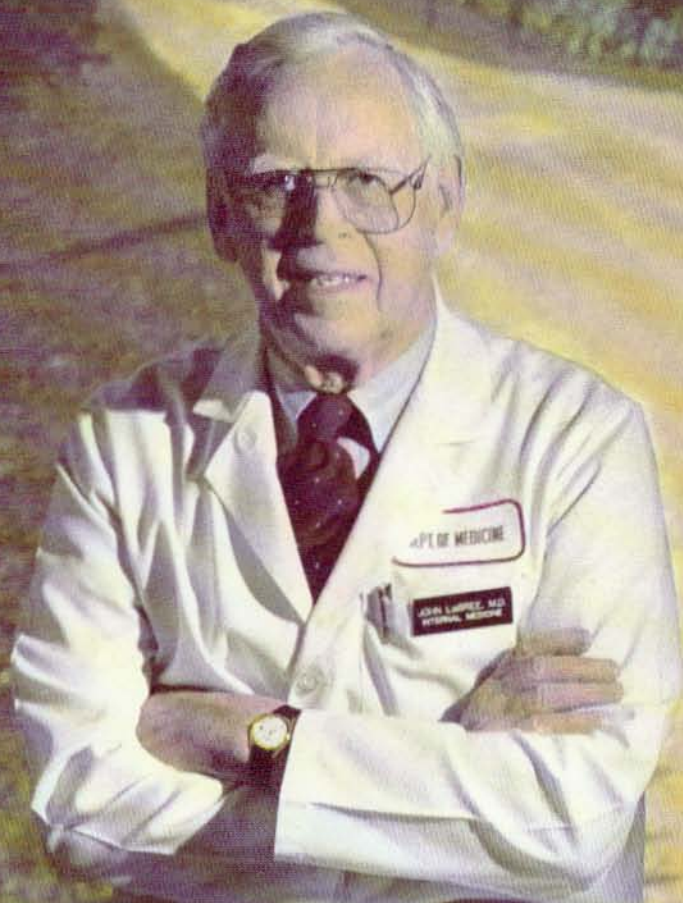


Health Sciences



*What's Down the Road
For Rural Health Care?*

*How lasers are
helping dermatology patients*

*What's new in
drug delivery systems*

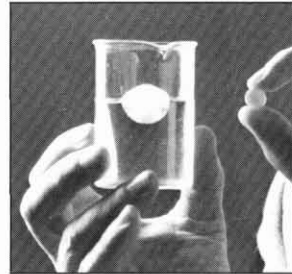
HealthSciences



page 8



page 11



page 15

2 ▼ Rural Rx

The outlook for rural health care isn't perfect, but it has its bright spots—thanks in part to University efforts.

8 ▼ Health Care in the Heartland

Shortages are being addressed in every health sciences discipline, from the allied health professions to veterinary medicine.

11 ▼ About Face

Disfiguring birthmarks and skin cancer are yielding to new dermatological techniques.

15 ▼ Special Delivery

Innovative methods of drug delivery get medicine right to where it's needed.

20 ▼ Health Beat

A roundup of the latest research and who's making news.

About the cover: Health care in rural America is a topic of increasing concern. Our stories look at the issues and dynamics—and at what the University of Minnesota is doing to help solve the problems.

About Face

Two dermatological techniques are getting under people's skin—in the best way imaginable.

by P.J. Rader

Two years ago Gladys Shea noticed an area in front of her husband's ear that looked like he had scratched himself. A few days later she saw that it didn't show any signs of healing. When a few more days had passed without improvement, she and Robert went to the doctor.

It was skin cancer, as she had suspected. After her husband's initial surgery, Gladys called the American Cancer Society (ACS) to get as much information as she could about basal cell carcinoma.

Knowing that the recurrence rate is about 50 percent in cases such as her husband's, she wasn't surprised when,



For Robert and Gladys Shea, Mobs micrographic surgery was the right choice to treat Robert's skin cancer. Scarcely a mark is visible by his right ear.

late last year, she noticed signs that the cancer might be returning. This time the doctor suggested something called Mohs micrographic surgery, and the Sheas immediately agreed. "If he wouldn't have brought up Mohs, I was going to," she says. "I knew from what I'd read that it had the best success rate of all the techniques."

Gladys has taken the leading role in her husband's health care since he had a stroke in 1979. Robert walks with the help of a brace and cane, his arm is in a sling, and his speech is not always intelligible, so Gladys always accompanies him and helps him communicate with others.

She was with him on a cold morning in early January when they came to the Cutaneous Surgery Center at The University of Minnesota Hospital and Clinic to undergo the Mohs surgery. As Gladys had learned in the ACS literature, Mohs has a 98 percent success rate. The center, totally self-contained since July 1989, offers the micrographic technique as well as the most advanced laser surgery and other general dermatological and cosmetic procedures.

Christopher B. Zachary, an assistant professor in the Department of Dermatology, heads the center with its staff of three nurses, a lab technician, and, currently, a doctor on fellowship learning the center's specialized techniques. Patients praise the staff's personal approach almost as much as they praise its medical expertise.

"In other places I've been made to feel as though I'm in the way, or people act as though Robert isn't even there and just talk to me," Gladys says. "It was not at all like that when we came to the University. The attitude of the staff all the way through was just tremendous. They explained everything directly to Robert, and they made it clear I was not cumbersome to have around."

A Map for Success

On the day of their appointment, the Sheas were brought into a procedure room that is equipped with what looks very much like a dental chair. Comfortable for the patient, the chair's height and angle can be maneuvered easily by the surgeon. Robert was helped into the chair, and Gladys took a seat where her husband could see her throughout the procedure.

Mohs surgery is done under local anesthetic, making it very safe even for patients with medical histories such as

Robert's. The only precautions needed in his case, Zachary says, were to stop his regular aspirin medication two weeks prior to the surgery to alleviate any possible excessive bleeding and to slightly dilute the local anesthesia.

*Patients
arrive in
the morning with
their cancer, it's
gone by lunch,
and all is
reconstructed
by tea time.*



"What we tell our patients is that it's very safe," Zachary says. "They are wide awake, and there is no recovery period. It's very efficient. They arrive in the morning with their cancer, it's gone by lunch, and all is reconstructed by tea time."

Tea time? Zachary is British and has been in the United States only since 1987, so he has to endure a lot of teasing from nurses and patients about his English colloquialisms.

The Sheas' stay at the center didn't even last until the usual "tea time" of 4 or 5 p.m. Because they caught the cancer early and because of the unique Mohs

procedure, they were able to leave for their south Minneapolis home by lunch, assured that all the cancer was gone.

Robert's procedure, like all Mohs surgery, began with Zachary and his fellow, O.J. Rustad, outlining the surgical area with a dotted line of ink. Rustad then injected the anesthesia, usually the only part of the procedure that causes any pain.

After the area was totally numbed, Rustad began scraping the upper layers of the tumorous skin away with a sharp curette. The cancerous tissue is usually mushy and removed in minutes. In the meantime the nurse had drawn a rough sketch of the surgery area on a paper towel. The nurses joke about their "art-work," but the map is crucial to the procedure's success.

Laying the map on Robert's chest, Rustad cut out a thin saucer of tissue from the curetted area and laid it very carefully on the paper, orienting it just as it had been on Robert's face. The edge of tissue that had been closest to Robert's ear lay next to the "ear" that the nurse had sketched and was angled just as the area was angled on Robert's skin.

Then it was time to wait. With a pressure dressing over the surgical area, Robert returned to the waiting room, where he and Gladys were free to watch television, read, or go downstairs for a snack. While they waited, David Kist, the center's technician, was busy with that meticulously oriented slice of tissue.

With each patient's sample, he cuts the skin into manageable sections carefully labeled to correspond with their positions on the map, and color codes them with red and blue dyes. He then freezes them and slices them horizontally into sections only six microns thick—about the thickness of two cells. He then mounts them on slides and stains them to reveal any cancer cells that might be present.

"This is the crux," Zachary says of his technician's work. "This is why Mohs is so great. It allows us to examine 100 percent of the base of the excised area. We're looking at 100 percent of what we've taken out."

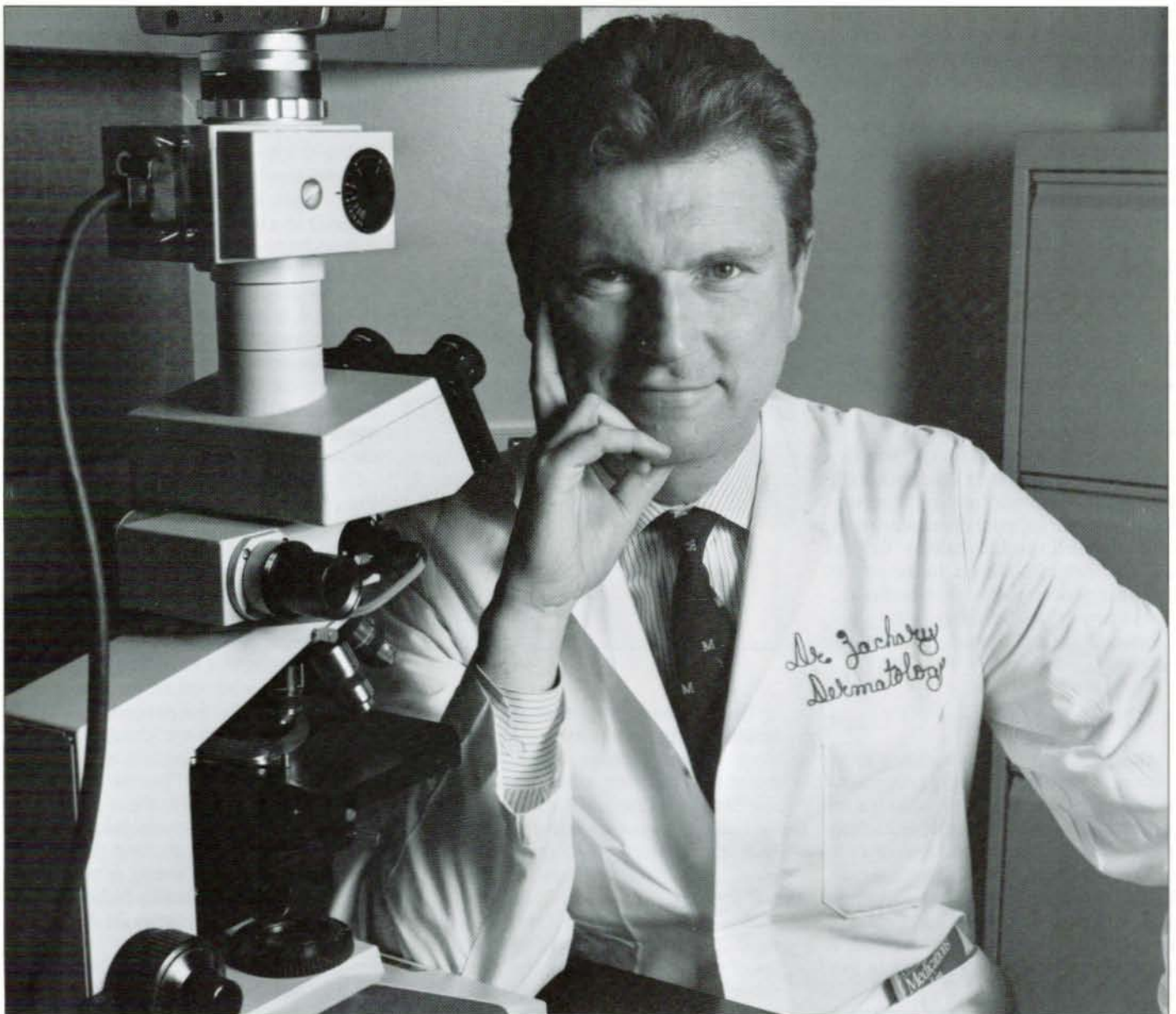
Because the slices are horizontal rather than vertical, it is possible to examine the entire perimeter of the area as well as to check for roots of cancer cells that may extend into the skin layers below what's already been removed. If cancer cells are discovered anywhere in the first set of slides, Zachary can bring the patient back in and remove another layer of tissue. The lab procedure is then repeated with

the second sample. It rarely takes more than three excisions to remove the cancer. The doctor can be microscopically sure he's gotten it all.

Because the tissue samples are so carefully oriented, it's also possible to avoid taking any more tissue than necessary. If Zachary spots cancer cells in a particular quadrant of the tissue sample, he will remove more tissue only from that area of the incision.

"This allows us to remove only the tumor-laden tissue," Zachary says. "This technique is very tissue sparing, which leads to less reconstructive surgery afterward."

This technique is very tissue sparing, which leads to less reconstructive surgery afterward.



Christopher Zachary, head of the Cutaneous Surgery Center, says the technician's work with the microscope is the crux of the Mohs process. The technique "allows us to examine 100 percent of the base of the excised area," he says.

The good news for the Sheas is that the first tissue sample was clean—no cancer cells—so Robert was brought back into the procedure room an hour later and the incision was carefully sewn up. Because the area of his surgery was so small, less than an inch in circumference, the reconstructive work consisted mainly of undermining the edge of the wound, which means loosening the skin and releasing it from its connecting tissue so it won't be too taut when it is stitched together. When **Rustad** was done, the line of stitches followed the fold of skin in front of Robert's ear in a natural way.

Another Mohs patient later that morning needed a second round of excision on his nose before his slides indicated that all the cancer was gone. A third patient had surgery on three different sites: below his right ear, next to the corner of his mouth, and next to his nose. When those slides came back negative, Zachary closed the sites by using small adjoining flaps of skin that he freed with undermining. When it was all stitched together, no stretched skin, puckering, or any other distortions were visible.

Skin grafts also are used commonly at the center, and about 60 percent of the patients are "closed" the same day they come in. Another 20 percent are allowed to heal without being stitched closed, and the remaining 20 percent of the patients are referred on to plastic, oculoplastic, or otolaryngology surgeons for more extensive reconstructive work.

The micrographic technique was developed in the 1940s by Frederick Mohs, a professor of surgery at the University of Wisconsin. He called it chemosurgery because he used zinc chloride to "fix" the tissue before removing it. In the past 10 years the procedure has been refined and improved so that fresh, non-chemically treated tissue is removed for analysis.

A Thousand Points of Light

Although the center is building its reputation in part with its highly successful Mohs surgery, laser surgery also is a major portion of the workload for Zachary and his team. With the addition of a second-generation pulsed dye laser, a \$200,000 piece of equipment specifically designed to eliminate the birthmarks known as port wine stains, the center is attracting patients from throughout the Upper Midwest.

"The carbon dioxide laser is very useful for a wide range of things—warts, tattoo removal, cancers—and dermatolo-

gists, gynecologists, and urologists all use it," Zachary says. "But the pulsed dye laser was developed and refined in the past five years with port wine stains in mind and is predominantly used by dermatologists."

When Barbara Alexander of Duluth saw a television broadcast about the new laser treatment available for port wine stains, she immediately called her son's dermatologist and asked her to track down the nearest place that she and her husband, Gregg, could take Tom for treatment. Within a few weeks, the family had an appointment at the center.

You often get 50 percent improvement with the first laser treatment, which is always very encouraging.

Tom, 15, had a port wine stain that extended along his left jawline down his neck to his collarbone. Although he had never said anything to his parents, one of the first things he told Zachary was that he had had to put up with a lot of teasing in school about the very obvious birthmark and wanted very much to get rid of it if possible.

"He's always handled it well," his mom says. "He's well liked and participates in a lot of sports. I only remember that once, when he was quite young, he asked me when it would go away. I told him it wasn't going to go away, and he got quite upset. But he adjusted. He accepted it as

much as anyone can. But when we told him there was a new technique that might be able to remove it, he was willing to try it. He knew it would be painful and take quite a while, but he wanted to go ahead."

The laser treatment has been variously described by patients as being similar to a pin prick or the snap of a rubber band or a burning sensation. One or two of those feelings, or even quite a few depending on a person's pain threshold, might be fairly easy to bear. But on Tom's most recent visit to the center, he endured 1,003 pulses from the laser. He was able to withstand such an extended treatment only with the help of sedatives and topical pain killer.

It takes from four to five treatments to eliminate a birthmark such as Tom's. He will be back before summer for what will probably be his final session, but already the stain is no more than a very pale pink area.

The dye laser is based on the principle that different colors absorb different wavelengths of light. The laser's light is tailored to a yellow wavelength that is absorbed by hemoglobin in blood cells, but not by the surrounding skin tissue. The time length of the pulse of laser light also is crucial. It must be long enough to heat the abnormal blood vessels to the point of self-destruction, but not so long as to produce damage to adjacent normal cells. It turns out the ideal wavelength is 584 nanometers and the ideal pulse is 450 microseconds.

"It causes bruising that lasts 10 to 12 days," Zachary explains. "Then the patient will notice a gradual improvement over the next two to three months. You often get 50 percent improvement with the first treatment, which is always very encouraging."

The center will soon offer the pulsed dye laser treatment to children aged 10 and younger, who will be put under general anesthesia for the procedure. "We find children in that age group really can't endure a full treatment without sedation," Zachary says, "but we know that the earlier we can get to these children the easier and more successful the treatment can be. You get the best results when children are as young as possible."

The Alexanders certainly believe that the long drives to Minneapolis during the past year have been worth it. "Tom's the typical teenager," Gregg says. "He doesn't want to talk about it or make a big deal out of it, but I think it's definitely helping his self-esteem. We think it will make a big difference for him in the future." ■