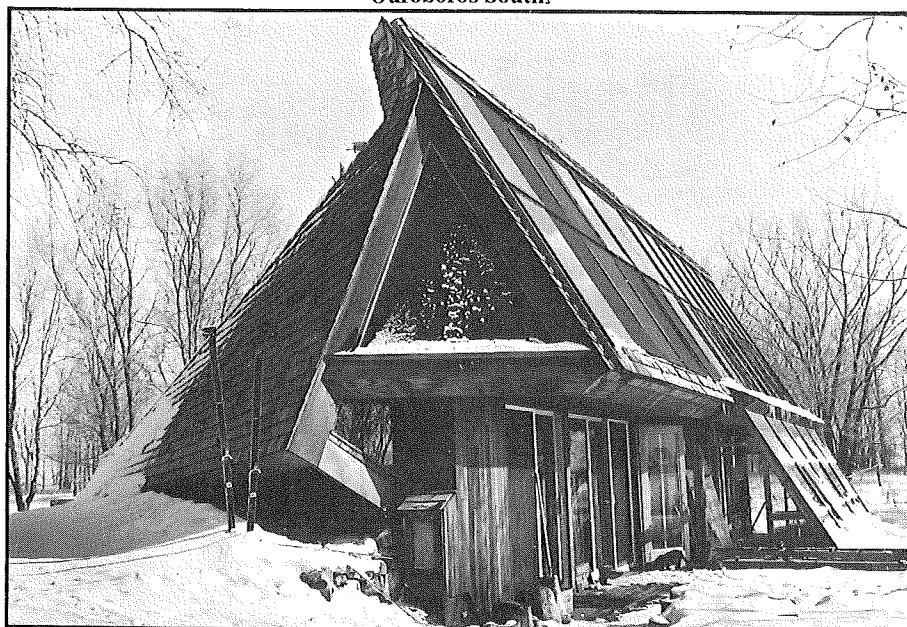
explains. "New energy standards are becoming apparent. All our buildings were designed under different energy assumptions. The assumptions have changed, and so must the buildings."

Employing his fund raising skills once again, Holloway organized a consortium composed of the University of Minnesota, the Minnesota Museum of Science, and the Urban Laboratory, Inc., to share responsibility for construction. The completed house will be operated by the science museum, which will be advised by the University.

For \$1, the students bought a house at 1020 Laurel Avenue from the Housing and Urban Development (HUD) agency. Blessed with all the desired attributes, the house was inexpensive, located in a low-income neighborhood, and had a good south exposure.

The back side of the house is flooded with sunlight all day. To gather this energy and convert it to domestic heating, the students installed solar collectors on the back wall and roof of the house. Because the shiny collectors are not visible from the street, the house retains its Victorian appearance.

Collection of the sun's energy is simple--anything placed in sunlight will heat up. Solar collectors maximize that effect, while minimizing heat loss. Flat-plate collectors, like those used at the Ouroboros houses, usually consist of a transparent glass cover with an absorbent surface underneath. The surface is painted black so that it will absorb more



Ouroboros South.

Energy

heat, just as black pavement does in the summer sun.

The transparent cover minimizes heat loss. Short wavelengths of light pass readily through the cover. Then, upon striking the absorbent surface, they are transformed into infrared wavelengths that cannot pass through the cover. The heat is trapped inside, ready to be transferred to wherever it is needed.

A transfer material, either water or air, is heated as it flows over the absorbent surface. In the commonly-used trickle collector, water trickles down the black surface and then flows into the storage tank.

The small stream of water trickling down the surface does not produce enough heat for Minnesota winters, the builders of Ouroboros South discovered. The Ilse collectors recently installed at the South and the East houses, eliminate this problem. Ilse designed an absorbent surface that enables a whole sheet of water, between one sixteenth and one eighth of an inch thick, to flow over it. Instead of using one sheet of steel for the surface, Ilse spotwelded two sheets together. In this sandwich collector, water is pumped up through the two sheets, and then returns to the storage tank. In the basement tank at Ouroboros East, air is forced past the hot water, through a heat exchanger, and then vented to the rooms above.

At Ouroboros East, the solar collectors will supply between 70 and 80 per cent of the necessary space and water heating. (An electrical heating system and specially modified fireplaces will supplement the solar heat.) For this cold and often cloudy climate, that is an almost unheard-of efficiency rate. Even staunch advocates of solar energy caution against investing in a collector for space heating in this part of the country.

The system works at Ouroboros East because students retrofitted the entire house to conserve energy. Insulation, weatherstripping and modified window designs all reduce heat loss and cold air infiltration. Without these conservation measures, the collectors would not be nearly as efficient.

The living space within the house has also been designed for the most efficient use of available energy, and special venting hatches between the three floors can be used to regulate warm air circulation. The first-floor public museum will be well-used during the daytime, and rarely used at night. The opposite is true for the upstairs rooms: the three students who will live there

will use them at night, and not in the daytime. Each student will have a living room on the second floor and a sleeping room on the third.

In the daytime, only the first floor will be heated with warm air from the solar collectors. In late afternoon, the students will open the venting hatches to their second-floor living rooms, and the warm air will rise and heat them. Before going to bed, they will open the hatches to their sleeping rooms. In the morning, the process is reversed. Hatches will be closed, concentrating the warm air on the ground floor.

As well as conducting seminars and tours, the student residents will have another important function. According to Hoffmann, "They'll live together to see if the sociology of the house is working. The lifestyle, the sociology is the key." Even the best-designed house will not work, Hoffmann says, if people cannot adapt their lifestyles to it.

Water conservation has not been neglected at the experimental house. It will have low-flush toilets, which use between two and four gallons per flush, and a Clivis composting toilet, donated by Clivis Multrum, Inc. Conventional toilets use five to eight gallons per flush.

Special nozzles on the sink taps and shower head will reduce water flow by an estimated third, and a Japanese-style soaking tub will eliminate the need for long, relaxing, wasteful showers. Be-

cause the students will shower before getting into the tub, the water will not need to be changed with each use. The tub will be heated by a small electric heater. When the water is changed, it will be filtered and recirculated through the flush toilets before entering the sewer system. This gray-water system will also be used with kitchen waste water.

No hot water will be piped to the shower. Instead, the water will be heated immediately by a point-of-demand heater in the shower head. In conventional showers, Hoffmann explains, water is heated to 140 degrees, then mixed with cold water to adjust the temperature. This system heats the water to the desired temperature for showering, between 90 and 100 degrees, with a significant energy savings.

As the project nears its May completion date, other modifications may still be suggested and implemented. And after living in the house for a few months, the students will probably find that some of the innovations are not working as well as anticipated, and that some are failures. "It's an experiment," Hoffmann says, "and experiments have a right to fail."

Even Ouroboros East is not the most appropriate solution for urban life, says Holloway, but it is a start. "We're trying to develop some possibilities," he says, "and these aren't all the possibilities."

Darryl Thayer

Teaching energy sufficiency to the urban poor

Darryl Thayer does not make solar collectors from steel or glass, nor tall windmills from tea kettles and beer cans. In a dilapidated office near Chicago and Lake Streets in Minneapolis, Darryl works with plywood. When he is finished, he will not have a museum, nor experimental windmills to show for his efforts. Yet, though less spectacular than other examples of appropriate technology in the state, Darryl's work is perhaps more vital: he is actually helping low-income people become energy sufficient.

Darryl is technical advisor for the

Center for Local Self Reliance (CLSR), a neighborhood organization that began last fall with a grant from the Housing and Redevelopment Authority. Working in the Powderhorn Park neighborhood, staff members teach residents how to use energy conservation techniques to lower their home utility bills. The CLSR has two areas of activity: an insulation project and demonstration projects in energy and water conservation.

The CLSR provides free insulation materials and advice to homeowners who qualify for the program. To qualify, the

homeowner must have an income of \$12,000 a year, or less. The program is based on "sweat equity": participants pay with their labor. According to Darryl, the CLSR has hired contractors to install insulation only for senior citizens who do not have friends or neighbors willing to help. Staff members introduce participants to each other, encouraging them to form block clubs and help each other with insulation.

With the free insulation materials comes education, for the program will not succeed unless participants understand the necessity for, as well as the techniques of, energy conservation.

"We get together in small groups at some area house and discuss the energy crisis," Darryl says. These neighborhood sessions have helped participants understand that the energy crisis is not a hoax, as some people think, but a permanent situation that requires a change in consumption habits.

"We have no motive for lying," says Darryl, explaining why people listen to what staff members say about the energy shortage. "No one on the project has fast cars or fancy women. We're not fat cats from NSP (Northern States Power), or politicians. We're people like them, so we have an inside."

Dressed in green corduroy pants with a red corduroy shirt over a blue turtle-neck, Darryl does look like a workman, not a fat cat. Area residents drop by the office and wander through the workroom when they please. If someone wants to talk, Darryl has time, even if it means dropping his construction work for a few minutes.

Community response to the insulation project has been great, says project director Barbara Weinschenker, because, "Everyone loves Darryl." Darryl attributes the project's success more to an article in the *Southside Paper* than to his personal charms. Since that article appeared, hundreds of people have applied for the insulation project, Darryl says--"It's a big way to reach people." And once involved in the insulation project, people often become interested in the demonstration projects.

Darryl is currently working on the first of the demonstration projects: a solar collector for a homeowner who participated in the insulation project. Other demonstration projects will include a water dam that reduces water use in flush toilets, a gray water system that channels waste water from sinks into the toilets before it enters the sewer system,

and a heat reclaimer for the fireplace.

With Darryl's help, the homeowner, Celeste Birkeland, has been building her solar collector in the workroom at CLSR. Her enthusiasm is fantastic, Darryl says--though he designed the prototype, she helped build even that.

In mild spring and fall weather, the collector will provide all space and water heating for her home. But in the cold winter months, the collector will supply only five per cent of the necessary heat.

"That's one of the facts of solar energy," Darryl says. "And this collector's probably as efficient as anything on the market." Celeste has insulated her



Photo by Rich Beckman

home, but unless an old house is totally rebuilt, Darryl says, insulation cannot make solar heating much more efficient. Nevertheless, even if the collector supplies only five per cent of the home's winter heat, it will save a considerable amount of energy and money.

The prototype Darryl designed is a focusing, not a flat-plate collector. It is made of plywood curved into a concave shape that is covered with shiny aluminum. Reflecting off the curved aluminum, sunlight will focus on a pipe that runs across the center of the collector. Focusing collectors intensify the sun's heat, just as a magnifying glass intensifies the sun's heat enough to ignite paper or dry weeds. Inside the pipe, air will be heated by the sunlight.

Air heated in the pipe travels to the house where it is blown over coils to heat domestic hot water. From the coils, the air then travels into the furnace and is used for space heating. In the summer, a

damper will be used to keep the warm air from entering the furnace--instead, it will be returned to the outside.

Unlike the system used at Ouroboros East, this one does not have a storage tank. Demonstration projects must be cheap and easy to use: a storage tank would increase both the cost and the complexity of the system. Celeste will be able to install this system in six hours, according to Darryl.

"To make sense, they (collectors) must be very cheap a square foot," Darryl says. "Otherwise, there is no reason to build them. It's easy to make a solar collector that works--the true challenge is to make one that's low cost."

In designing this focusing collector, Darryl has met the challenge. Commercially, it would cost \$40 a square foot, he says. This one costs \$3 a square foot, plus sweat.

After this collector is finished, Darryl will design additional models that meet the same cost and construction criteria. He just designed a collector for his home that cost 85 cents a square foot and was built and installed in one day.

Darryl did not learn his craft through backyard experiments. Before working for CLSR, Darryl was a physicist for a local industry. He designed their solar collectors--the expensive kind. Darryl says the collectors he designed for the firm lost contact with reality because they lost all cost efficiency. He quit. "I don't like working at a system that has no practicality," he says. "It's like spinning your wheels...I want my work to count."

Darryl has brought skills from big industry into a community organization in which his work does "count." Although the focus is currently on helping homeowners conserve energy, Darryl and the CLSR also have plans for the economic development of the Powderhorn Park area. Working with Southside Community Enterprises, the CLSR will encourage the development of community-based industries related to appropriate technology. He would like to see local industries manufacturing solar collectors and thermal curtains.

Yet in spite of the CLSR's early success, Darryl is aware that they are not reaching the people most in need of help. "The really poor don't have homes," he says. If renters insulate to lower their utility bills, their landlords will raise their rent, Darryl says, "and *that's* a tough thing to deal with."

But tackling tough problems is Darryl Thayer's stock in trade.



Photos by Vickie Kettlewell

Era Wheat

By Linda Deml

A poster on Robert Heiner's office wall proclaims that Minnesota scientists have developed 95 varieties of wheat, 17 of which are superior varieties used exclusively by northern wheat farmers. Era wheat is probably the ultimate example.

Heiner, research geneticist and professor of agronomy and plant genetics at the University of Minnesota, knew Era "stood head and shoulders above the rest," when he first came to Minnesota to do selection and testing on the project in the early 60s.

Elmer Ausemus, who retired from the University staff in 1964, had been breeding a new kind of wheat—a cross between

a dwarf variety and a large-kernel variety. The results had been phenomenal.

Heiner continued Ausemus' wheat-breeding experiments. A total of eight years spent in development paid off: since its first appearance on test farms in 1970, Era wheat has increased Minnesota wheat yields by a whopping 157 per cent, almost tripling wheat yields for the state.

But Era had a deficiency which hindered its acceptance. At 13 per cent, Era's protein content was below the 15 per cent of the standard wheat variety, Chris. Foreign markets traditionally demanded wheat containing 15 per cent protein.

Era wheat has increased Minnesota wheat yields by a whopping 157 per cent, almost tripling wheat yields for the state.

As a result, Era, which had a higher yield per acre than Chris, was less acceptable to grain industry people like Pillsbury, Peavey and International Multifoods. Heiner recalls that "people involved in evaluating wheat baking qualities felt we were making a big mistake" by trying to market Era wheat.

The years 1971-1972 were "very touchy," according to Heiner. Pressure from grain industry people led the government to discount Era 20 cents a bushel because of its lower protein content. But there was certain evidence the industry people could not ignore.

Heiner and his colleagues refuted the arguments of the grain industry people. "Era came about primarily because we felt there wasn't enough attention paid to farmers' concern," Heiner says. Most of the concern, he added, had been with the milling and baking qualities satisfying industry standards.

In testing Era wheat for traits such as flour yield, mixing characteristics, water absorption, and color and texture, Heiner found that Era performed well in all respects except its protein content. But Heiner and his colleagues argued that Era's protein deficiency could be made up by increased use of fertilizer in the fields. Therefore, they considered the risk of marketing Era wheat worth taking.

With the backing of the University, test farm sites were set up throughout the North Central Region, which was

particularly suited for a spring semi-dwarf wheat like Era. The Era wheat grown in Washington, Montana, North Dakota and Canada proved superior to any other variety, Heiner says.

"Farmers who tried Era were usually convinced," Heiner says. For many farmers who planted Era, income and yield both rose 30 per cent. In 1976 the increased income to Era wheat growers was \$45,375,000 over and above what they could have earned planting other wheat varieties. Heiner calculates that one bushel of wheat yields 80 one-pound loaves of bread, and the additional five bushels per acre Era yields over other varieties results in an additional 1,210,000,000 loaves of bread.

The milling industry also preferred Era because of its superior mixing qualities. According to Heiner, a representative from International Multifoods confided to him that he didn't know what they would have done without Era in their bake shops.

The turning point was in 1972. The Russian wheat deal left the United States without a grain surplus. The federal government, therefore, removed the 20-cent discount on Era wheat. This action made Era competitive with other wheat varieties on the wheat exchange market. Farmers were allowed to grow practically anything without fear of discounted prices, Heiner recalls. "I think the wheat would have caught on even with the discount on it, but it would have taken a couple years longer," he says.



Dr. Robert Heiner inspecting Era wheat samples.

Removing the discount caused Era wheat production in Minnesota to soar from 800,000 acres in 1969 to 4.1 million acres in 1976. Today, about 70 per cent of all wheat planted in Minnesota is Era.

Faced with Era's new popularity, the grain industry had to reconsider its position. University of North Dakota wheat quality experts, who had tried to keep Era

out of their state, capitulated. The state of North Dakota now raises 1.5 million acres of Era. Grain millers changed their technologies to accommodate Era's better mixing qualities.

Heiner expects even greater wheat production in Minnesota in 1977. One of Era's hidden advantages proved to be its high drought tolerance. If growing seasons continue to be as dry in Minnesota as they have been in recent years, Era will continue to be a popular choice for farmers.

Experimentation on more and better wheat varieties continues at the University of Minnesota. In 1975, for instance, a new wheat variety called Kitt was developed with slightly less yield per acre than Era but a higher percentage of protein.

"We want to show people that we aren't insensitive to industry concern about the protein content in wheat," says Heiner. Of the 300 varieties of wheat experimented with every year, Heiner and his associates choose only 50 to 60 for further testing.

New crosses of wheat are promising yields 25 per cent greater than Era, according to Heiner. Greater yields combined with better fertilization and weed control and technologically improved equipment may be the answer to increased food production and a hope for less hunger in the world.



Biomass

The growing energy resource

By Jim McCartney

Biomass.

Sounds like something left to rot in a field or thrown out with the garbage.

Well, according to popular conception, that's what biomass is.

Biomass is not simply organic waste, however--it is organic material, alive or dead, that can be used to produce energy. Since all animal matter derives from plant matter, plants are the main source of biomass.

"Biomass is a form of solar energy," says Roger Aiken, a resident fellow in mechanical engineering at the University of Minnesota and a member of the University's Center for Studies of the Physical Environment (CSPE). "Plants capture solar energy and store it in their tissues as chemical energy. Our concern is to convert this chemical energy into usable energy forms."

The initial challenge in using biomass as an energy source is to find the form of biomass that can capture a maximum amount of sunlight.

So far it has been found that cattails convert solar energy more efficiently than any other plant.

"They're natural machines for converting solar energy," says Douglas Pratt, head of the University's Botany department.

Dale Moss, an agronomist at the University, discovered the potential of cattails when he noticed that they possess a highly efficient rate of photosynthetic conversion. Specifically, he found that the leaves on a cattail grow at an angle to the sun that maximizes photosynthesis while minimizing shade.

"The geometry of the cattail's foliage canopy is perfect," Moss says. "The leaves are just the right size and face the sun at just the right angle to capture the maximum amount of solar energy."

Moss and a graduate student named Carl Fox planted a paddy of cattails on the University's St. Paul campus to measure how much organic mass could be produced.

The results were impressive. Moss found that not only do cattails capture an optimum amount of sunlight, but they also have a very long growing season.

"They grow like wild from early spring to the first frost," Moss says. "They're a tremendously productive plant."

Cattails can produce a yearly average of 30 to 35 tons of biomass per acre. According to a CSPE report, this is more than twice the mass produced by corn, and over three times the mass produced by trees--both of which are considered to be highly productive.

"One of the biggest advantages of cattails as biomass," Moss says, "is that they can be grown in peat bogs."

Moss points out that Minnesota has over seven million acres of peat bogs. According to the January report of the Commission on Minnesota's Future, Minnesota contains over half the peat in the contiguous United States.

"And what good are these bogs?" Moss asks. "Recreation? You wouldn't have much fun in them. Agriculture? Farmers can't farm them. The land is practically useless."

"The importance of growing cattails in peat bogs is that peat bogs are non-agricultural land. If biomass is to be considered a serious alternative, it must be grown on non-agricultural land. In addition to the energy shortage we have now, we will undoubtedly have a food shortage in the near future. We don't want our energy crops and food crops competing for the same acre of land."

Despite the vast potential of cattails as biomass, virtually nothing is known about how to cultivate them or convert them into usable energy forms.

"There has been surprisingly little research done on cattails," says Pratt, who will be continuing Moss' experiments with cattails on a \$25,000 grant from the Minnesota Energy Agency (MEA). "We're going to have to find their optimum growing condition: what kind of nutrients they need, how densely

they should be planted to produce maximum yield, what temperature they thrive at, how they germinate--the list of what we don't know goes on and on."

Cattails will also have to be chemically analyzed to determine what storage products they contain, Pratt says.

"We already know they contain a tremendous amount of starch," Pratt says. "And starch can be turned into food, chemical feedstocks, or liquid fuels."

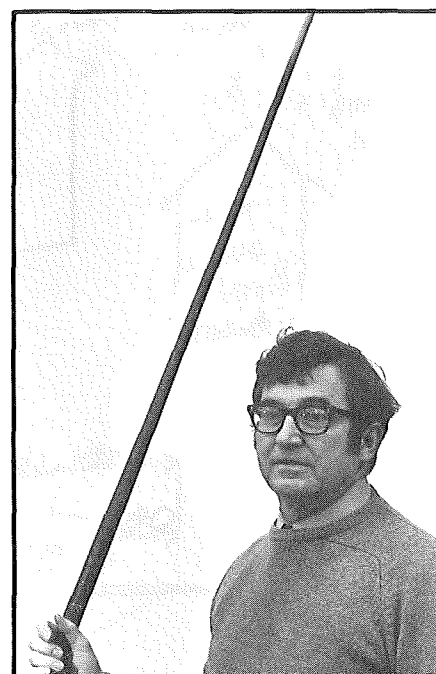
The main difficulty in using cattails--or any other form of biomass--will not be so much how to grow them as how to convert them into energy. No conversion process has yet been developed to efficiently unleash the chemical energy stored in plant tissues.

Professor Perry Blackshear of the Mechanical Engineering department and director of CSPE, suggests cattails be compressed into briquets which can then be burned as fuel.

"You can burn cattail briquets in utility boilers just as efficiently as you can burn coal," Blackshear says. "And cattails are less polluting than coal."

Unfortunately, the combustion process would unleash only about 20 per cent of the energy stored in cattails.

"Considering the valuable products that cattails contain," Moss says, "to burn cattails at a 20 per cent efficiency rate would be like burning your furniture to keep warm."



Perry Blackshear.

Photo by Dayna Smith

There are two other processes for converting biomass into usable energy, both of which may prove to be significantly more efficient than combustion--pyrolysis and fermentation.

"Pyrolysis is what is taking place in your fireplace once the smoke and fire have burned themselves out and only glowing coals remain," says Jon Noring, a graduate student in mechanical engineering at the University.

Pyrolysis is similar to combustion in that it heats fuel to produce energy. Combustion uses air to burn its fuel, producing energy amidst smoke and flames; pyrolysis heats fuel in the absence of air, producing energy more efficiently than combustion since energy is not lost in flames and smoke.

Noring is working under Professor David Kittelson of the Mechanical Engineering department and CSPE on developing a laboratory-scale pyrolyzer (a device that pyrolyzes material as a boiler would burn material). They hope to use the pyrolyzer to obtain liquid fuel from biomass. They will also test the fuels produced to determine if they are viable sources of energy. The project is funded by a \$36,000 grant from the MEA.

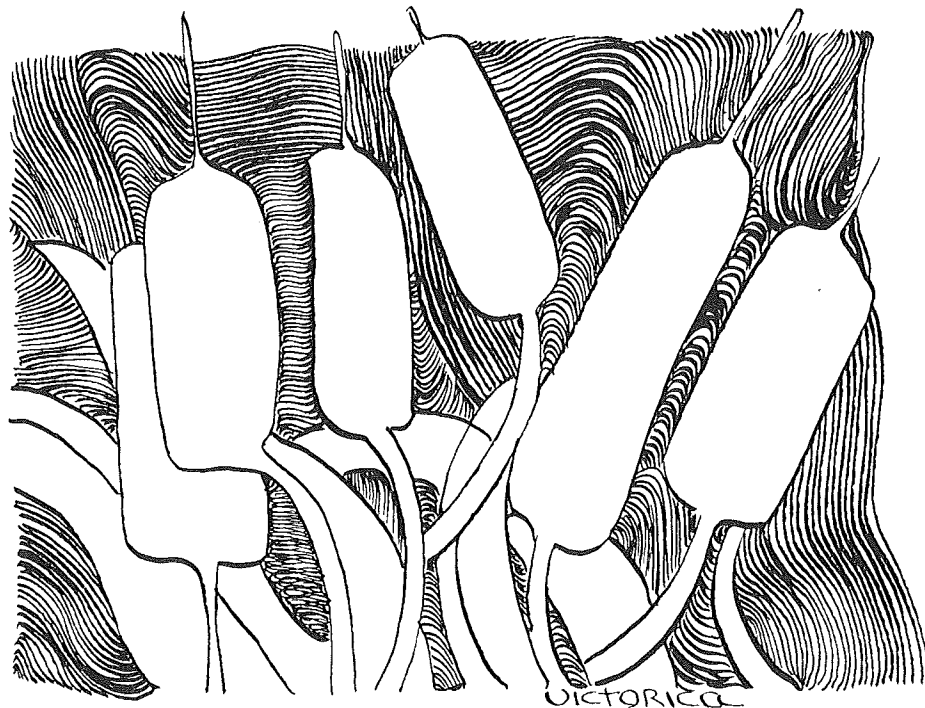
Noring has spent the past several years developing a pyrolyzer called a "fluidized bed reactor" in which biomass can be pyrolyzed. The fluidized bed reactor turns the biomass into a gas, which flows into an adjoining tank to be condensed into liquid.

"Fluidizing bed reactors have been used in industry for the past 20 years," Noring says. "Our general purpose model, however, will be the most flexible yet devised--we should be able to pyrolyze any form of biomass."

The liquid produced from the various forms of biomass will be tested as fuel in various types of engines. Kittelson hopes his experiments will enable power plants to use biomass as fuel.

Professor Rex Lovrien, a member of the University's Biochemical-Biological Science department, has received a \$20,000 grant from the MEA to chemically analyze the pyrolysis products, and to determine if raw liquid products can be fermented to produce useful chemicals.

The main problem in converting biomass into a useful chemical or source of energy, Lovrien says, is to separate the cellulose (which contains the stored chemical energy of the plant) from the lignin (which holds the cellulose together like glue). If the lignin is not extracted,



Drawing by Guadalupe Victorica

the chemical energy of the cellulose cannot be efficiently utilized.

Pyrolysis is one way to "crack the lignin," says Lovrien. Biomass can be more easily fermented into useful chemicals or fuels once it is pyrolyzed.

Lovrien will also chemically analyze the cattails produced from Pratt's experiments. Cattails have an advantage over other forms of biomass in that they contain no lignin. Little is known about the process of fermenting cattails into useful forms of fuel.

As yet, none of these conversion processes--combustion, pyrolysis or fermentation--has proven efficient in unleashing the chemical energy stored in biomass.

Combustion pollutes the atmosphere and is inefficient, pyrolysis yields impure products, and fermentation is a slow, hard-to-control process. Despite these flaws, biomass is a good energy source.

Patrick Starr, a mechanical engineering professor at the University, studied the economic feasibility of collecting and firing biomass as fuel. His studies indicate that biomass can compete with coal as a source of energy.

Biomass is also less polluting and is just as efficient as coal, claims the MEA's December 1976 Environmental Report.

The report further argues that biomass maintains the ecological balance, as opposed to fossil fuels, which upset the balance.

Yet if biomass is a viable alternative energy source, what are its short and long term potentials?

Blackshear feels that the short-term potential of biomass lies in agricultural residues and peat. Agricultural residues, much of which are burned off or plowed back into the soil, could supply nearly half the state's energy needs, Blackshear says. Peat, which already supplies a major portion of the energy in Ireland and the Soviet Union, could meet the total state demand.

Blackshear adds that the collection and conversion of these two fuels would provide jobs in the rural areas. "Perhaps this would stem the tide of people coming to the cities to find jobs," Blackshear says.

Cattails have the best long-term potential for producing energy, Blackshear maintains.

"We must develop cattails as quickly as possible," Blackshear says. "Why, it's forecast that the southwestern area of Minnesota, which is already losing population, will be in for a long, long drought. If they could grow and harvest cattails in the wasted bogs (where a drought would not affect crop growth), they might be able to weather the drought. Otherwise they could be in for some difficult times."

In view of Minnesota's foreboding future of long droughts, food shortages, overpopulation, pollution, spiralling energy costs, and severe energy shortages, biomass must be considered a serious alternative energy source.

We can no longer afford to throw it out with the garbage or leave it to rot in the fields.

Underground Building

Burying our heating problems

By Jim McCartney

Energy shortage.
Pollution.

Urban blight.

One crisis after another. And the Commission on Minnesota's Future portends the worst is yet to come:

--Minnesota depends on natural gas and petroleum for 75 per cent of its energy needs. Yet at the present rate of consumption, the United States has about an 11-year supply of petroleum. Additionally, Canadian oil exports to the United States, which supply over half of Minnesota's petroleum, will be entirely phased out by 1980.

--Pollution control may have to be sacrificed to energy production. Increasing reliance on nuclear power may compound the existing pollution problems.

--The population of the five-county area surrounding the Twin Cities is expected to increase by 250,000 to 300,000 over the next several decades.

A growing number of architects and engineers at the University of Minnesota, however, feel that such adversities need not be inevitable. We can, they say, conserve energy, reduce pollution, and preserve our environment. How?

Build underground.

"The potential energy-saving and environmental benefits of building underground are just remarkable," claims Professor Charles Fairhurst, head of the Civil and Mineral Engineering department at the University of Minnesota. Fairhurst is also president of the American Underground Association, and senior editor of its journal, *Underground Space*.

"You know, 30 per cent of the total energy consumed is for heating and cooling buildings," Fairhurst says. "Yet underground buildings could easily be energy independent."

Energy independence is possible, Fairhurst explains, because the earth provides near-perfect insulation. Thirty feet below the earth's surface, the temperature is a constant 54 degrees F., despite radical climatic changes above

ground. A thick blanket of earth also protects the building from the wind, further reducing cold air infiltration.

What Fairhurst advocates in theory will soon be tested in fact with the completion of the University of Minnesota's Bookstore/Admission and Records building. The building is 95 per cent underground. Paul Shipp, a graduate student in mechanical engineering at the University, heads a project funded by the National Science Academy to study the thermal capacities of the earth in an underground structure. Since the study was designed for a variety of environments, four types of backfill, each of which is indigenous to a different climate in the United States, were used on the bookstore's north side. The various

temperatures of the backfill will be measured against the energy requirements of heating and cooling the building.

The Bookstore/Admission and Records building has other energy-conserving features besides the insulation and temperature consistency of the earth. The building is completely insulated with styrofoam, and nearly half of the above-ground surface is covered with a foot of soil. All the glass panels open to the outside are double-paned to prevent heat loss. Engleman ivy planted along the base of the courtyard windows regulates sunlight. In summer, the ivy's leaves will protect the inside of the building from direct sunlight; in winter, the defoliated ivy will allow sunlight to heat the building. A waste-recovery system will transport heat from the exhaust ducts to inlet air ducts in the ventilation system.

Solar energy panels will be installed along the top level of the east wall to supplement the conventional steam heating system.

Yet even with all its energy conservation characteristics, the University's Bookstore/Admissions and Records building will not be independent of outside energy sources.

"The building will cut energy consumption by about 70 per cent," says



Photos by Dayna Smith

Staircase in the University of Minnesota's Bookstore/Admissions and Records building.

David Bennett, the principal architect of the building and an assistant professor in the University's School of Architecture. "Without the solar energy, however, energy consumption would only be cut about 25 per cent."

The possibility of building energy-independent structures will be studied in a University-Industry project funded by the Minnesota Energy Agency (MEA) and coordinated by Ray Sterling. Sterling, a research assistant in the University's Civil and Mineral Engineering department, says the purpose of the project is to lay out, design, and price both residential and large-scale underground structures.

Bennett, however, has designed an underground building which he feels could be energy independent.

"The designs for the Fort Snelling Center (the new Minnesota Historical Society Center near Fort Snelling) are before the state legislature right now," Bennett says. "If the proposal is approved, Minnesota could have the most advanced effort in energy independent building in the entire United States."

The Minnesota Historical Society plans to remove virtually every structure in the proximity of Fort Snelling built since 1848 in order to recreate the landscape of the early 19th century. The new center, according to the proposal, will be the only modern building near the fort.

"We decided to build it right into the side of the river bluff," Bennett says. "Since the roof of the building will essentially be at ground level, the building will not disturb the historical setting being recreated around the fort."

Energy will be generated, as well as conserved, by the new center. "The solar collectors should not only supply enough energy to run the building all year around," Bennett says, "but they will produce excess energy. We'll sell the excess energy to NSP during the summer and buy it back during the winter."

The energy-conserving potential of such buildings is tremendous, especially if one considers that, according to the Energy Research and Development Administration (ERDA), 70 per cent of all residential energy and 30 per cent of the total energy consumed in the United States is for space heating and cooling.

Underground buildings have another advantage: they preserve the natural environment. "There will be great advantages in building low-cost housing projects underground," Fairhurst says.



"The houses will no longer have to look like hell or be crammed together. You will also be able to build more houses per acre of land, yet preserve almost three-quarters of the surface area for landscaping. When you consider that the median cost to build a house today is \$40,000 to \$45,000, not to mention the high cost and scarcity of land, underground development looks very attractive."

Few people realize that underground building can be attractive as well as energy-conserving, Bennett says. "When you tell most people about underground buildings," he says, "they conceive of a dark, cramped hole deep beneath the surface with a shaft leading to it. They don't realize that an underground building can be full of open space and natural light."

Bennett's Bookstore/Admissions and Records building illustrates his point.

Environment

Although it was unfinished at the time, **Progressive Architecture** magazine granted Bennett and his associate Jack Myers, an award for the building.

The bookstore has high ceilings and long, wide concourses. An open courtyard in the middle of the building is surrounded by glass windows through which most of the natural light enters. "The bookstore has more window space than most conventional above-ground buildings," Bennett says.

"The design is so thoughtful and beautiful," says Shipp. "It's obvious that both aesthetics and comfort were considered. You can read books and books on the construction of underground civil defense shelters, and all they can talk about is how many people can be crammed in for how long a time. They almost doomed sub-surface building to the rank of mole-holes; but the new bookstore abounds with light and space."

Bennett admits, however, that underground space can have discomforts not suffered in conventional above-ground buildings.

"The earth is such a good insulator that there is little or no fresh air infiltration," Bennett says. "Without an adequate ventilation system, the air in underground buildings can get quite stale. In above-ground houses, of course, the air comes right through the walls and the cracks in the joints. The advantage of

having a ventilated underground space (as opposed to a non-ventilated above-ground space) is that you can control the amount of air infiltration."

Bennett also points out that underground buildings have a tendency to get damp in the summer--as do basements. He says that a dehumidification system would take care of this problem, and adds that underground buildings do not need to be humidified in the winter as do conventional houses.

Although the living discomfort of underground space can be overcome without much difficulty, the construction problems are not always easy to solve. Ray Sterling, who studied underground engineering in a University testroom 80 feet below Northrop Field, explains that the structural supports must be designed to prevent the ceiling and walls of the structure from caving in. Furthermore, he says, certain types of soil may be unsuitable for underground construction, causing walls to leak or collapse. And if the water table is high, a water pump may need to be used during construction to protect the machinery from damage.

While such technical difficulties are not always solvable, they are usually avoidable. Ray Sterling and John Carmody, an independent consultant, researched possible underground building sites for the University of Minnesota's Planning Office. They studied the geolo-

gy and climatology of various locations in the Twin Cities to determine if the conditions were suitable for underground construction.

"We found that much of the Twin City area has excellent potential for underground construction," Sterling says.

Underground space may have problems which neither architects nor engineers will be able to solve--living underground may produce detrimental psychological effects.

"Some people aren't going to enjoy having a couple feet of soil over their head," says Joel Barker, Director of the Futures Department of the Minnesota Science Museum. "People may get the feeling of claustrophobia or anxiety--or they may even get the feeling of being buried alive."

"People may become more alienated as a result of the privacy provided by underground living. What would happen to the community if no one could look out the window to see what the neighbor is up to?"

The most serious difficulty facing underground building is neither technical nor psychological--it is economic.

"People can't get reasonable loans from banks or fair insurance rates from insurance companies for building underground homes," says Ray Sterling. "Since banks and insurance companies have no set procedures regarding underground home building, they simply regard it as a high risk in terms of construction and resale value."

Sterling hopes that the advantages of reduced heating costs, durability, protection from the outside environment, and lack of upkeep costs for the exterior will persuade buyers and lenders that underground homes are quite feasible--especially since construction costs are little or no more than above-ground construction.

Fairhurst predicts that underground building will not be given adequate attention by Americans for some time:

"It seems like it usually takes a worldwide crisis to stimulate our development. The energy crisis may be the first such crisis that isn't a war--although it certainly can be compared to the threat of an invasion. The OPEC embargoes were a godsend--they forced us to focus our attention on a problem we refused to recognize before it was too late...We don't have to get into a mad flap about it, but we must learn to make the most of our available resources. And 55 mile-an-hour speed limits and 65 degree buildings are peanuts compared to underground building."



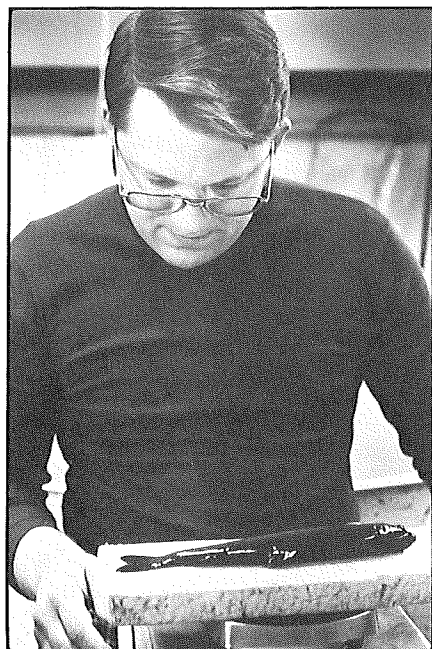
View of Folwell Hall from the bookstore.

Photo by Dayna Smith

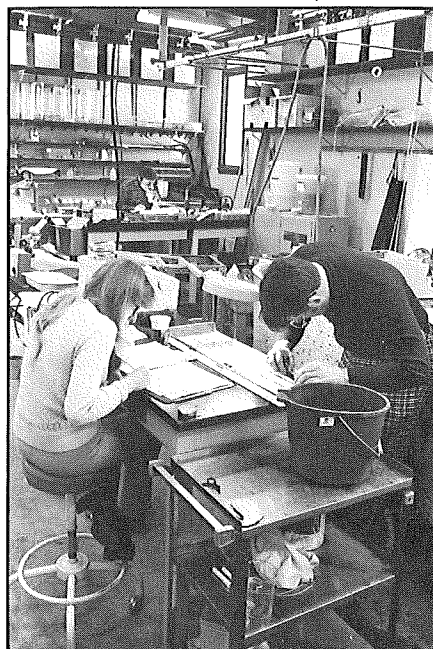
Monticello Field Station

Setting water standards

By Linda Deml



Dr. Ken Hokanson weighing a rainbow trout.



Darlene Schooley and Ken Hokanson in the field station's lab.

At the eastern edge of Monticello, on the Mississippi River, sits a small field station in which unprecedented research has begun.

In the Monticello Ecological Research Station, biologists, part-time students, and technicians are performing research that will be used to establish national water quality standards.

Financed by a \$2 million grant from the Environmental Protection Agency (EPA), biologists are studying the effects of heated water on fresh-water fish and other aquatic life. In the 1980s, the EPA will use the station's data to establish federal regulations for controlling heated water emissions into the environment. These regulations will affect the design and location of power plants and industrial facilities.

Like other power plants, the Northern

States Power (NSP) plant discharges heated water. Although this water is circulated through cooling towers before being returned to the Mississippi River, it is still hot enough to raise the river's temperature.

According to Ken Hokanson, chief biologist at the Monticello station, heat waste pollution could harm fish, change the chemical properties of the water, and make river water less valuable for local farmers, industries, and downstream cities.

These possible effects could be disastrous for the residents of Monticello, who use river water for irrigation, swimming, fishing, and drinking. These same residents will have to pay added costs of pollution control, which will be passed onto them via increased electricity rates.

The EPA research staff are trying to

determine the best and most economical way to prevent heat waste pollution. They collect data by combining laboratory studies with field studies of fish and other aquatic organisms. Fish are placed in channels of water heated to different temperatures. Biologists then study the effects of these various temperatures on the fish and document their responses to this environmental stress. The heated water is provided by an underground pipe exchange system with the NSP power plant.

Although NSP has cooperated with the EPA by leasing land for the field station, NSP officials are quick to explain that whatever work the biologists do is entirely independent of NSP influence.

One of the first things the biologists must do before beginning the heated water studies is define the fish environment. Hokanson says this will involve looking at the whole food chain--all the organisms fish feed on as well as hundreds of plant species. To measure the fish environment, the staff are studying water quality and the food chain.

"This whole community of organisms has never been measured before. I guess you could say we are seeking a shortcut way of evaluating this environment," says Hokanson.

Barbara Poeschl, a seven-year veteran with the EPA and a physical science technician, measures water quality. Every day around sunrise and again in late afternoon she collects water samples at various stations in the four operating channels. Back in the lab, she measures each water sample for its chemical content. One of the most important aspects of her work is measuring the percentages of nitrogen and argon in the river water. "If these elements are there in large enough doses, it could be detrimental to fish life," she says.

Biologists John Arthur and John Shyne study the insect populations in the channels. Because insects are the main fish food, it is important to measure how heated water affects insect larva. "We have to determine if heated water causes insects to get out of their natural synchrony," says Arthur. If heated water causes too many insects to emerge early, he says, they will hatch in winter and die, seriously decreasing the food supply.

To study this, the two set bug traps along the channels. Arthur, chief bug man, sometimes dons a wet suit to sample the numbers of insects entering and leaving the channels.

Inside the laboratory are several huge

Environment



John Shyne checking a bug trap.

Photos by Jim Machowski

begin, possibly this fall.

This first stage in research-defining the fish environment has taken longer than expected. A number of structural problems or "mean tricks of poor engineering" as Hokanson calls them, have slowed up progress.

"We would like to be further along than we are," admits Hermanutz. But because the field station is the first of its kind, it presents special problems in addition to structural design.

Hokanson's desk is piled high with report forms that government administrators require before they will continue funding the project. Hokanson has had to do all the paperwork himself, because of the small staff.

"In government you generally have enough money but not enough people," Hokanson says. Most of the biologists at the station were transferred from the National Water Quality Lab in Duluth, a branch of the EPA. Additional staff for Monticello could not be hired because of a government restriction on hiring. "Our solution will probably be a cooperative venture with private firms and universities," Hokanson says.

What will happen to the field station after their current project is completed? As far as the staff are concerned, their work has only begun. As Hermanutz says, "The multitudes of pollutants will insure our never running out of work."

glass jars with fish specimens taken from the channels last spring. Roger Hermanutz, in charge of the fish sampling program, says they will look in the stomachs of these fish to see what they've eaten. As well as studying fish eating habits, Hermanutz will also survey sur-

vival rates, growth and distribution, and reproduction habits of the fish in the channels.

Once the fish environment studies of Poeschl, Arthur and Shyne, and Hermanutz are well documented, the main experimental work on heated water can



Roger Hermanutz.



Shyne cleaning an outlet in one of the heated channels.

Animals

As long as the clinic continues its unique services, endangered birds of prey are in less danger of extinction.



Raptor Clinic

By Linda Deml

Patrick Redig bends intently over a small patient lying unconscious on the stainless steel operating table. He looks over his shoulder at the lighted X ray to refresh his memory of the fracture. Turning back, he carefully aligns the fractured bone, inserting a tiny steel rod to keep it in place...

In 45 minutes the operation is complete and the groggy patient opens its eyes. Redig smiles. The patient, he says, has a good chance of recovery...

This is an unusual surgery because

the patient is a hawk, and Redig is a rare sort of a doctor, who operates a hospital for raptors, or birds of prey. Here at the University of Minnesota's School of Veterinary Medicine, the raptor clinic treats and returns raptors to the wild.

A total of 204 birds of prey were treated at the raptor clinic last year--from a cross-eyed owl named Gibson to the common hawk to the endangered American bald eagle, osprey and peregrine falcon. Thirty-five per cent are eventually returned to their natural habitats.

Redig, the only veterinarian in the country specializing in raptor medicine, says the clinic began by chance. While he was a sophomore in veterinary medicine at the University of Minnesota, he met Mark Fuller, a Ph.D. candidate who was using crippled birds for physiology research. Redig saw the birds in Fuller's back yard one day and went over to introduce himself. "We decided to see if we could put them back together again," Redig recalls.

In 1972, using his own money, Redig set up the clinic in his basement. Dr. Gary Duke, an avian physiologist under whom Redig studied, suggested Redig do graduate work in raptor medicine and write proposals for funding. Since then, Redig has been involved full time in the raptor clinic. Fuller and Duke work there on a part-time basis.

The clinic now has new and larger facilities in the Animal Sciences/Veterinary Medicine Center on the St. Paul campus. Over 650 injured birds of prey have been shipped to the clinic from all over the country.

The most common injuries treated occur when birds fly into wire fences, are hit by cars, or are caught in traps. But about 30 per cent of the birds have been shot by hunters.

Redig talks about an X ray of a bald eagle shot with 29 pieces of lead. One of the pieces had lodged in the bird's spinal cord and caused permanent damage. "The bird didn't respond to treatment, so we had to destroy it," Redig says.

The birds are understandably terrified when first brought into the clinic. But they generally calm down, according to Duke. "Most are remarkably tolerant of casts and bandages," Duke admits. While they recover from surgery, the wings and feet of the birds are bandaged, and their tail feathers taped for pro-



Photos by Vickie Kettlewell

Animals

tection. One snowy owl left a large lump of bandages on its foot untouched, though it had been bound for many weeks.

In addition to the surgery rooms and the recovery rooms, the clinic has several indoor flight rooms where compatible

species of recuperating birds can perch and stretch their wings. In an outdoor pen, two student volunteers, also amateur falconers, exercise the convalescing birds, retraining them to fly and acclimating them to the weather before they are set free.

About 35 per cent of the birds are released. According to Duke, the average stay for an injured bird is about four months, but this varies according to the seriousness of the injury. One golden eagle stayed there for a year, he says, because it needed two or three corrective surgeries for a broken foot.

About 30 per cent of the birds treated at the clinic end up permanent cripples. These birds are used in research or breeding projects, or are given to zoos. "They are taking the place of an otherwise healthy bird," Duke says.

Birds that die are used for post mortem studies.

Most techniques used at the clinic were developed by Redig; little is known outside the clinic about raptor medicine. He designed the steel pins and wiring techniques used for repairing bird bone fractures. Redig also studies respiratory diseases of birds and ways of diagnosing bird diseases.

Redig has also started a large library of bird X rays and a large data bank on bird diseases which he says will be available for public use in the future.

The raptor clinic is financially secure for at least another two years, thanks to donations from individuals, private foundations, and a \$5,000 contract with the Fish and Wildlife Service.

"We hope to get some kind of state funding in the future," Redig says.

As long as the clinic continues its unique services, endangered birds of prey are in less danger of extinction.

Dr. Patrick Redig.

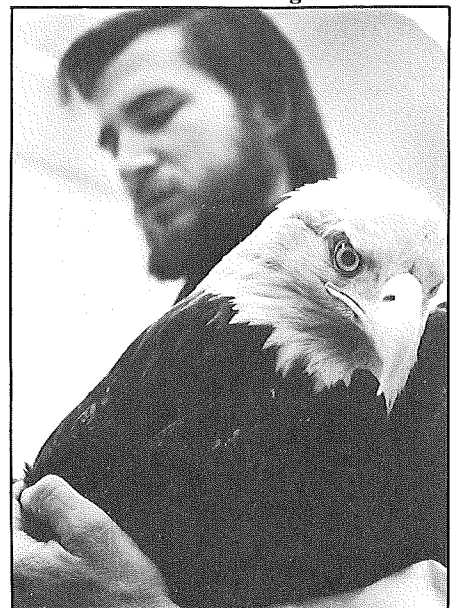


Photo by Vickie Kettlewell



Photo by Rich Beckman

Edmund Graham

Freezing the future

By Dayna Smith

Perhaps if Dr. Edmund Graham weren't already internationally known for his research work, his fables would bring him the recognition he now enjoys as a pioneering geneticist.

"Someone must take the leadership and pioneer, not merely follow the proverbial calf path," Graham begins one of his tales. It is a fable about a lost calf wandering haphazardly, as calves do, through virgin forest before finally reaching home. Generations follow, never venturing off the original route: "'twas such a crooked path, but still they followed, do not laugh."

It's precisely the spirit behind Graham's fables that makes him a visionary as well as a pioneering scientist. On the fourth floor of the Animal Science Veterinary Medicine building at the University of Minnesota, he and his colleagues don knee-length white lab gowns and, in antiseptic laboratories, delve into the mysteries of freezing and reviving cells.

"We're number one in the world here as far as research in storing semen goes," Graham says, "and I guess number two in successfully freezing eggs. England is ahead of us there."

The ability to store sperm and egg cells, or germ plasm, Graham says, is an essential step toward increasing world food production. By freezing or freeze-drying germ plasm and reviving it when needed for reproduction, more animals can be inseminated with the germ plasm of genetically superior animals.

Graham's field of study is cryobiology--literally, the science of low temperatures. Behind doors with titles such as Liquid Nitrogen Storage Tanks, vials of bull, ram, turkey and other animals' sperm "hibernate" at -197 degrees C. (-320 degrees F.). Because the molecular activity is slowed, the germ plasm ages very slowly and can therefore be stored indefinitely ("as far as we can tell," Graham says).

Because freeze-storing of semen with full fertility is so successful, world-wide

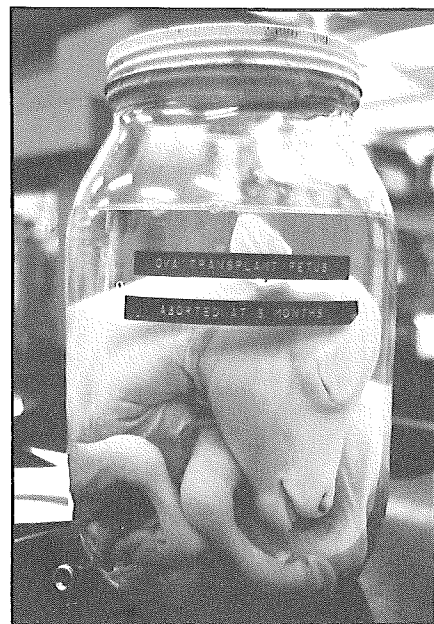
breeding services can now provide semen for artificial insemination of entire domestic herds. Wastage from superior sires can also be eliminated, Graham says. He estimates that by freezing the semen, which would ordinarily die within a few days after collection, over 50,000 artificial breedings in a lifetime are possible from a single sire.

Currently Graham and his associates, Dr. Bo Crabo and Professor Virgil Larson, are the only researchers to have repeated success with freeze-drying germ plasm, a process that will eliminate the need for sub-zero storage tanks.

"See these?" Graham asks, taking a vial off a shelf. "All we have to do is add water and we have live bull-semen." It's almost as easy as freeze-dried coffee, he add facetiously.

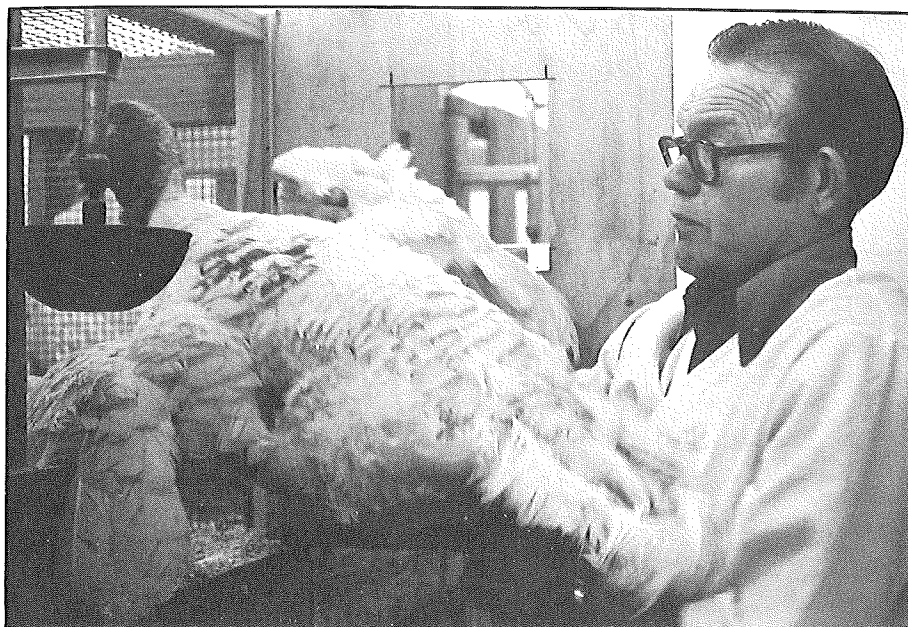
Although semen freezing and storage has met with great success, Graham has found freezing the egg, the female reproductive cell, more difficult.

Graham was the first to confirm the results of earlier research with ova trans-



Photos by Vickie Kettlewell

plants. During an ova transplant, a pre-fertilized egg is transplanted from the producing mother to a host mother. A genetically superior animal (such as a record milk-producing cow) can be super-ovulated and her eggs fertilized with the semen of a superior bull before ova collection. A host mother, usually genetically inferior, will carry the calf to term. Unlike sperm cells, which can be kept alive outside the producing sire for several days, an egg has only a 12-hour life span after removal from the female.



Animals

The host cow's ovulation cycle during the transplant has to be synchronized exactly with the donor cow's cycle at the time the egg is removed, or it will be aborted. With successful freezing, the eggs can be stored until the host reaches the appropriate stage of her cycle to accept the fertilized egg. This freezing technique eliminates the need to transplant within 12 hours.

"Unfortunately, efforts in the freezing and thawing of viable eggs have met with less success than those on sperm, which is probably due largely to the much greater volume of the egg," Graham says. "In our experiments we have successfully frozen and rethawed an egg that was eventually brought to term only in the rabbit."

A specimen of a normal calf fetus grown from a pre-frozen egg is preserved in a jar in Graham's lab—a tribute to his partial success. It was aborted by a host cow after five-and-a-half months. Graham is quick to point out that even this half success is encouraging. Freezestoring of anything more complex than a single cell (except for the kidney) is far from developed.

Like all researchers, Graham and his associates must continually find funding for their experiments, but since

much of his research is economically practical, funding is generally forthcoming. Not so for Graham's more futuristic project, an extension of his germ plasm bank, the Library of Life.

"We are now witnessing what is probably the premature extinction of a multitude of species of organisms brought about by man and civilization," Graham says. "What I propose is a Library of Life where we could develop a germ plasm reservoir of all species of animals, plants, and microorganisms for future breeding and research work. Just think—if we had had this knowledge (cryobiology) 150 million years ago we could recall the prehistoric Brontosaurus or Siberian Tiger today, and fill in our sketchy information. If a library collection is started today, by the year 2050 your granddaughter could go to the library and look up the red wolf, which will be extinct in a few years. She could check out a fertilized egg and grow a fetus in a nutrient bath, because by then host parents would not be necessary. It would be an invaluable tool to researchers."

And what would become of the grown red wolf? "Well," Graham says, "hopefully we have enough intelligence to be responsible. It would either be put in a zoo or raised as a pet. Maybe you could even show it by then."

Because the Library of Life is not part of the University-sponsored research, Graham has little time to work on it. Nevertheless, his small library has received some contributions. For instance, a local zoo called him when a black bear had to be destroyed. The bear was ejaculated electrically and the semen is now in Graham's library along with a collection from a buffalo that died after it was caught in a fence.

Graham feels that if an organized effort were made to collect germ plasm from zoo animals as a matter of course, those that will not breed in captivity (such as the giant panda and cheetah) could be artificially inseminated.

"The technological problems we will encounter in establishing a library are small compared to the problem in overcoming human short-sightedness and lack of vision," Graham says. "The probability that no one now living will reap the benefits of such an effort will turn many potential sympathizers away at the outset." Because many people believe the Library of Life is far-fetched, Graham's dream will probably never materialize on the grandiose scale he envisions. Yet it is obvious he will not give up trying. Quoting John D. Rockefeller, Graham says, "Problems are only opportunities in work clothes."

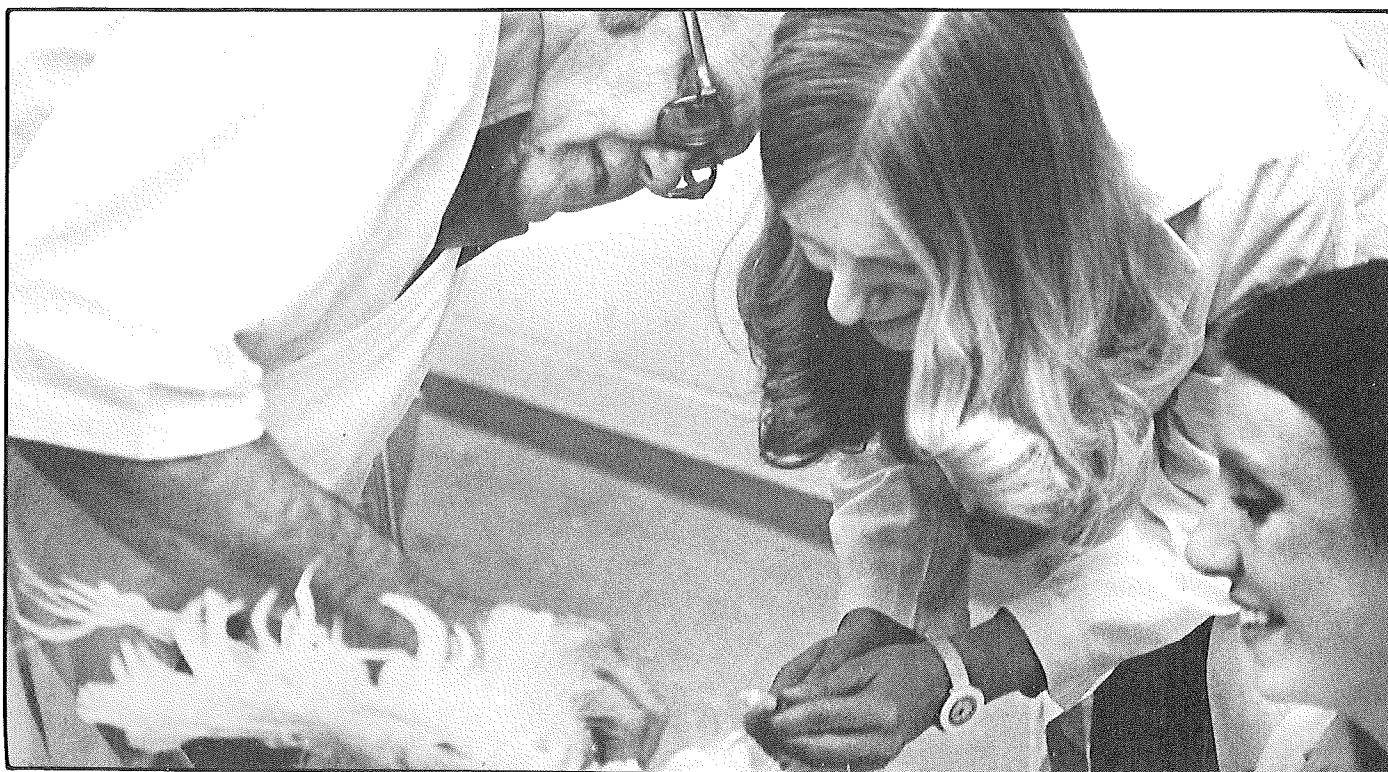


Photo by Vickie Kettlewell

"If you're three and you come to the University of Minnesota, you have as good a chance for survival as if you're 30 and have a transplant done elsewhere."



Photo by Mary McDonough

Kidney Treatment

By Vicki Fung

It is a quiet evening on Station 22 at the University of Minnesota Hospitals. In a dimly lit room, curled up on a special bed that monitors his weight, lies a tiny, brown-haired boy, hidden under a pile of blankets. At first glance, very little is going on. Nothing could be further from the truth. To his right, a complex piece of equipment is filtering his blood, maintaining fluid temperatures, blood flow rates, and chemical balances. To his left, a sophisticated electronic monitoring system reports his vital signs--blood pressure, respiration, cardiac activity. And from the motionless sleeping form stream blood lines, cardiac monitoring electrodes and wires, and intravenous infusion equipment--all part of a remarkable process, hemodialysis, which keeps 22-month-old Kurt Chadwick alive.

Kurt is a victim of hemolytic-uremic syndrome, characterized by the massive destruction of his red blood cells leading to severe anemia. Discovered when Kurt was nine months old, the disease has since disappeared. But it left him with kidneys so degenerated that he had to be put on peritoneal dialysis for six months. In peritoneal dialysis, a special salt solution called dialysate is pumped into the abdominal cavity where, by diffusion, the body's chemical imbalance is corrected.

"He had a catheter in his gut 24 hours at a time," says Don Chadwick, Kurt's father. According to Kurt's dark-haired mother, Gaelyn, "It worked, but

it was taking away proteins and fats that his body needed."

On the advice of Kurt's pediatric nephrologist, the Chadwicks came up from their home in Decatur, Georgia, to Minneapolis on August 26, 1976. There was no hemodialysis program in Atlanta, where Kurt was being treated, and the University Hospitals, known for their pioneering in kidney research and their progressiveness in treatment of children with kidney failure, was the best place for him to go. The Chadwicks came to Minneapolis with the knowledge that Kurt would need a transplant.

Weighing in at only 10 lbs., Kurt needed to be strengthened before his kidneys could be removed. He started hemodialysis on September 2. Gaelyn remembers, "He was sick at first--always throwing up--but he got bigger and stronger." But very high blood pressure brought on a stroke at the end of September, leaving Kurt's left side weaker than his right. On October 15, he had a nephrectomy--the operation for removal of his kidneys. Gaelyn knows it was painful for him. "He couldn't even cry for two weeks."

Kurt's big chance came in January of this year, when he received a kidney from his father. For two weeks, it worked beautifully, giving Kurt unseen strength to sit up and play--until the worst feared happened: his body violently rejected the kidney and it had to be removed. This

meant dialysis again for Kurt, every other day for four to five hours. In time, he will cut back to three times a week.

Hemodialysis isn't all that's kept Kurt alive. The University Hospitals Kidney Transplant Program deserves much credit. Begun in the early 1960s, the program expanded greatly in 1967 when Dr. John Najarian of California took over as head of the surgical team and established the University as a major kidney transplant center. Over 800 transplants have been performed since Najarian's advent; approximately 130 in 1976 alone.

Behind hemodialysis and surgery, specialists are at work, improving the medicines and technology that make such treatments possible. The University of Minnesota has been notably innovative in the areas of drug synthesis and kidney preservation.

Patients from all over the world are referred to the University of Minnesota Hospitals for kidney treatment. Once admitted, they are carefully evaluated, and depending on the nature of their disease, their kidneys may or may not be removed. Then a donor is sought--either a relative or a cadaver, although a relative is preferred since there is a smaller chance of rejection. In order to determine compatibility, the recipient and donor are tissue typed, just as people are tested for blood type. According to transplant surgeon Dr. David Sutherland, the best kidney a person could get would be from a brother or sister who has the same tissue typing. Graft survival after transplantation is then 90 per cent or better, Sutherland says. It will be around 80 per cent if it is a partial match from a brother, sister, or parent, and from 70 to 80 per cent with a good match from a cadaver. Patient survival is 10 to 15 per cent higher than graft survival; if rejection occurs, the patient can always go back on dialysis.

"The University transplants a higher



Kurt Chadwick on dialysis.

Photos by Mary McDonough

proportion of kidneys from living donors than any other place," Sutherland states proudly. Two-thirds of the kidneys, he estimates, are from related donors and one-third are from cadavers; the figures would be reversed for most other hospitals. Some doctors speculate that the quiet stability of the Midwest family unit encourages decisions to use living donors. The less stable lifestyles of the coasts discourage use of living donors.

Its work in the areas of pediatric transplantation has given the University further distinction. According to Dr. Michael Mauer, director of the pediatric kidney dialysis program, "The University has transplanted around 120 children at an average of 20 a year. In Europe, they don't transplant children under five. We've transplanted three patients under one year old. The problems were tremendous and none of them are alive." Dr. Mauer feels that any age over one year is much better. "If you're three and you come to the University of Minnesota, you have as good a chance of survival as if you're 30 and have a transplant done elsewhere. We're the only place that can say that."

Transplantation, if possible, is greatly favored over dialysis, because thorough though dialysis is, it is not a replacement for a real kidney. "The kidney is not just a filter," Mauer explains. "It also produces hormones: it is an endocrine gland." According to Mauer, the kidney activates Vitamin D, an essential for bone development. It also produces erythropoietin, the stimulus for red blood cell production, and other hormones that

maintain the body's salt balance. "The human kidney operates with incredible precision. The artificial kidney is not as sophisticated as the real one.

"We don't have the technology to totally replace organs with artificial ones," Mauer continues. "This is especially true in the child, a growing organism. Any disturbance of one major organ system will affect other systems of the body. Thus, children with kidney failure grow poorly, if at all," Mauer says. Patients often begin dialysis with expectations of a magic cure. But even with

treatment, they are not well. Most are weak and anemic, subject to intercurrent illnesses. The disappointment is that even in the best of dialysis situations, the patient is not physically normal.

The death rate in chronic dialysis stands at about 10 per cent a year, because of complications with blood access and clotting, vascular disease, coronary artery disease and infection, Mauer says. "We use the artificial kidney in children in three instances: 1) when the kidney fails acutely but recovery looks optimistic; 2) when a child suffers from certain poisonings; and 3) when a child suffering from chronic renal failure must be prepared for a transplant."

Technical difficulties inherent in dialysis and transplantation of very young children have discouraged many transplant teams from accepting these patients. The University, however, has reported good results: 85 per cent of the children they have transplanted are alive. Still, techniques and treatment are far from perfect. As Mauer admits, "The reason we do something is because it works, not because we understand it."

Twenty-two-year-old Mary "Lou" Boulay has a happier story to tell than the Chadwicks. She is holding her own, six years after a kidney transplant. Her success is even more spectacular given that her younger brother died three years ago from the same disease. Her father needs a transplant within a year.

Lou was born with familial nephritis, a hereditary nephrotic disorder that fortunately does not recur in a transplanted kidney. Symptoms of drowsiness, dizziness, short attention span, impaired concentration, sharp back pains, impaired hearing and progressive kidney degeneration mounted until the syndrome was finally diagnosed at the Mayo Clinic in Rochester when Lou was nine years old. She was told that she would need a transplant sometime between the ages of 16 and 30.

"In high school the kids didn't understand what was happening, why I was not 'with it,'" Lou recalls. Missing gym class because of chronic fatigue was the most upsetting part. She was forced to leave school in November, 1970, when her kidneys and spleen were removed and she went on dialysis. She spent the month of December at home with a tutor, making three trips a week to the University to be dialyzed for eight hours at a time. Memories of dialysis cloud her face with anxiety. She emphasizes how she hated it, how painful it was for her, and how she never relaxed. To ease the pain,



Lou Boulay lends a hand in her physical education class.

she says she was drugged with Darvon and morphine. "I was always afraid that something would get in there and just clot everything up--and it would be all over."

Lou returned to school for a week in January, then was called in for a transplant. "I was frightened at the news of a transplant," she says, "because I was facing the unknown and there were no guarantees." On January 11, 1971, Lou received a new kidney from an 18-year-old boy who had died of a brain hemorrhage. The need for a cadaver kidney thus brought another facet of the University Hospitals transplant service into play.

When a cadaver kidney must be transported, the Renal Preservation Unit is called into action. The unit consists of two components, the Mox-100 Kidney Preservation Console, which receives the kidney at the site of the transplant, and the Mox-100 Kidney Transport Module, which actually contains the kidney in a carefully controlled environment. As described by Les Olson, assistant scientist in charge of the Renal Preservation Unit and Research Lab, temperature is reduced from body temperature to between 7 and 9 degrees C., or about 42 degrees F. The kidney is perfused with a solution developed and produced at the University of Minnesota, called silica gel aerosol fractionated plasma, a serum without any clotting factors. Ph, pulse pressure, oxygenation, and rate of perfusion are precisely monitored and controlled. The organ itself can be examined chemically as well as physically, and ideally, it can be preserved up to 72 hours, Olson says.

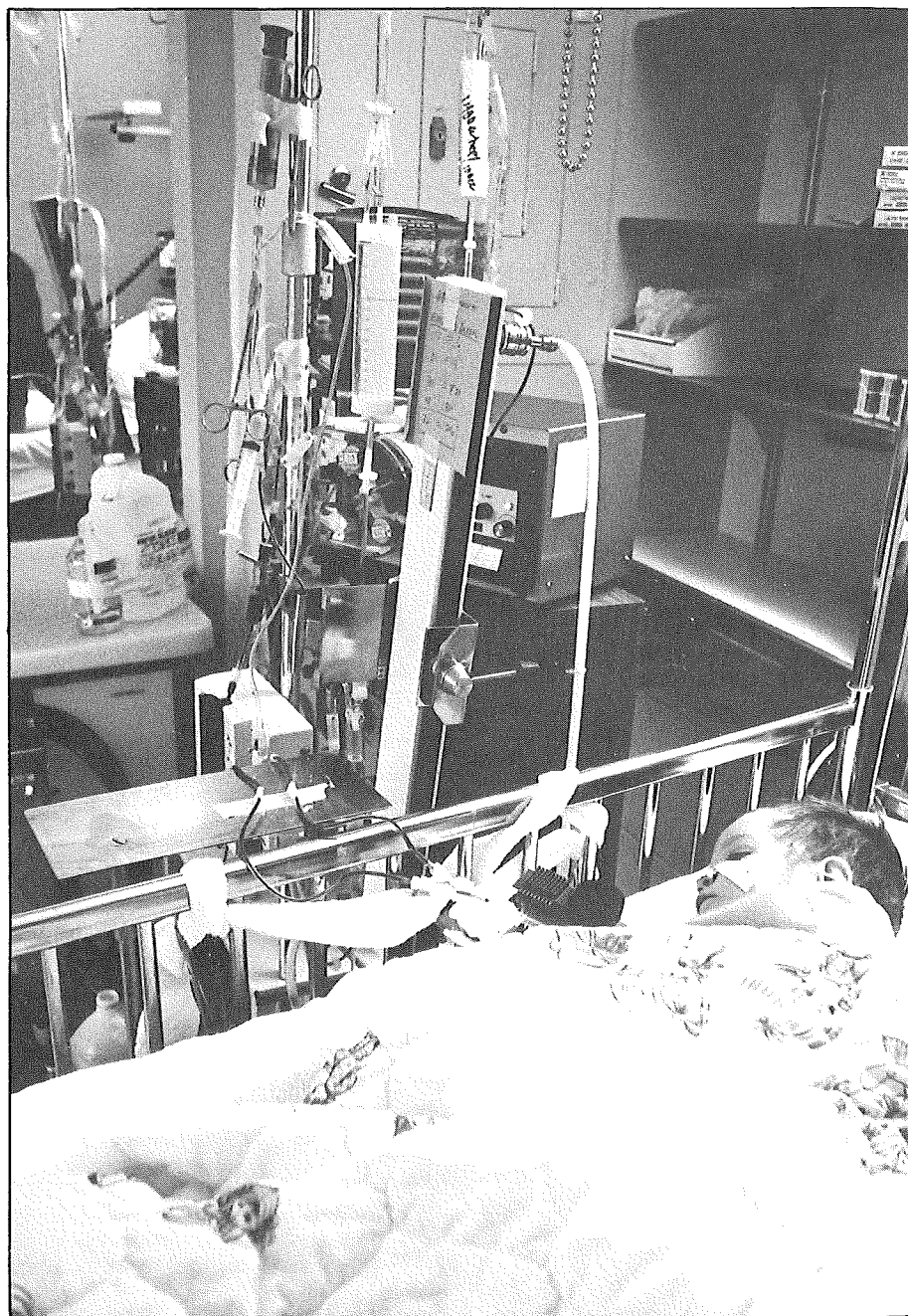
As might be expected, operation expenses run up a tremendous bill. "It costs \$1,000 just to turn the machine on," Olson says. He estimates a price tag of \$6,000 to \$9,500 to finance the unit, hospital costs, the nephrectomy, and flight costs for pickup and delivery. For a transplant, including cadaver kidney transport, Olson set the costs at \$20,000 plus \$1,000 a year for medication--a relatively modest price compared with \$30,000 to \$40,000 annually for dialysis, or \$200 to \$250 per dialysis, three times a week. Fortunately, patients with permanent kidney failure are eligible for Medicare benefits when they need maintenance dialysis treatment or a kidney transplant.

Olson takes pride in the Renal Preservation Unit. "We have the technology right now," he says, "but we need kidneys badly." The list of people in need of kidneys in Minnesota, he says, numbers

around 220; the figure for the national pool is about 17,000 with 3,000 to 4,000 names being added each year. Supply lags pitifully behind demand. Says Olson, between 125 and 140 transplants are performed at the University each year. Nationally, the total hovers around 1500. He wishes that people would take steps to donate their organs, instead of merely considering the idea and then forgetting about it. "All people have to do is go

down to Station 22 and see those little kids on dialysis," he says.

As awesome and complex as transplant surgery may seem, it is perhaps the simplest part of the treatment. What proves to be the most delicate, most trying time for the patient is after transplantation, when the body must either accept or reject the new organ. To a certain extent, the body's response is



Kurt hooked up to a pediatric hemodialysis unit.

Health

controlled by medications, called immunosuppressants, which dampen the body's tendency toward rejection.

Kurt Chadwick was evidently pre-sensitized to the kidney he received, and thus rejected it. Lou Boulay accepted her new kidney. And ironically enough, neither could tolerate the immunosuppressant, antilymphocyte globulin (ALG); with Kurt, it had to be discontinued because his platelet count dropped drastically and he stopped producing urine; with Lou, the medication was stopped after five days, because her temperature shot up to 104 degrees F. Plagued by nightmarish headaches, she eventually contracted spinal meningitis and was semi-comatose for about two days.

What is ALG and how does it work? Dr. Richard Condie, head of the Minnesota ALG Program, explains that ALG is made by injecting a horse with human lymphocytes. The horse makes antibodies against these lymphocytes. Blood is then removed from the horse, the globulin fraction which contains all the horse's antibodies is separated, and the portion containing the antibodies to human lymphocytes is given intravenously to the transplant patient. ALG is pure gamma globulin, five per cent of which is antibody. Its purpose is to destroy the lymphocytes in the recipient's circulation so that none will be left to process the foreign antigen on the cells of the newly transplanted organ.

ALG was first formulated by Russian zoologist and bacteriologist Elie Metchnikoff around the turn of the century. According to Condie, it was first used in the 1950s to see if it would prolong skin grafts. In the 1960s, it was tried clinically by Dr. T.E. Starzl in Denver and Dr. John Najarian in San Francisco. It was discovered that the drug could reduce the incidence of allergic reactions from 80 per

cent to five per cent after it is purified from a crude serum. Condie says that he and 15 others began work on purification in 1971, and by 1973, they had perfected it. The incidence of allergic reactions with the use of ALG is now around only one per cent.

ALG works to reduce the immune response. But there is no such thing as destroying only the white cells and antibodies directed against an antigen on a foreign kidney cell's surface; the whole immune system is affected. The problem is that ALG is a **nonspecific** immunosuppressant, which means that in order to stave off the immune system's attack on a transplanted organ, ALG must also inhibit its ability to attack any real foreign invaders, namely bacteria and viruses. Dr. Ronald J. Glasser in his book on the immunological system, **The Body is the Hero**, writes: "It is possible with ALG to drop a person's lymphocyte count from 6,000 per cubic milliliter of his blood to zero, to deplete his circulating lymphocytes so that none are left." As a consequence, transplant patients are highly susceptible to infections which often prove fatal. Chicken pox, a viral disease, is potentially lethal to children on immunosuppressants who have not been exposed to the disease before.

According to Condie, ALG is administered for 14 days in doses of 1 to 2 grams per day, in conjunction with a steroid--such as prednisone--which fights rejection; Imuran, another immunosuppressant; and an antibacterial agent, such as Gantrisin, to cut down infections. But by using ALG, the steroids, and Imuran, continues Glasser, "The rejection phenomenon can be stopped but so will the rest of the body's defenses, leaving those immunosuppressed as helpless as the newborn infant without any immune system at all."

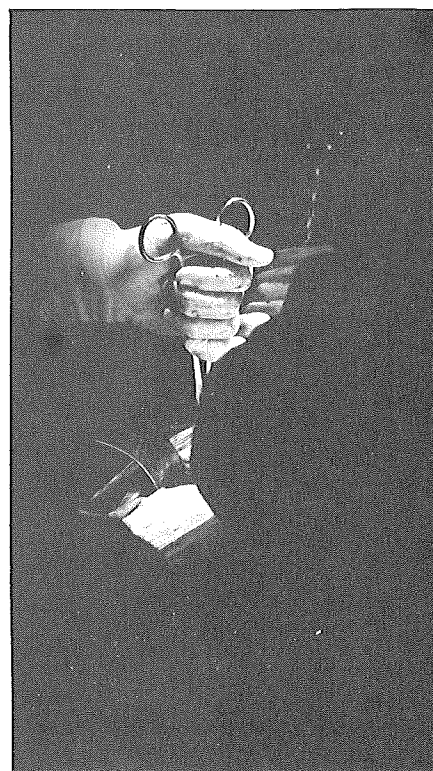
As far as efficiency goes, ALG seems too thorough. With some transplant patients suffering from severe infection, it has been necessary to stop the drug and even remove the kidney to clear up the infection. Condie and others realize the need to strike a balance between too much of the drug or too little--in other words, between severe infection or rejection. His research efforts are now focused on this problem.

Psychological adaptation to hemodialysis and kidney transplantation is every bit as vital as physiological adaptation to the patient's well-being. In recognition of this fact, the University Hospital's transplant service has a staff of one psychiatrist and two social workers avail-

able to patients for consultation on a one-to-one basis.

The main stress of maintenance hemodialysis stems from the patient's struggle against dependency. The patient becomes keenly aware of his/her dependence upon a machine and upon a regimen, and at the same time feels pressure to be independent and lead a normal life. The real problem arises if a patient has conflicts in either areas of dependency or over-independency. The dependent patient may find dependency comforting, take advantage of being ill and pampered, and will then find it difficult to give up the invalid lifestyle. On the other hand, dependency so threatens over-independent patients, that they may rebel against treatment. Such patients will often deny being ill because they cannot accept the passivity associated with dialysis.

Dr. Dorothy M. Bernstein, child and adolescent psychiatrist and consultant for the transplant service, points out that hemodialysis is a stressful experience evoking primitive fears of pain, mutilation, and loss of body wholeness. Younger children dread that they may be drained of blood by the process. Bernstein has written, "Anxiety (is) aroused by the necessary immobilization with concurrent feelings of helplessness and dependency."



Photos by Mary McDonough



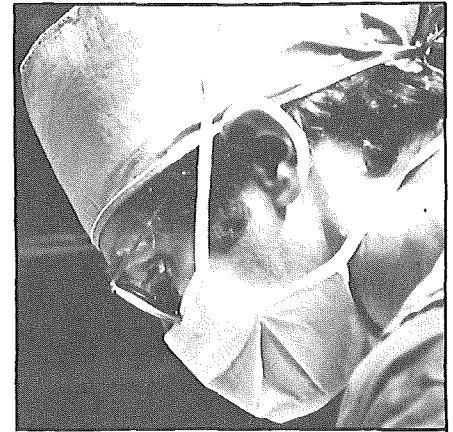
Surgeons perform Leesa Tomlinson's transplant.

Similar difficulties arise for children after transplant surgery. "The major task after loss of a body part then appear(s) to be incorporation of the new organ into the ego and body concept," according to Bernstein. Both she and Dr. Roberta Simmons, of the departments of sociology and psychiatry at the University of Minnesota, agree that the adolescent years are the most difficult. It is a period during which young people must handle many changes, and as Bernstein puts it, struggle with problems of self-concept due to transplantation or altered physical appearance due to medication--the continued use of immunosuppressive drugs and steroids being standard maintenance medication for all patients.

After Lou Boulay went through transplant surgery, she was given massive doses of prednisone (a steroid), Imuran (an immunosuppressant), Gantrisin (an

antibiotic), and Riopan (an antacid taken to counteract the prednisone, which causes ulcers). She still takes these medications, though at considerably reduced dosages. But she recalls the side-effects of the prednisone: "It made me look like a gopher!" She says it made her face puffy, gave her a big appetite, caused her to gain weight, threw her into sweat spells at night, made her hair fall out, and gave her a rash. Today the symptoms are gone, but her face remains rounded and full.

One-third of the children transplanted show a retardation in growth because of previous kidney dysfunction and the steroids, which stunt growth. Were it possible to get a good matched transplant from a sibling, which is very difficult to do in a child, the dose of steroids can be cut and then growth and development of the child will more nearly approach



normalcy. The problem is that most children have to have a cadaveric transplant or a transplant from a mother or father, which is only moderately better than a cadaveric transplant, and therefore take large doses of steroids, causing them to remain children physically.

Young Kurt Chadwick's growth has already been affected. Unusually small and thin for his age, he eats poorly and doesn't walk yet. But his mother claims that his motor skills and ability to pick up on things are that of a normal 2-year-old.

Bernstein has had experience with unhappy teenagers who on their own have decided to reduce their medication. Lou Boulay identifies with their frustration over lifeline medicines and their acknowledged dependency on the hospital. "It's hard to accept that you are going to be a patient the rest of your life," she remarks sympathetically.

Bernstein and Simmons also agree that by far, diabetics, who become extremely ill on dialysis, and adolescents have the most suicidal tendencies. In addition, the suicide rate is higher among patients on the artificial kidney machine and among transplant patients than in the normal population, Simmons says.

Peer relationships and altered family relationships can have a large impact on a child's emotional reactions. Family support is crucial to successful adjustment. However, a child may have difficulty in shedding the ill child role, Bernstein says, if the parents are overprotective. The basis of support for Lou Boulay consisted of her family and close friends she has known all her life. Together they enclosed her in a protective shell. Returning to school and breaking out of that shell was tough when she discovered how vastly her values differed from those of her peers. She saw how she had matured through seeing people suffer and die--"people striving to live an extra moment,

Health

an extra day."

Lou herself has contemplated death. "Right when I went into surgery, I thought, 'You're so sick and so fatigued, you don't know. Something's going to happen, and if you die, it will be for the best then. You haven't known what it's like to feel good.'" Lou then saw death positively, as a need, and life for her became the unknown. Back in school, she found that she took things more seriously than her peers and that so many of their concerns seemed trivial. "I was more appreciative of life," she insists. "I had the will to live and fight for my identity." So she endured stares and the impersonal atmosphere for awhile, and eventually, she got back into the social world without compromising her new-found values.

Family relationships among the Chadwicks have shifted somewhat in the past few months. Gaelyn has grown extremely close to Kurt and now knows him better than anyone. She knows his needs, his discomforts, his moods--and responds to them with a sensitivity that only a conscientious parent could acquire. But her increased devotion to Kurt has pushed aside his four-year-old sister, Kim. "Sometimes we forget she's just four," Gaelyn says regretfully. According to her mother, Kim felt painfully neglected for the longest time. "When we were with Kurt at the hospital, she thought we left her to have a good time." In an unusual instance, Kim was allowed visiting privileges in the Atlanta hospital where Kurt was staying. "When she saw how sick

Kurt was, she realized it was no picnic," says Gaelyn. "He was distant when he was sick. Kim even told me he was 'not a brother.' But now he plays with her. Now they love each other and need each other," Gaelyn says with satisfaction. Both Don and Gaelyn are especially proud of Kim's maturity and independence, and they try to make up for the times when family attentions center on Kurt.

Don's and Gaelyn's relationship has felt the stress of their child's long illness. They are closer in their awareness that they must both make sacrifices, often to the neglect of each other's needs. Gaelyn, believing that mothers are closer to their children than fathers, admits that the demands of Kurt's illness have taken her away from her husband. "Chronic illness can break you up or bring you together," she says. "In Atlanta, I've seen husbands walk out." Fortunately, Don and Gaelyn say, their experiences have made them stronger. They don't think that alienation from each other is likely.

The Chadwicks have felt tremendous support from relatives, the hospital staff, the Prospect Park Methodist Church, and each other. They consider the doctors "friends who feel your hurts." The nurses, they say, have taken special interest in Kurt. "People in Minnesota have opened their hearts to us," Gaelyn says gratefully, "and when I leave, I will go back having made some very dear friends. People here have made an effort to let us know they care."

Don broaches the subject of death, saying, "I don't fear it." He feels he has become more accepting of it after having witnessed the pain and dying at the hospital. "I believe in God, that we're here to serve Him. There is a better life. When I see Kurt suffer, I think of Christ on the cross. This is not the best life." But Don admits that such thoughts are "scary." Gaelyn's voice breaks in, saying, "If it's (death is) an end to suffering, then maybe it's the answer we're looking for." She questions, "If I believe in the Kingdom of Heaven and in sitting at the right hand of the Lord, who am I to say that I don't want Kurt to die?"

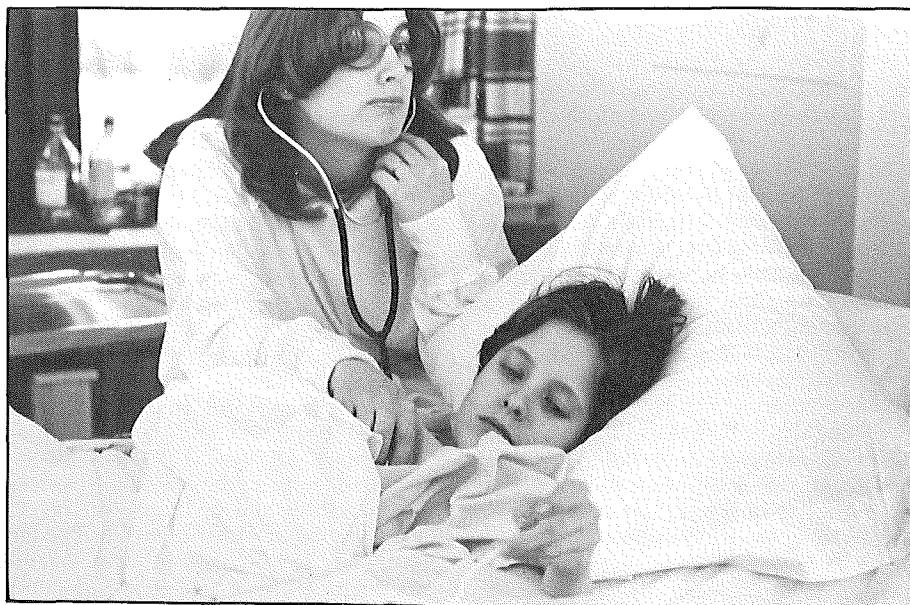
Many of Kurt's and Lou's experiences have recently become known to 14-year-old Leesa Tomlinson of Minneapolis. Up until a year ago, the small, slender teenager was fine, her parents James and Clarice say, but symptoms began to set in. Leesa became tired, crabby, anemic, and her motivation was low at school. The Tomlinsons brought her to North Memorial Medical Center in November, 1975, where doctors zeroed in on her kidneys as the problem source.

Leesa was referred to the University Hospitals in February, 1976, where it was discovered that she has medullary cystic disease, a fairly common cause of kidney failure in 10- to 15-year-olds. Because the disease is hereditary, the entire family was checked for signs of abnormal kidney function. James, Clarice, and their other two daughters, Michelle, 18, and Stephanie, 10, are normal.

By March, it was determined that Clarice's tissue type best matched her daughter's; Clarice was therefore chosen to be the donor. "If it had been a toss-up," laughs James, "I would have done it." His wife was understandably frightened at the thought of donating her kidney.

An avid sportswoman in the past, Leesa has been hoping that the transplant will improve things. Chronic fatigue has forced her to cut back on a variety of sports she enjoys, such as volleyball, basketball, bowling, and horseback riding, although she continued to ski and swim until last Christmas. In fact, much to the amazement of her doctors, she entered a diving meet just before Christmas and took second place in the Amateur Athletic Union (AAU).

All last summer, Leesa came to the clinic more and more frequently, waiting for test results that would call her in for surgery, says Clarice, who is a student in banking occupations at Hennepin Tech-



Leesa before surgery.



Photos by Mary McDonough

nical Center's North Campus. But the results said "no" as Leesa's quality of life went down. She says she could talk about her illness with good friends, but her crabbiness often made her intolerable. In addition, says Clarice, "Leesa had a denial thing going for a while; she refused to admit that she was being affected."

An excellent student at Hosterman Junior High, Leesa was on the honor roll until January. Then in February, she began taking lessons at home under the Homebound Program.

The transplant took place in a four to five hour operation on February 15. In a separate operating room, Clarice's kidney was removed, while Leesa was being prepared to receive it. Seeing Clarice's rather pale, grayish kidney "blush" as it was hooked up to Leesa was a miraculous sight to behold. Interestingly, Leesa's kidneys were not removed, because it was not deemed necessary. They will continue to function in their diminished capacity, along with the new one.

The Tomlinsons estimate a bill of around \$60,000 for the nephrectomy, transplant, dialysis, and care. They have no insurance, but fortunately are eligible for aid from the Crippled Children's Service and Medicare.

Several days after surgery, Leesa was looking radiant. Says her mother happily, "Her color hasn't looked so good in years." So far, she has had no complications with her third kidney or the medicines she must take. Clarice regrets that Leesa's illness, compounded by the immunosuppressants, won't allow her to

grow much beyond her 4 feet, 6 inches. "But if it weren't for what has happened," she smiles, "she wouldn't be alive."

Leesa's future seems secure and in many ways, optimistic, especially since she has known what it's like to be healthy and is striving for things to be as they were. Restless from days of watching daytime television in her hospital room, she is anxious to return to school and eventually join the diving team again.

Determined to get out and do things, Lou Boulay is doing just that in a job that she finds extremely rewarding. With her Associate of Arts degree in special education that she earned at St. Mary's College after two years, she now has a teaching position in physical education at the Cooperative School and Rehabilitation Center in Minnetonka, where she works with handicapped and mentally retarded 13- to 23-year-olds. She says her personal growth and self-esteem have gone up since she began working. She picked special education because of a strong emotional tie with her brother, who was mentally retarded.

Lou has also learned to accept her dependence on the University. Twice a year she returns to the kidney clinic and gynecology department for checkups, and once a month she consults the dermatology department about her skin cancer. She continues to take the post-transplant medications, which by disturbing her immune system, leave her 25 to 30 times more prone to cancer than a normal person would be. She says she is aware of the dependency-independency conflict

being thrust upon her, but is strong enough to want to "cut the cord."

Kurt Chadwick will eventually be put on the list for a cadaver kidney. But a second transplant is a lot to think about, as Gaelyn and Don well know. "I am a mother," Gaelyn says, in a voice quavering with emotion, "and I don't want him to go on and reject another kidney. But as long as there's hope, I've got to go on." It hurts her to think, as she does, that Kurt knows exactly what's going on. She cannot escape guilt associations. "When Kurt's in pain and he looks at me, I just know he's blaming me for it all."

Realistically, the Chadwicks must consider finances. Although most of Kurt's bills are covered by insurance and Medicare, the costs of holding on to a home in Georgia and keeping one in Minneapolis may force Don, who has made occasional trips back home, to give up his half of the business and look for a job up here. Gaelyn says she would be willing to work, and in the future might go into nursing.

The Chadwicks agree that living through Kurt's illness has made them both stronger and more independent. It has been a trial that has taught them to live each day at a time and to avoid getting too wrapped up in the future with things that have no immediate answer. They place a good deal of faith in the superior technology and health care offered by the University of Minnesota Hospitals, and in Kurt's unyielding stamina. Says Gaelyn proudly, "Kurt's such a fighter, you can't do anything but fight with him."



SLIC staff members listen to community treatment specialist Mark Clark during a staff meeting.

Photos by Jim Machowski

SLIC

Out of the "dark ages" in mental health

By Donna Ahrens

"Mental health care is in its infancy compared to the advances that have been made in medical science," says the young man reclining in a beanbag chair. "We've come a long way in treating people's bodies, but in treating people's minds, we're still in the dark ages."

Mark Clark and the other 20 staff members of Sharing Life in the Community, Inc. (SLIC) think their program represents an important step toward improving Minnesota's mental health care system. A state pilot project (funded by the 1975-76 Minnesota Legislature) which began May 1, SLIC is a mental health treatment program for "revolving door" mental patients--individuals who have been hospitalized in mental institutions three or more times.

The program's approach to "deinstitutionalizing" clients--enabling them to live and work in the community--is to treat them as responsible adults who are accountable for the consequences of their own behavior.

"A lot of (mental health treatment) programs have an 'I'm healthy, you're

sick' attitude toward people who've been in mental institutions. If you treat people as though they're sick, they'll continue to play the role of dependent patient. We expect clients to relate to staff on an adult-adult basis, not on a patient-doctor basis," says SLIC executive director Don Schmidt.

SLIC's philosophy of client responsibility is incorporated into a self-help plan designed by each client upon entering the program. The self-help plan encompasses basic coping skills areas essential to learning to live successfully in the community.

Each week clients assess their progress and revise self-help plans accordingly. The plans are written up, signed by the client and staff member working with him or her, and used as the basis for treatment.

The program's emphasis on client responsibility in treatment and accountability for behavior is unusual in the field of mental health treatment; but even more unique is SLIC's focus on working with clients in their own apartments, rather than in a "treatment facility" such

as a clinic, board and care home, or private office. By going out to clients where they live, work, and socialize, SLIC staff feel they can best accomplish their goal of helping clients acquire basic skills for coping with day-to-day stresses.

"Learning to budget money, shop for groceries, cook, clean an apartment, wake up and get dressed at a decent hour--these are daily living activities that many of our clients haven't mastered, because they've been dependent on their families and institutions most of their adult lives," Schmidt says.

In order to begin working on these coping skills in daily living, SLIC initially helps clients to finance and equip an apartment in one of the three counties (Ramsey, Washington, and Dakota) SLIC serves. Many clients rent apartments close to the SLIC office, a small frame house in South St. Paul.

For Frank G. (not his real name), moving into his own apartment marked a major step toward independence. He had lived with his mother all his life--he is 30 years old--except during his four hospitalizations.

Initially, some aspects of independent living were hard for Frank to cope with--particularly grocery shopping and cooking. "Staff people helped me with shopping, and showed me how I could cook in quantity and freeze meals, so that I didn't have to cook something new every night," he says.

Susan F. (not her real name), a client who entered the SLIC program in November, says, "I couldn't have (moved) without all the support the SLIC staff gave me. It was really a hard thing to go out looking for apartments--a couple of times I just felt like giving up." For the last seven years, Susan has lived in board and care homes where "there wasn't much going on--people mostly just sat around."

"Sitting around" is an activity all too familiar to people who have spent considerable time in hospitals and board and care homes. SLIC encourages clients to discover new ways to spend time alone or with others by developing social and leisure skills activities. Announcements of concerts, plays, movies, recreational and educational activities in the Twin Cities are posted on a bulletin board in the SLIC office.

Many clients take classes (swimming, pottery, and woodworking, for example) through the YMCA or South St. Paul education program, or are involved in church groups. They are also encouraged to develop hobbies--sewing, knitting,

photography, and crafts.

Frank G., a self-taught clarinetist with an active interest in music, says he has changed his attitude toward listening to music since entering the SLIC program.

For a long time, he says, "I was kind of ashamed of my interest in music" because it was "just one more thing I couldn't do anything with, another one of my useless interests." When he lived at home, he kept his stereo in his room and turned it off whenever anyone came in. Now, he says, "when staff people come over, I put on some records to listen to while we talk."

Another less tangible but equally important area of coping skills centers on social-interpersonal relationships. Often clients' only friends are other people who have been institutionalized, either in mental hospitals or in board and care facilities for former psychiatric patients. Clients seek out non-institutionalized friends through educational, social and recreational activities.

In addition, SLIC staff members act as role models, helping clients learn to interact with others on an adult-adult basis, by giving them direct feedback about their behavior.

"We don't play games with clients," community treatment specialist Kathie Taylor says, "and that's often not the case in treatment programs like ours."

For example, she explains, sometimes a staff member will confront a client about an issue that makes the client uncomfortable. Instead of talking about the problem, the client may respond with

"space talk," lapsing into a rambling monologue about his latest dream or "hallucination."

Taylor continues, "Some mental health professionals will play along with the client's game by saying something like, 'Oh your latest trip to Venus sounds really interesting. Tell me more about it.' If a client starts doing that sort of thing when I'm talking to him, I say, 'Okay, I'm sure that's very interesting for you, but I can't make sense out of what you're saying. What I'd like to talk to you about is how you're going to budget your grocery money this week.'"

Taylor adds that as a result of direct, open communication with staff members, clients learn to be assertive in other relationships. "Many clients haven't learned to say 'I'm hurt' or 'I'm angry.' We want clients to be able to express what they're feeling, whether it's with staff members or with their friends or with their families," she says.

Family relationships constitute another basic coping skills area. "The traditional mental health system encourages continued dependency on families," Schmidt says. A psychiatric patient is released, goes home, and demands that his parents take care of him or her when difficulties arise in coping with stressful situations.

"Sometimes families think, 'What did we do wrong?' when a child has chronic coping problems. To make up for their guilt feelings, they say, 'Okay, we'll take care of you,'" Schmidt adds. This attitude feeds into the cycle of dependency and inability to cope.

The SLIC program works with parents and clients in helping both move from dependent child-parent relationships to adult-adult relationships.

When a client is admitted to the program, his or her family meets with SLIC staff to draw up a family contract limiting client-family contact. Usually the family agrees to have no contact with a client during the first month of the program, and two to three contacts per month after that.

SLIC staff helps conduct bi-weekly family therapy group sessions where parents can learn to deal with their feelings about themselves and their "problem" children. Some families also attend monthly meetings of FEDUP (Families of Emotionally Disturbed United for Progress), a support and advocacy group organized and run by parents of "revolving door" clients.

Parents are supported by SLIC staff

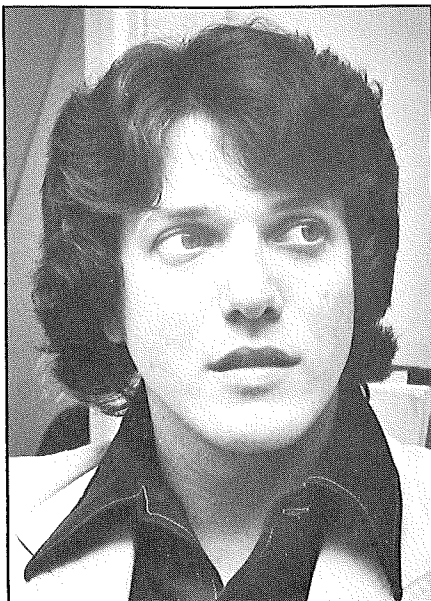
in their efforts to help their sons or daughters work toward independence, even when it occasionally means denying them money or food.

"Sometimes clients will run low on money at the end of the month and say, 'I'm going to call my mom and get money from her,'" Kathie Taylor explains. When that happens, a staff member calls the client's mother to stress the importance of forcing clients to deal with budget problems on their own.

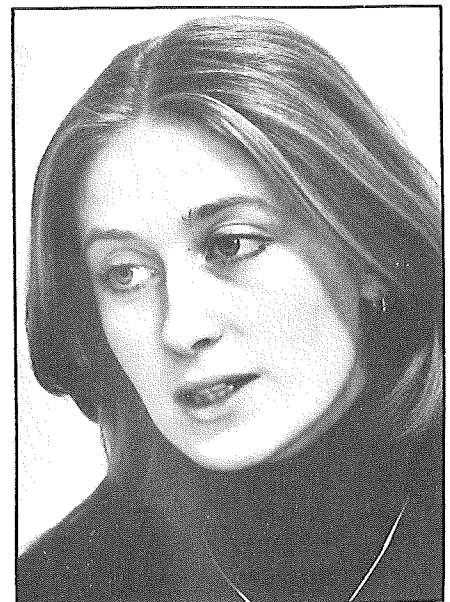
"One client's mother called us back to say that--for the first time in her life--she'd told her daughter, 'I'm sorry, but I'm not willing to give you the money this time.' It was a real hard thing for her to do. We told her that we knew it was hard, but that it was the only way her daughter would learn to take responsibility for herself," Taylor says.

But client-family dependency relationships work both ways. Frank G. says that his mother is "glad to see me independent, but also kind of resents it... She has dependency needs of her own that I can't fulfill for her the way I used to." Other relatives have criticized him for moving.

"My aunt would say, 'You should be taking care of your mother.' I know that it's hard for my mother to live alone now...But I feel like now she'll have to deal with her own life and find new people to be with, because I have to make a life of my own." He says that SLIC staff have helped him overcome the guilt feelings he had always had about leaving home.



Don Schmidt, SLIC executive director.



Kathie Taylor.



Drawing by Guadalupe Victorica

Once clients have begun making progress in coping skills areas of daily living activities, leisure skills, social-interpersonal relationships, and family interaction, they are better able to work on vocational goals. Nearly all SLIC clients have held jobs in the past, but most have been short term (the average job lasted five months) and 94 per cent have been unskilled.

SLIC staff members help clients set realistic vocational goals ("If a client says he wants to be president of Dayton's in six months," Schmidt says, "we let him know we think that's being unrealistic"). All clients participate in at least one "constructive activity"—a job, volunteer work, education classes, vocational training classes—per week.

Susan F. is taking a typing class at the YMCA, and typing the newsletter at a nursing home as a volunteer. "I'm up to 60 words a minute now, with two mistakes, so I shouldn't have much trouble passing the civil service typing exam," she says. Before being hospitalized, she held several civil service clerical positions, and is looking for a secretarial job now.

Frank G., who went through an electronics training program a few years ago but was never able to get a job in electronics, is brushing up on his skills by repairing television sets. Meanwhile, he picks up spending money occasionally by working at day labor.

SLIC staff members help clients prepare for jobs by role-playing job interviews, often using videotape equipment. Staff members call potential employers to explain the SLIC program and the

client's participation in it. "Employers are understandably reluctant to hire a person with a history of psychiatric hospitalization," Taylor says. "Knowing that there's an organization standing behind the client often helps remove some of that reluctance."

Developing a good working relationship with the community—police, social service agencies, business people, landlords, as well as employers—has been a priority since the program began.

"SLIC couldn't operate without the community's support," says Pat Parker, SLIC business manager. "I've lived in

the South St. Paul area for nearly twenty years, and I know the community really well. Everyone has been tremendously supportive and accepting of SLIC's goals."

The police, neighborhood storekeepers and social service workers have SLIC's telephone number, and are urged to call if SLIC clients cause problems for them. When a disruptive incident occurs, a SLIC staff member goes to the business or agency to find out what has happened and decide on the best course of action in dealing with the incident.

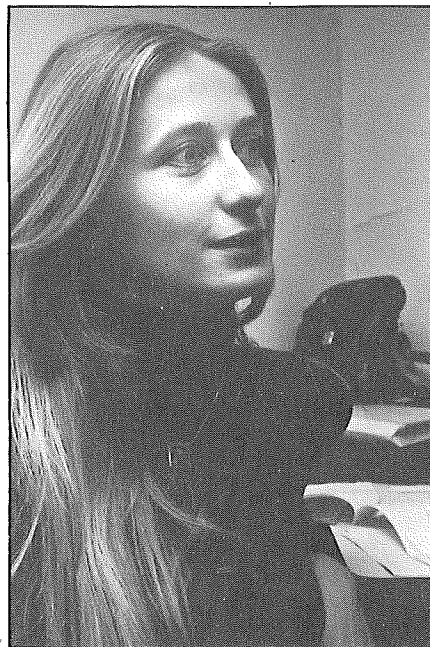
"I think we've gotten such good support from the community people because we've made good on our promise to be always available if they need us," Schmidt says.

"Always available" means just that: SLIC operates on a 24-hour basis. The 15 community treatment specialists who work directly with clients operate in two shifts, and two staff members are always "on call" between 11:30 p.m. and 7:00 a.m.

Although community treatment specialists work with clients on a one-to-one basis, they use a team approach to treatment. Thus, every staff member sees every client.

"We don't want clients to transfer their dependency on families or institutions to a particular staff person," Schmidt explains.

Staff cooperation is essential to the team's operation. To insure staff sensitivity, all staff members participated in five-and-a-half weeks of training last summer, before SLIC began taking



clients. Schmidt feels that potential problems of conflicting counseling styles and personalities have been minimized because they were dealt with in training.

"The group norm is direct, open communication," he says. "When problems do occur, it's because the group norms haven't been followed--for example, if someone stewes over an incident for a week and **then** blows up at a staff meeting."

The staff, ranging in age from 21 to 47, represents a range of lifestyles, educational backgrounds, and practical experience in mental health work. The one thing they have in common is a strong commitment to SLIC's philosophy and goals--a commitment that can be disruptive to their personal lives.

"Personal life? I don't have one," community treatment specialist Mark Clark says ruefully, looking up from a client's file. Clark, 22, worked in a nursing home and a hospital psychiatric unit before joining the SLIC staff, "but SLIC asks more of you than other programs."

The pressure to be always "on"--emotionally sensitive and responsive to clients and staff members--can be taxing: "For a long time, I found myself dreaming about SLIC," Clark says. "I'd wake myself up from a sound sleep, talking to a client in my dream."

The staff's dedication of time and energy appears to have paid off. Because SLIC has only been serving clients since August, any statements about the program's overall success must be qualified, executive director Schmidt says. But he adds that statistics from the first four months of SLIC's existence indicate that the program is doing exactly what it set out to do--keeping clients out of mental institutions by teaching them to use the community as a living space.

Since August, SLIC has taken in 19 clients, and is now accepting one new client each week (clients are referred to the program by county social workers). SLIC clients have spent 94 per cent of their time living in the community (i.e., not in hospitals, jails, or board and care homes) since entering the SLIC program. Nearly 70 per cent of the clients have been enrolled in pre-employment training. Several clients have held jobs since entering the program.

"Thus far, we have every reason to believe that our program is a success," Schmidt says.

Funding for SLIC seems secure for the next two years. The legislature has provided money for a research study to



Photos by Jim Machowski

determine whether SLIC is more effective than traditional mental health care service agencies in deinstitutionalizing "revolving door" clients in Dakota, Ramsey, and Washington counties. Over a three-year period, SLIC clients--the experimental group--will be compared with a control group of people with similar histories of psychiatric hospitalizations. SLIC staff are convinced that their clients will be able to break out of the "revolving door" syndrome much more successfully than the control group clients.

As a model state pilot project, what will SLIC's success mean for mental health care in Minnesota?

Don Schmidt hopes that other counties will set up programs similar to SLIC. "I'd like to see the state turn the mental health system around so that we don't rely so heavily on state mental institutions," he says.

Ideally, Schmidt continues, mental health care treatment would be centered in three types of programs. A few "security units" (small wards in state psychiatric hospitals, for example) would house long-term psychiatric patients, "people who really need to be locked up because they're a proven threat to the community."

More "acute care facilities"--psychiatric wards of private hospitals, board and care homes--would be used for short-term psychiatric treatment.

Finally, maximum emphasis would be placed on establishing community-based treatment programs--like SLIC--to treat coping problems early and to reduce the number of "revolving door" clients in the mental health care system.

Schmidt concedes that the idea of community-based mental health treatment is revolutionary.

"You know, there's this myth that our program is something radical," he says. "But to us, what seems radical is the traditional mental health care system's approach--storing people in institutions and maintaining them there on large amounts of drugs, at the taxpayers' expense."

Compared to the traditional system's approach, SLIC's philosophy of teaching coping skills in the community--so that people stay out of hospitals--"seems very conservative and more humane," Schmidt adds.

"And what's more," he says emphatically, "it's working."



Epilepsy Treatment

A new program with a comprehensive approach

By Donna Ahrens

Sherry Kilburn, 28, was diagnosed as epileptic fourteen years ago. After the diagnosis, she received anticonvulsant medication that controlled her seizures for nearly ten years. Yet even then, she says, "It was pretty rough going for a few years."

Several years ago, while she worked at University of Minnesota Hospitals as a food supervisor, she began to have seizures again. She started to withdraw from her friends and social activities: "I just went to work and came home. Period."

Last spring Kilburn returned to college (at the University of Wisconsin at Stout) to get a degree in vocational rehabilitation because, "I did **not** want to be a dietician for the rest of my life. I figured that life held bigger things for me. Besides, I really, really like working with people, so voc rehab sounded perfect for me."

Kilburn made it through the school year but continued to be plagued by seizures, even after a change in medication. By summer, "I was really a wreck. I went **status epilepticus** (recurring seizures with little or no recovery between

seizures) and wound up in the hospital pumped so full of phenobarbital (an anticonvulsant drug) that I overdosed on it." She recovered in time to return to school in September, but by then her almost daily seizures were severely interfering with her classes and extracurricular activities.

In December, Kilburn's neurologist referred her to the Comprehensive Epilepsy Program's Diagnostic Treatment and Rehabilitation Program (DTRP), a newly-opened unit at University of Minnesota Hospitals. She was accepted into the program, and began her stay at the unit on January 4.

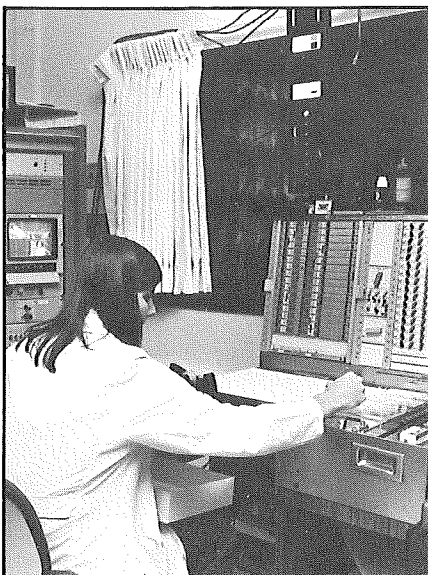
The DTRP, funded by the National Institutes of Health, marks a major improvement in epilepsy treatment for individuals like Sherry Kilburn, who have been unable to achieve seizure control through traditional anticonvulsant drug treatment (in 75 to 80 per cent of epileptics, seizures can be controlled satisfactorily through available medications). The program includes intensive diagnostic and treatment services, social and rehabilitation services, group and indi-

vidual counseling, outpatient treatment, and, for some patients, help with living arrangements. Patients must be at least twelve years old, and most of the people admitted to the program thus far have been in their twenties.

Dr. Robert Gumnit, program director of Minnesota's Comprehensive Epilepsy Program (CEP), helped develop the new unit. CEP also sponsors more than 30 research projects at the University of Minnesota and the Mayo Clinic, and offers professional and community education services throughout the state.

According to Gumnit, the DTRP is unique in its comprehensive approach to treating people with chronic, long-term problems with seizure control. Most other epilepsy treatment programs focus on what goes on in the hospital. "And that's certainly the most dramatic part--you come up here (to the unit) and see all the fancy equipment and all the staff team members running around," he says. But the program staff is also concerned with what happens to patients when they leave the hospital, so that the results of the hospital diagnosis are integrated into a coordinated program of out-patient care and residential follow-up. "This way," Gumnit explains, "we can work with these people over a period of years, rather than just knock ourselves out for six or eight weeks and then drop them."

Gumnit emphasizes the unit's team approach to working with patients. People who have long-term problems with seizure control "in general suffer from a multitude of problems of the most chronic and complicated type, and they



Monitoring the EEG machine in the unit's observation room.



Judy Crawford studying while her brain waves and behavior are monitored in the observation room.

can't be handled in isolation," he asserts. "The medical and socio/psychological aspects of epilepsy go hand in hand."

The team staff includes specialized physicians and nurses, as well as a social worker and a counseling psychologist. "Each professional works in his or her own area," Gumnit says, "but we're constantly trading information so that we can work out the best course of action possible for each patient."

Patients usually stay six to twelve weeks in the eleven-bed hospital unit while they undergo diagnostic testing and are evaluated for medical treatment.

The unit is more "homey" than the average hospital ward. Kitchen and laundry facilities are available for patients to use. In the lounge, patients can watch television, play cards, or relax with visitors. Patients have meals and hold classes in a combination dining/classroom. Their own belongings--wicker chairs, posters and wall hangings, stereo systems, skis, hanging plants--add a personal touch to the somewhat sterile, white-walled rooms.

During their stay, patients participate in daily education sessions, and occupational therapy groups. Vocational counseling is available, and a work evaluation program allows patients to perform tasks in auto mechanics, clerical work, and sewing. A recreational planning committee of patients, staff, and students from the University of Minnesota helps arrange events such as parties and outings to concerts and movies.

The unit's diagnostic facilities represent the most recent technological advances in providing better information about seizures. Gumnit defines a seizure as "a sudden episode of altered consciousness or involuntary movements, accompanied by a disturbance in the electrical discharges within the brain." Only people who have repeated seizures--about two per cent of the population--are considered epileptic.

Most people associate epileptic seizures with the **grand mal** (generalized tonic-clonic) seizure. In this type of seizure, the person loses consciousness and falls to the ground, with rigid jerking movements of the arms and legs.

But a seizure may also take the form of an almost unnoticeable lapse in thinking for five or ten seconds (the **petit mal**, or generalized **absence** seizure). A third type of seizure, the psychomotor, is often marked by automatic movements such as lip smacking or pulling at clothing. The kinds of seizures an epileptic



Sherry Kilburn.

Photos by Jim Machowski

experiences depend upon the nature of the abnormal brain activity and the area of the brain where the electrical discharge occurs.

An electroencephalogram (EEG) is used to detect these abnormal discharges. At the DTRP unit, several elaborate EEG monitoring systems provide a more complete picture than previous systems of the locations of unusual brain activity that cause seizures. Using three monitoring systems, the medical staff can gain more precise information about the frequency and patterns of seizures over a long period of time.

In the observation room, the patient's seizures and brain wave patterns can be viewed simultaneously on a split-screen television monitor, while the patient is hooked up to an EEG machine.

Elsewhere on the unit, the patient's electrode discharges can be monitored when he or she wears a helmet with sixteen electrodes attached to it. The discharges are picked up by an antenna system in the ceiling and relayed to the EEG monitor in the observation room.

A portable "walkabout" monitoring system can record limited brain wave activity while the patient is outside the hospital. With the walkabout system, eight electrodes attached to the patient's head are connected to a small cassette recording machine carried inconspicuously under his or her clothing.

EEG reading are supplemented with nurses' observations of each patient's seizure behavior and patterns. After EEG data and clinical observations have been studied, the medical staff develops an individualized medication plan, and periodically checks the level of anticonvulsant medication in the patient's bloodstream.

The ultimate medical goal is to determine the minimum drug dosage necessary for a patient to attain maximum

seizure control--a process that can take as long as several months, depending on the types and severity of seizures the patient experiences. In a very few instances, an individual's epilepsy may be treated surgically.

But finding the medical solution to seizure control is only a part of the total program. The unit's comprehensive approach "encourages people to deal with every aspect of their epilepsy--medical, social, psychological, and vocational," according to Jean Johnston, the team's research nurse clinician. In group therapy sessions led by social worker David Olson and counseling psychologist Debra Plesser, patients share their feelings and try to understand how epilepsy affects their lives.

Children and teenagers with poorly-controlled seizures may feel socially isolated and develop low self-esteem, Olson says. He adds that the stigma associated with having epilepsy can lead to a poor self-concept and adversely affect a child's social behavior.

Verna Brant, who entered the unit in late January, cites her own history as an example of the kinds of social and psychological problems that can result from having epilepsy.

Brant's epilepsy was diagnosed in childhood, but it was in junior high school that she began having noticeable seizures. "Adolescence is hard enough as it is, but being 'different' at that age really makes it a lot worse," she says, shaking her head. "The other kids would make fun, you know, call me mentally retarded, even though they knew I wasn't. After awhile you learn to think that you're just no good...I developed a real classic inferiority complex...Sometimes I'd get so angry at my parents or at other kids that I'd just want to start yelling."

It wasn't until she spent part of her senior year of high school at a home for emotionally disturbed children that she began to change her attitude toward herself and others. Through therapy, she "gradually began thinking about questions like, 'Who am I?' 'What makes me an important person?'"

Only last year, however, during her senior year of college (at Maranatha Baptist Bible College in Watertown, Wisconsin) did she finally overcome her old inferiority complex.

"For so long, I never thought anybody loved me," Brant says softly. "And even if people told me differently, I just never could be convinced of it."

Health

Other individuals try to deny the social and psychological aspects of their epilepsy. Sherry Kilburn says, "I only realized last year that I'd never really accepted my epilepsy. I thought I had, but I was wrong—I was really still fighting the fact that I was epileptic. Finally last fall, I talked to my counselor at school about it and worked on adjusting my attitude. After all, my epilepsy is there, it's a part of me, and there's no use hiding it or denying it."

Both Kilburn and Brant think that the group therapy sessions help patients deal with personal problems related to epilepsy. "It's interesting hearing people express some of the same feelings about themselves that I had up until recently, and that I had to work through," says Brant. "One of the best things about the group is that we trust each other, because we've gone through some of the same experiences."

The commonality of experience helps make the group more effective in discussing patients' attitudes, Kilburn adds. "Sometimes someone (in the group) will say that epilepsy hasn't been a problem at all for him, that everything is cool and he's never had trouble dealing with it. It's pretty hard to maintain that stance when there are nine other people in the room saying, 'Hey, I'm an epileptic, too, and I don't think I buy that.'"

Debra Plesser underscores the importance of the group in changing behavior and attitudes. "I think one of the most powerful things (about group therapy) is when one of your peers lets you know that you've been hiding your feelings," she says. "You know, I can say it and Dave (Olson) can say it, but **we're just staff**. Our power is not that great, and neither is our influence, compared to the power of peers in the group."

"What we're striving for," Plesser continues, "is to make patients realize that they have to take more responsibility for themselves. The institutionalization or overprotection that has gone on for 25 or 30 years has to stop at some point."

Some patients, like Kilburn and Brant, have been living away from home for a number of years; others have become dependent "in areas where they have the potential to be independent," says Jean Johnston. On the unit, patients are responsible for keeping their rooms clean, making their own beds, and taking turns at K.P. duty whenever the unit's kitchen is used.

Some of the daily education meetings deal with the patient's responsibilities in treatment, such as taking medications as prescribed, learning the possible side

effects of certain anticonvulsant drugs, and discussing medication problems with their physician. Other sessions stress the importance of establishing daily routines and health habits that may help control seizure frequency.

The overprotection and social isolation of some patients can lead to problems in coping with routine social situations. The staff help individuals improve social behavior, from table manners to interpersonal skills.

"A lot of epileptics have been so terribly socially isolated that they don't know how to act," Plesser says. "Sometimes they've been treated like little children, so that they don't know some of the basics of human courtesy." Plesser, Olson, and nurses let patients know when their behavior is inappropriate or when they might handle a social situation in a better way.

One former patient came to the unit from a rural environment where he had been "socially and psychologically deprived and isolated for years and years," Plesser continues. "In the beginning of his stay here, he was extremely isolated. But during his stay, he really bloomed. He didn't know how to act, and very often his behavior **was** inappropriate, but all you had to do was say, 'You know, this isn't the best way to handle (this situation).' And he just ate it up. He **wanted** to know how to be with people so much."

The staff's encouragement of patient involvement in and assertiveness about their treatment has resulted in a few staff-patient confrontations. At one

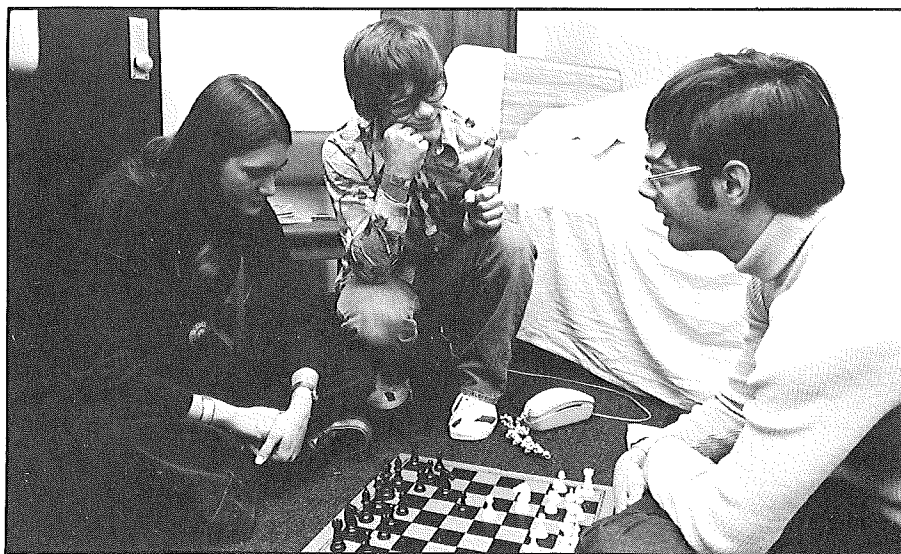
"community meeting," patients criticized a lack of communication between patients and doctors. They also raised the issue of confinement to the unit. Patients are granted one four-hour free pass (or two two-hour passes) each week, but must be accompanied by staff at all other times if they leave the hospital.

Grinning ruefully, Sherry Kilburn says, "I was like a bull in a china shop the first couple weeks I was here. I was just **furious** at Dr. Ramani (the attending physician) for not letting me go outside." On one occasion, in fact, Kilburn packed her bags and was ready to quit the program.

"But then I sort of calmed down. Now some of the other patients are starting to get antsy.... But not everybody feels the confinement so much. Some patients are really content with the close supportive atmosphere and they're happy as clams just sitting in the lounge or their rooms."

Another patient, who had been in the unit for two weeks, says that sometimes the staff imposes rules without explaining the reasons for them: "You don't find out about a rule until you get into a situation where you break it," she says. She adds that doctors are hard to pin down sometimes. "You sort of have to grab them by the arm, pull them into your room and say, 'What's going on?'" But both she and a longer-term patient agreed that the staff-patient communication is improving.

Jean Johnston admits to some recent patient unrest, but adds that a certain degree of restlessness is to be expected given the nature of the unit.



Theresa Schramm and David Beneke play chess as Eldon Kilsdonk looks on.

"No matter how much anyone does to give the unit a home-like atmosphere, it's obvious that this is still a hospital, with all the problems of confinement and idle time that hospital life entails. And living for weeks with ten other people of varying intellectual and emotional levels is bound to cause strain at times," she says.

The stresses of life on the hospital unit, however, are in many ways minimal compared to the kinds of problems patients will face on being discharged. Thus, an extremely important component of the DTRP is follow-up and out-patient care. Each patient is assigned a follow-up counselor--Plesser, Olson, or Johnston--who contacts appropriate community service agencies, employers or work centers, the patient's personal physician or the referring hospital, and, in some cases, residential facilities.

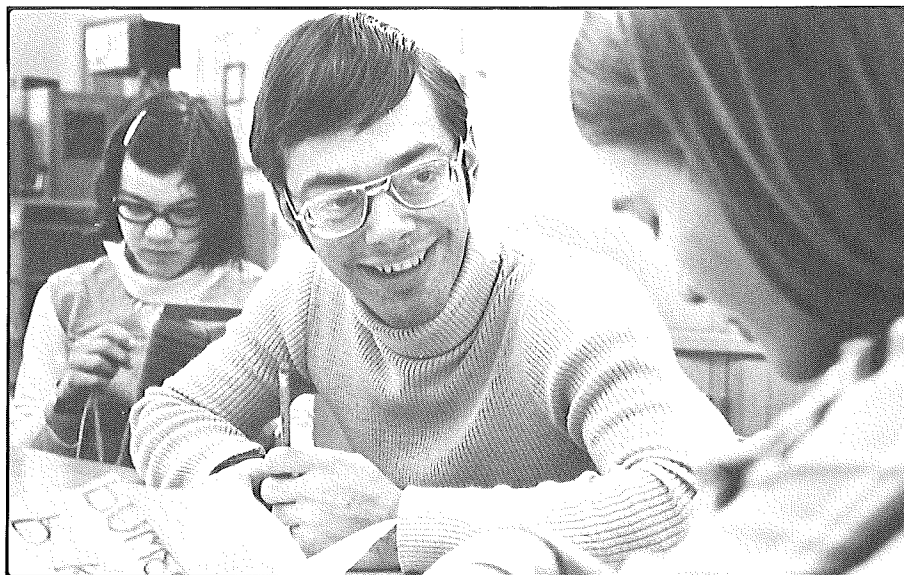
Dave Olson says, "We try to provide a longer-term, more consistent approach to follow-up than what's been done in other epilepsy treatment programs. We try to have agency representatives come in for a conference where we share all the information we have about the patient, getting the discharge plans as well-organized as possible, with as many people or resources as need to be involved."

Patients' families also are consulted on immediate and long-term patient treatment plans. In some cases, Plesser says, the team feels that a patient will be better off living away from home.

"If the evaluation of the team is that the patient's home situation has been detrimental," Plesser says, "we feel anything we've done here will be immediately wiped out when the patient goes home. In that case, we push to have the patient go to a residential facility that we feel would be better for him or her."

Sheltered workshops are an employment possibility for some patients following hospital discharge. Others, like Brant, will return to jobs they held before they entered DTRP. Brant has been working since last summer as a maid in a hotel in Roseville, but eventually she would like to find a job as an assistant teacher in Baptist education.

Plesser, the team member who does most of the vocational counseling, says that "sometimes you find college graduates working in sheltered workshops. There may be a good reason for a particular situation like that, but oftentimes it's because the person has been unable to find employment--either seizures have prevented it, or hospitalizations have interfered with the job."



Verna Brant, David Beneke and Theresa Schramm in an occupational therapy session.

Photos by Jim Machowski

The DTRP staff does not arrange jobs for patients, but will contact an appropriate resource such as the Department of Vocational Rehabilitation or the Minneapolis Rehabilitation Center. "The main emphasis is on putting (patients) in touch with the right resource when they leave here," Plesser says.

The staff's concern with aiding patients in their return to the "outside" world raises the significant issue of the need for community education about epilepsy. Judy Soderberg, education coordinator for the Comprehensive Epilepsy Program, started "from the ground up" in designing programs to clear away some of the misconceptions and negative attitudes people hold about epilepsy.

When Soderberg was hired in January 1976, she found that, "I couldn't coordinate the epilepsy education services because there simply weren't any being offered." Since then, she has concentrated primarily on education sessions for parents of children with epilepsy and for professionals who work with epileptics--social workers, nurses, teachers, rescue squads.

In education meetings, Soderberg talks about three basic concepts in understanding epilepsy--medical aspects, first aid, and psycho/social aspects. About the latter, she says, "People need to take a good, hard look at some of the negative attitudes (about epilepsy) they've been carrying around before they can begin to deal effectively with problems of people

with epilepsy."

"The old philosophy in epilepsy treatment," she says, "was that you made the person well and then turned him back to the community, which was often hostile and unwilling to meet the needs of individuals who were somehow different." The new philosophy, she continues, is that "we should work both sides of the street, so to speak--make people better equipped to deal with negative societal attitudes, but also work on changing those attitudes."

Unfortunately, societal attitudes are slow to change, and people like Sherry Kilburn and Verna Brant can't wait for that to happen. The medical treatment they will receive through the DTRP should make their physical problems easier to cope with. But equally important are the less tangible educational and psychological benefits the program provides, as patients sort out their feelings and form more positive attitudes about themselves.

Kilburn says, "There are two ways to deal with epilepsy--you can stay inside of yourself and never take any big social or psychological steps. Or, you can push yourself and take those steps toward being better educated and feeling good about yourself. I've pushed and pushed... I couldn't live the rest of my life in a compacter, always worrying about what other people would think or say about me. I like to knock down walls, but I can only do that by taking down my own walls."



Photos by April Saul

Jeannette Piccard

By Patty Ferrara Mork

Jeannette Piccard has accomplished two feats which have brought her closer to heaven than any other woman on earth.

In 1934 she became the first woman to pilot a balloon into the stratosphere.

In 1974 she was ordained a priest by The Episcopal Church--one of the first women ever to be so ordained.

Over 40 years have not dimmed Piccard's memory of her world-famous flight into the stratosphere. With the same ceremony and awe which accompany her at the altar, Piccard unwraps a silk handkerchief to show her leather-bound pilot's license. "I was aware that day," she says softly, "that I didn't do anything as pilot of that plane. It was God..."

God also inspired her to become a priest. Piccard cannot explain how she realized that it was her destiny to become a priest, but "I knew it when I was 11," she says. "How could I have gotten such an impossible idea when I was so young, and why did it persist over the years?" With a smile, she answers her own question--"Because it wasn't my persistence."

Yet even with the help and inspiration of God, Piccard was faced by a great opposition--after all, she was a woman. **National Geographic** refused to support her balloon flight because they disapproved of sending a woman and a mother

on so dangerous a flight. "But they would have sent a man to be killed and leave his wife and children to starve," Piccard says.

When she was illegally ordained in 1974, enraged clergy told Piccard she would go straight to hell. Even before her ordination, the unequal status of women in the Church led her to write to all the



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bishops and deputies of the Church: " 'If one part is hurt, all parts are hurt with it.' (I Corinthians 12:26) I hurt! I hurt! I am hurt by all the hypocrisy, the cowardice, the lies with which I have been fed, the contempt with which I have been treated for nearly three-quarters of a century, and if I hurt, then since we are one body, you must hurt also.' "

Despite her plea, after her ordination the clergy charged Piccard with disobeying her bishop and participating in an illegal service, and demanded the bishop depose her. In response to the clergy's demands, the bishop sent Piccard a letter forbidding her to function as a priest.

In both cases, Piccard defied her opposition, and ultimately, overcame it. In 1969, because of her accomplishments as a pilot, Piccard became a consultant for the Manned Spacecraft Center of NASA. And on January 6, 1977, her ordination was officially recognized.

But Piccard desires neither fame nor credit for her remarkable achievements. Reciting Psalm 115, Piccard says,

"Not unto us, O Lord, not unto us, but to thy name give glory."



Wesley Balk

Challenging conventional opera

By Rebecca Wallin



Photos by Mary McDonough

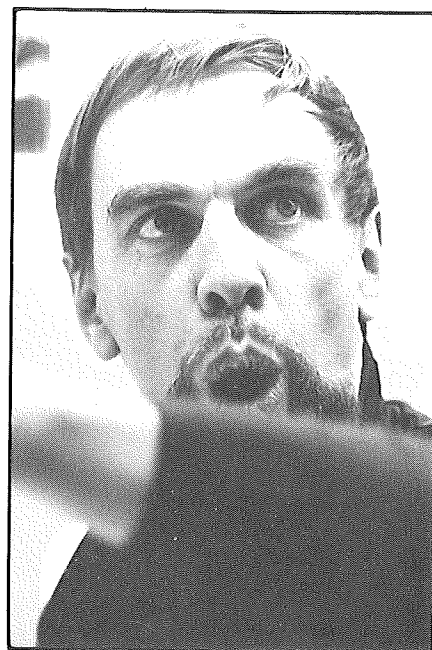
A man dressed in a turtleneck, polyester slacks, and Earth Shoes sits in a faded brocade chair just off the stage. Looking down at the script on his lap, he thoughtfully strokes his goatee. He writes furiously in the margins. His head bobs up again, and he quickly reimmerses himself in the action. Rising from his chair, he demonstrates a seductive wiggle to a woman in the cast.

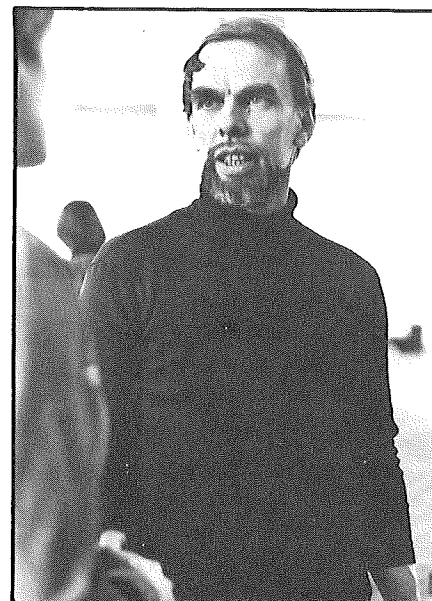
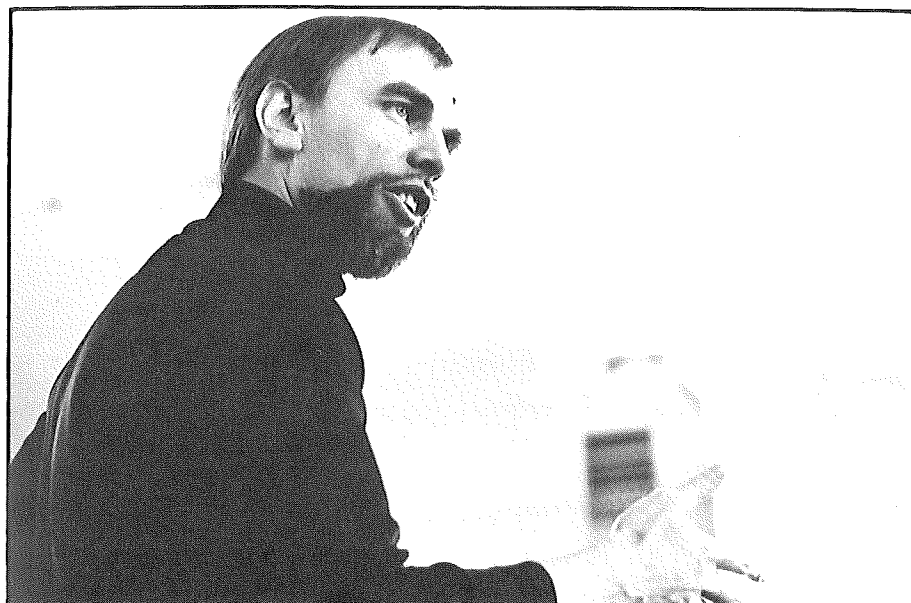
The man's name is Wesley Balk. He is a director for the Minnesota Opera Company. Balk, a Yale Ph.D. and Fulbright scholar in opera direction, founded the company with Vernon Sutton in an attempt to fuse contemporary images with traditional opera.

"I wanted to tell people the truth. There was no sense in saying opera was great when it wasn't. But it's like our poster, 'Stamp Out Opera.' It doesn't mean 'Stamp Out Mozart.' It means stamp out old conventions and clichés and rituals."

The company commissions new works, produces traditional operas that are contemporary in design and staging and performs classics in translation. Only seven of its 45 productions can be considered standard works. As the *New York Times* observed, "The Minnesota Opera Company demonstrates that opera is still a vital and valid medium for contemporary expression...This remarkable company...has won wide recognition for imagination and enterprise."

For years Balk has been attempting to create the perfect fusion between theater





and music. He is trying to discard the rules which had previously dictated pompous poses and stylized gestures in operatic productions. Instead, he aims at the creation of a balanced singer-actor. According to Balk, "To be such a performer one has to be many things. This person has to be highly trained vocally--a singer. He or she also has to be a musician capable of reading scores. He or she has to be able to act, to relate to other actors on the stage, and to move with facility, incorporating the skills of a dancer."

In order to train such singer-actors, Balk created the Opera Studio. "Our goal," he says, "is to train the young singer-actor as a total performer--a concept about which much is said but little is done...The growth and stimulation on both sides has been deeply gratifying and, whatever the cost beyond our regular budget, the money spent on the program may very well be the best spent in our history." His book, **Training the Singer-Actor**, which will be published this year, reflects this continuing concern.

Balk uses improvisation to facilitate the fusion between theater and music. A few years ago he directed a totally improvised opera entitled "The Newest Opera in the World." Three huge wheels of fortune were spun onstage to determine every twist of scene, plot, and musical style. Everything undecided was left to the improvisational talents of the cast and the music director, Philip Brunelle.



The free rein that Balk gives cast members supports his contention that, "We're constantly dealing with human beings going through time and life creating as they go. They are involved personally as well as in the capacity of performers and you can't slice it up at one day and say 'Well, there you are--a finished performance.'"

Balk's students marvel at his relaxed directing style. According to Grant Wheaton, "There is never a sense that he reproduces what he wants. He seems to guide rather than direct, yet things end up unified."

Balk has directed more than 30 productions for the company as well as

several experimental theater pieces at the University of Minnesota. He collaborated on the creation of such past productions as "Oedipus and the Sphinx," "Faust Counter Faust," "The Business of Good Government," "Transformations," and "Black River." His future plans include a Midwestern Opera Touring Company and a Minnesota Opera School.

Assuredly he will continue in his experimental and imaginative vein, attempting to mold traditional forms into contemporary images. As he once said, "Maybe there is some masochism involved. It's like a horrible Faustian urge, but I can't resist looking for something better."

Martha Boesing

Her plays tell the woman's story

By Patty Ferrara Mork

Theater is a place "to recognize our oppression and celebrate our strength," says Martha Boesing, playwright, actress, director, and one of the founders of At the Foot of the Mountain, a feminist theater collective.

"I want to stand up for and embrace all the values that are really ours, to celebrate the values that are important to my woman-self--tenderness, mothering, nurturing, strength, gentleness," says Boesing, whose plays have been performed in Atlanta, New York City, and Washington D.C., as well as in Minneapolis.

"I don't think woman's story has been told, what it's like to grow up in a society where you are told you are not

as good as a man," Boesing says. Her plays tell that story.

Boesing has long been involved in theater. She was one of the founders and co-directors of the Fourth Street Playhouse and of the Moppet Players, which later became the Children's Theater. For three years she was an actress with the Firehouse Theater. In New England she performed in several productions that she and her husband Paul wrote together. "We have a long history as a duo--he writes music and I write scripts," Boesing says. Together they wrote "The Wanderer," an opera which has been performed by the Minnesota Opera Company and the Opera Company of Houston, Texas. In 1973 Boesing was play-

wright-in-residence at the Academy Theater in Atlanta. Later she moved back to Minneapolis to begin At the Foot of the Mountain.

The collective was originally formed in 1974 by three men and three women. In March 1976 it became a feminist theater collective. There are now seven women in the group.

The company is now in residence at the Pillsbury-Waite Cultural Arts Center. It performs at colleges, women's centers, crisis centers, and community theaters.

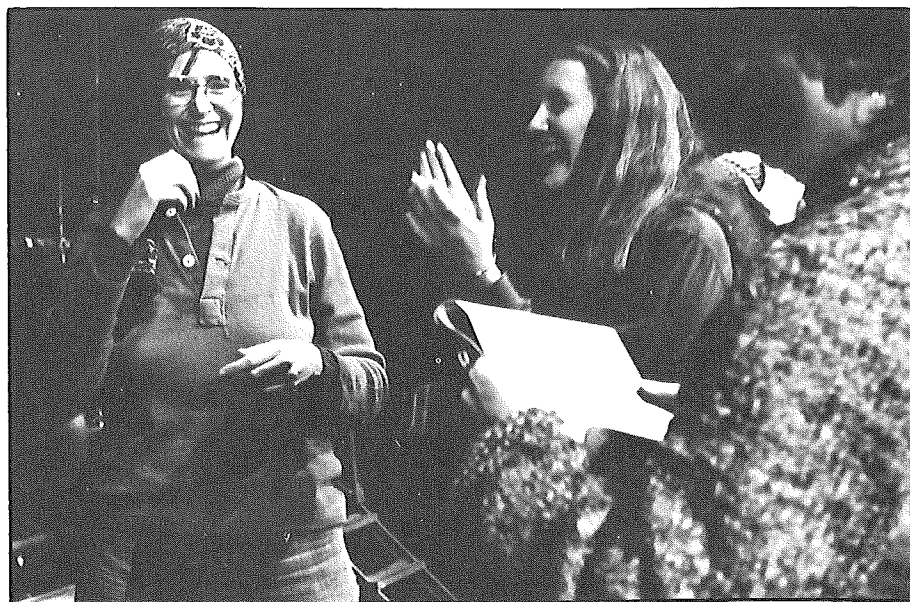
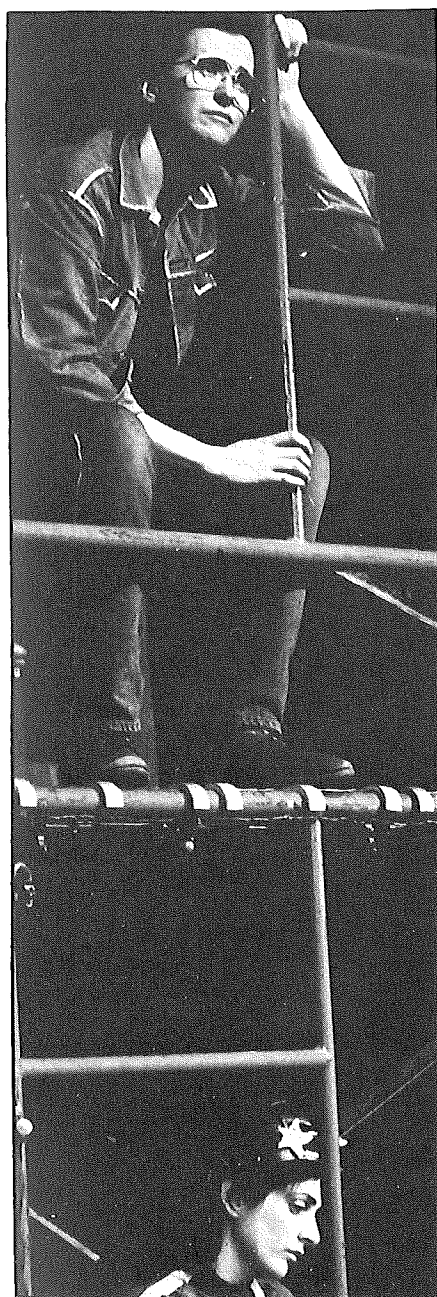
Members of the collective are involved in all aspects of a production--even in writing the scripts. Through this sharing of the creative process, Boesing no longer feels she owns her writing. Although she admits "the creation of a play is where my voice is," she believes the collective's input will improve her writing.

In her next play, "The Moon Tree," a play about women and madness, Boesing will tell the cast the story and let them improvise before they see the script. "Not colored by my words, they will invest themselves out of their own fresh spaces. It will no longer be my play. If the language doesn't fit," she says, "I will rewrite it."



Photos by April Saul

By limiting membership to women, the collective hopes to maintain an atmosphere of openness and equality, Boesing explains. "We are not male haters, but when a man comes into the space, we're different." The women change because of society's values, she says. "In our society a woman has been conditioned to perceive her life goal and energies in relationship to the man in her life. As a result we either kow-tow to him or resist him. Either way, we give away power to him."



Yet power struggles occasionally pervade even the open atmosphere of the collective. Jan Magrane, actress and co-founder of At the Foot of the Mountain, tells about a rehearsal in which she and Boesing were improvising a fight scene. "I slammed Martha up against the wall, and we really got into a knock-down, drag-out fight," Magrane says.

After the outburst, they began to discuss how their anger and feelings of frustration stem from societal oppression. "Martha was scared because I slammed her up against the wall, and I was mad because she pushed me around," Magrane says.

Members try to bring their feelings into the collective, unlike traditional actors and directors who "leave their feelings at the door," as Boesing says.

These feelings affect how they act their various roles, she continues. Boesing says she had trouble playing the part of a woman who assumes a male role in a lesbian relationship because, "I like being a woman." As she thought about the character, Oxtail, in "Babes in the Bighouse," Megan Terry's play about women in prison, she realized that every woman sometimes wants to be a man.

"Oxtail just got locked into that part. Outside she wants to be cool like Paul Newman, while inside she's a soft woman with two kids," Boesing says. That realization enabled Boesing to understand and act the part. Her Oxtail saunters around like Paul Newman and also re-

veals a tender feminine side. "Oxtail loves women because she finds the understanding and affection she needs from them. The work on my own emotions," Boesing says, "allowed the character to emerge."

Political impact is the goal of the theater collective's productions. "Theater, as a live medium, has the power to change people's lives," says Phyllis Jane Wagner, actress and director in the collective.

The most recent member of the collective, Aurora Bingham, was so moved by the company's production of "RAPED: A Woman's Look at Brecht's EXCEPTION AND THE RULE" that she quit her job to join the company as business manager for half her former salary.

The collective interrupted their performance of "Raped" for spontaneous audience testimonies, asking the audience how they had been raped by men and by society. There were some devastating testimonies, Boesing says, ranging from the story of a woman who had been raped by a policeman to a poem about the rape of Alaska. One woman spoke of her marriage as rape, because her husband never allowed her to do what she wanted. "The play became a communal event, no longer a production by the collective," Boesing says.

This audience involvement is perhaps the highest compliment the collective has been paid.

Charles Biederman

Structuring a new world of art

By Vicki Fung

"I am a part of a new world that's going to be formed."

What sets rebel artist Charles Biederman apart from the rest of the art world is his philosophy on the artist's relationship to nature.

"Man, as an artist, first learned to create in the **image** of nature's creations. Today he is learning to create in the **way** of nature," Biederman says.

Biederman himself expresses nature's way in an abstract, non-imitative art of pure geometric form. He works at what he calls "the structural process level of reality. My goal is not to recreate nature but to study the way nature creates."

Biederman's unique theories on art started a powerful European movement more than 25 years ago known as Structurism. Structurist art, formally developed from painting, shares some of its properties with sculpture. It analyzes the underlying structural process of all natural forms to discover the methods by which nature operates.

Biederman's works, called structurist reliefs, create the effect of nature through the use of space and form and the juxtaposition of colors. The reliefs are made of rectangular aluminum planes with smaller planes attached to the background and to one another. To achieve a high degree of precision, the planes are machine tooled.

"As Frank Lloyd Wright predicted in 1894," Biederman says, "the machine would be the new medium. The machine is the most adaptable, most perfect means of creating geometric forms. Planes are the simplest building blocks of art."

The reliefs engage both mind and senses. Although simple and uncluttered, they are painstakingly disciplined and deliberately executed.

In an effort to get closer to nature, Biederman has gradually retreated from urban life. In 1941, he rented a studio on the edge of a park in Chicago to be near a natural environment. The following year,

he moved to Red Wing, Minnesota, where he could be surrounded by bluffs, trees, animals, and rural midwestern country. On a wooded hill by his secluded home, he studies nature every day.

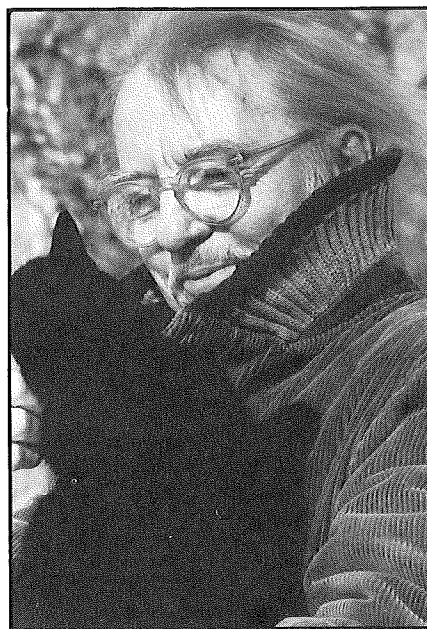
Structurism pervades his environment right down to the yellow rectangular planes that are the doorknobs of his two white "shops," located a short distance from his house. He calls them shops because "studios belong to painters and sculptors," and like painting and sculpture, "they're obsolete. I abandoned painting and sculpture as useless forms in 1937." Relief models, early paintings, and collages neatly line the white walls inside. A quote from Cezanne hanging by the door reads, "The agreement of art and nature must develop."

Biederman's immaculate white house is much like his art. It is simple, sparsely but appropriately furnished. Half-sized models of his works hang in striking relief against the white interior. In his study are pictures by Monet, Cezanne, and Frank Lloyd Wright. Biederman lovingly points to a photograph of his wife of almost 35 years, Mary Katherine Moore, who died two years ago. "She was entirely a part of my work, and the only person who understood what I was doing," he says quietly.

Biederman's evolution as an artist traces the routes of key movements in art history. He started as a realistic painter imitating nature, while attending the Art Institute of Chicago from 1926-29.

In 1937, disillusioned with American culture and art, he left for Paris where he hoped to find a better creative climate among those whose works he admired. There he developed Structurism from the basic principles of four pioneering art directions. He began this process by using ideas from Monet, who had tried to record the same brilliance of color and intensity of light he observed in nature.

Cezanne was the next powerful influence in Biederman's art. Cezanne's representation of nature in terms of planes inspired Biederman to incorporate



Photos by April Saul

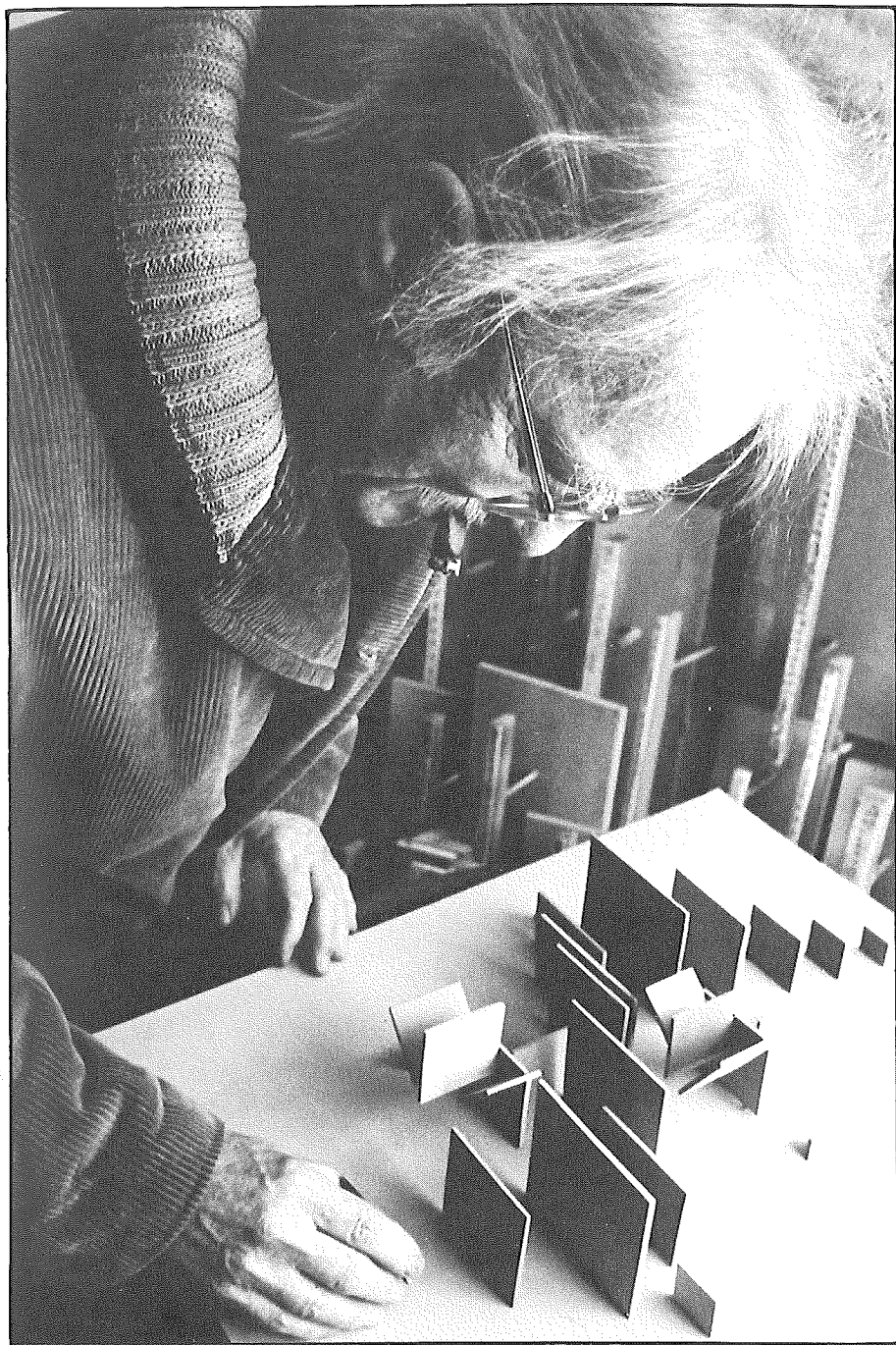
structures into art.

Biederman then went on to incorporate Mondrian's rectangular forms and primary colors plus black and white and asymmetric balance. He also drew from a movement that was concerned with formal organization of planes and expression of volume in terms of modern industrial materials, attempting to create an abstract art in three instead of two dimensions.

Shortly after he began work in Paris, geometric forms became the dominating structural force in his work; organic forms gradually disappeared. He found his paintings becoming more like sculpture and realized that the 2-dimensional surface would not accommodate this disparity. He moved into 3-dimensional space.

After spending time abroad, he came to the conclusion that "Paris was no longer concerned about art." Shrugging thoughtfully in his cool, subdued living room, the bright sunlight filtered by trees and cigar smoke, Biederman discusses his artistic evolution: "Everything was imitative; the past was everywhere."

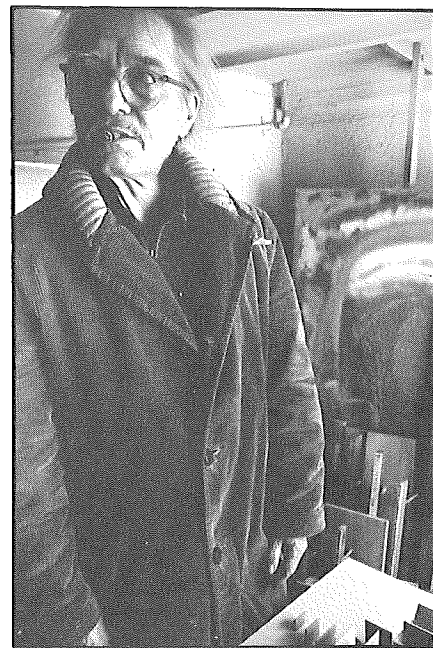
The artistic void in Paris made Biederman more appreciative of America than before. "I discovered America," claims the artist, stretching in his chair. He explains that because the burden of the past does not lie heavily on America, it is not spoiled by conventions and formulas. It provides an ideal breeding ground for art—a point proven in the case of Frank Lloyd Wright, Biederman says. "This very cultural deficiency and lack of a well-aged tradition is in these times a para-



mount advantage," Biederman says. He agrees with Alfred North Whitehead, whom he quotes as saying, "The only place I see where another great flowering of European culture might come is in the American Middle West, where the start could be fresh and from the ground up." Grinning, Biederman adds, "The Midwest has a clean slate. The coasts have screwed up theirs."

Biederman good-naturedly describes himself as "the best-known unknown artist in America." The general response to his philosophy and style has been one of critical hostility.

Biederman is a notorious rebel in the art world. British painter Robin Denny once said of him: "He has carried through one of the most radical and single-minded attempts in modern art to



formulate a new definition for art and its relationship to the organic world." Biederman feels that the antagonism and forced independence keep him young. His face is relatively unlined and his movements are remarkably strong. "I enjoy growing. That's the beauty of life." Following tradition to him would mean suspending his evolution in stagnation.

Of his opposition, he says with humorous defiance, "If they want to think I'm nuts, they're welcome to it." He has learned to handle critics, as he has learned to understand those who, seeing commercial value in the trends he sets, plagiarize his style. "Many artists are exploiting my style in the United States and Canada. They must grow into it as I have. The imitators are too anxious to get there. Artists can get away with a lot. They look like they have some connection with a deity.

"I've been rejected by the New York gang," he says, smiling. "But I was known in Europe 20 years before I was recognized in America."

The St. Paul Gallery and School of Art gave him his first one-man show in Minnesota in 1954--12 years after his move to Red Wing. He remained virtually unknown in Minnesota until the Walker Art Center showed the first major retrospective exhibition of his work in 1965, entitled, "Charles Biederman: The Structuralist Relief, 1935-65." The Minneapolis Institute of Arts presented another retrospective exhibit of his works from

Pioneers

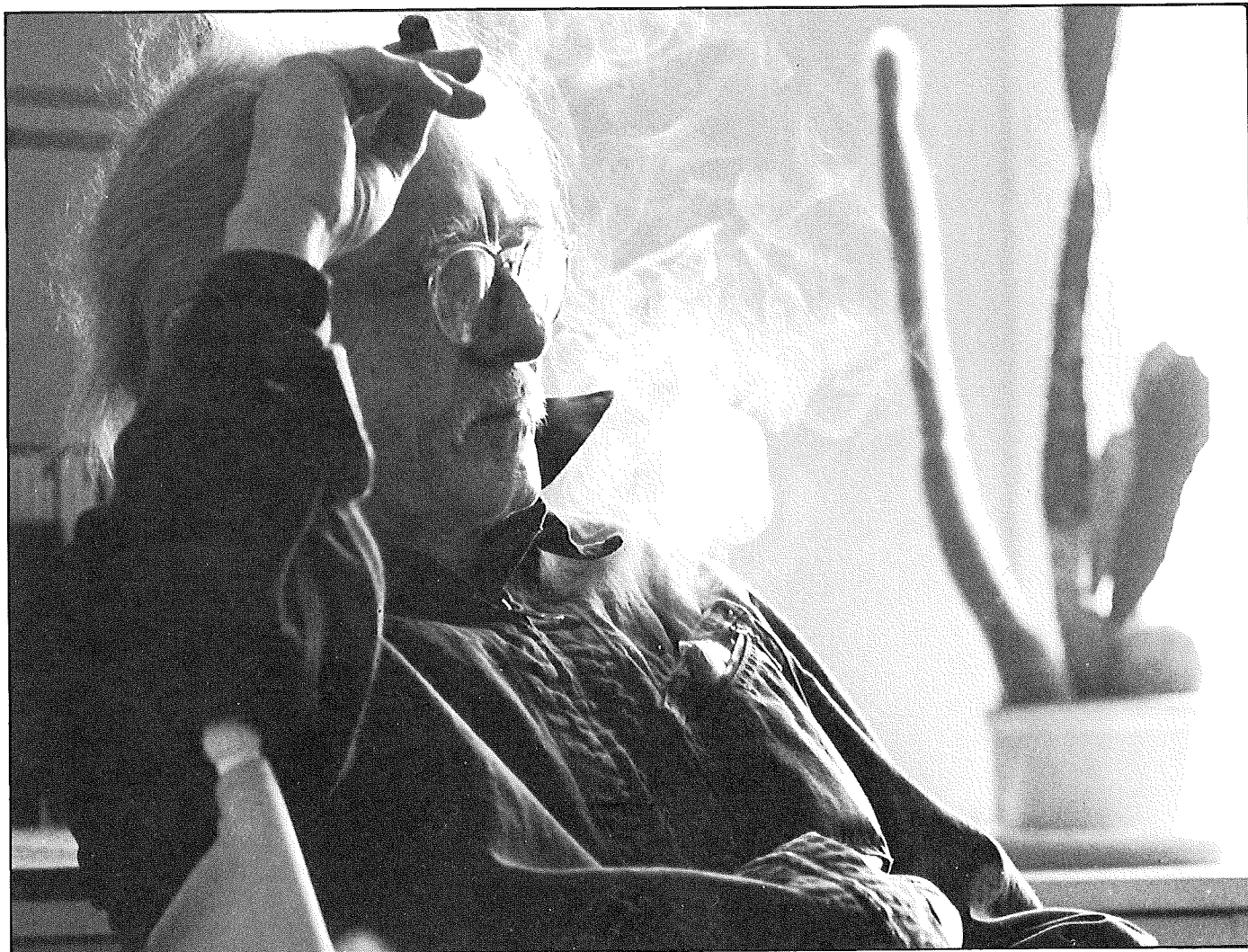


Photo by April Saul

October, 1976 to January of this year.

Living in isolation has been difficult, for Biederman is by no means introverted or unfriendly. It was hard for him at first to understand that "people didn't recognize my art. My only visitors for the longest time were my European friends." His closest companions are his lively, rotund dog, Flicka, and two cats.

As for the future of art, the indomitable Biederman believes that things will get better. Art for him is "an instinctive, humanizing force that is being dehumanized...one of the most profound means at man's disposal for comprehending reality." He feels that one day art will be recognized as such.

Atop his favorite hill, his scraggly

white hair blowing in the chill wind, he says, almost as if to reassure himself, "I have faith. I don't even see the recognition of my art. It's hard when you know damned well you won't live to see the acceptance of it."

But Charles Biederman feels responsibility to himself and to the new world. And so he continues his quiet revolution.

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