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Rutgers Alumni Mag: Meet the Cancer-Fighters

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Detroit, Mich. -- One of the nation's best-known cancer researchers, Bonnie F. Sloane (Ph.D., Physiology, 1976), now ranks as an internationally renowned expert on "proteases" – highly complex enzymes that play a crucial role in the development of breast cancer, which kills more than 40,000 women each year.

Another top cancer investigator, Q. Ping Dou (Ph.D., Chemistry, 1988), spends his days peering into an electron microscope and scribbling arcane pharmacological formulas on a blackboard, as he struggles to build "synthetic molecules" for a brand-new family of breast-cancer drugs that will do their work without side effects.

While these two world-class research scientists go about the daily business of studying cancer at the molecular level, a 35-year-old computing wunderkind with an undergrad degree from Rutgers – Richard L.H. Rauscher (B.A., Computer Science, 1991) – directs the 39-member staff of one of the nation's leading Information Technology and Biomedical Informatics departments. Rauscher's daily task: To design, test and implement a mind-boggling computer and communications system that will link U.S. cancer treatment and cancer research in a single, unified system easily accessible to all.

Welcome to the high-tech and high-intensity world of Detroit's famed Barbara Ann Karmanos Cancer Institute, which treats more than 6,000 cancer patients each year, while also conducting 200 different scientific investigation programs and 300 clinical trials. Long regarded as one of America's most innovative and patient-friendly cancer centers, Karmanos operates on a yearly budget of \$200 million and receives \$54 million in research grants each year.

Drop by the Detroit offices and laboratories of these three hard-charging Rutgers alumni, and the odds are high that you'll get a fascinating glimpse into the extraordinary world of state-of-the-art cancer research. You'll also meet three dedicated people who work long hours at incredibly detailed assignments – while



insisting that they wouldn't have it any other way. Why do these healthcare professionals keep putting in their 12-hour days and weekend sessions at the huge cancer center in midtown Detroit?

In the stories that follow, all three do their best to explain why the struggle to defeat cancer has become the ruling passion of their lives.

Dr. Bonnie Sloane, Cancer Protease Researcher

The recent winner of a \$5.8 million "Breast Cancer Center of Excellence" research grant from the federal government, cancer biologist Dr. Bonnie Sloane is frequently described as one of the world's most knowledgeable researchers on how a large family of enzymes ("proteases") interact to "turn on" breast cancer.

As the longtime director of her own research laboratory at Wayne State University and the Karmanos Cancer Institute, Dr. Sloane manages a team of investigators working to determine which of the nearly 500 human proteases are linked to tumor growth. Her lab is also busy these days in an effort to develop imaging probes and techniques that will permit scientists and clinicians to accurately observe these interactions.

Says the 1976 Rutgers Ph.D. grad, while outlining her vision of the huge project: "If we know which proteases increase the growth of breast cancers and how to stop them, we can tailor patients' treatment very early on. In addition, the ability to monitor treatment by noninvasive means should enable us to change therapies during the course of treatment to ones likely to be more effective."

Interestingly enough, this widely published world-authority on enzymes and cancer thinks of her research project as a kind of "jigsaw puzzle." "I find the process of trying to identify the roles played by these proteases quite fascinating," she noted, when asked to account for her remarkable dedication to the task. "When I started studying proteases, everyone thought that they were only involved in the late stages of cancer, but now we know that they often play a role prior to the actual development of the disease.



Bonnie Sloane, Ph.D.

"Trying to figure out what's going on at the biochemical level is like trying to put together the pieces of a puzzle. Every time you discover something new, you're putting one more piece in. But you have to remember that all of this is taking place in three dimensions plus time, and so in four dimensions – and every time you put in a new piece, the entire thing changes on you and becomes even more complex.

"That can become pretty frustrating at times...but it's also a terrific challenge for the researcher."

Adds the award-winning Detroit researcher, who also teaches pharmacology and cancer research at Wayne State University:

"In recent years, we've come to understand that some of these proteases play an important role in tumor progression, whereas others actually play a role in preventing tumors from progressing.

"The problem is that if we don't understand what each of the enzymes is doing, it's very difficult to target the proteases with cancer therapies. This is an immensely complex and challenging task, and I think we have to be sure – as a society – that we continue to fund this kind of cancer research adequately."

Describing her high-profile career as a top U.S. scientist who travels around the world frequently to conduct seminars and deliver scientific lectures, Dr. Sloane notes that her interest in enzymatic reactions and cancer really took off during a research project in New Brunswick. "I've never forgotten the sense of excitement I felt as a graduate student," she says, "working intensely on a project that looked at how proteases regulate shrinking of the uterus – what we call 'involution' – after a woman gives birth.

"It was here that I first began to study the ability of proteases to 'digest' protein. I guess I'm a little unusual, in that I've kept up my interest in this area during all the years since I left Rutgers."

Dr. Sloane also talks openly about another unusual aspect of her biography: the fact that she, herself, is a survivor of uterine cancer. "I was very lucky," she says today, "because I caught it early, and because I knew where to go to find the best resources I could for treatment.

"Because of that experience – but also because I'm an educator – I spend a lot of time thinking about how women can educate themselves on the subject of cancer. I don't recommend that they just jump on the Web and start looking around, however. What's really essential is to learn all you can from reliable sources, such as the National Cancer Institute website [www.cancer.gov], and then use it to help you ask good questions of your doctor.

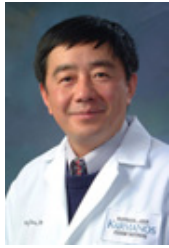
"As a cancer researcher who's also a cancer survivor, I do believe in getting educated, and in making sure you get a second medical opinion whenever you can!"

Dr. Q. Ping Dou, Pharmacology Researcher

A cutting-edge cancer researcher at the Karmanos Institute, Q. Ping Dou has spent the past five years working non-stop on what he hopes will be a powerful new weapon in the battle against deadly breast cancer: a new family of "synthetic" drugs designed to attack tumors without causing side effects.

While nailing down nearly \$500,000 in federal research grants during the past two years, Dou has gained national fame as a "molecule designer" with a knack for finding biochemical solutions to cancer-related problems at the level of a single cell.

Ask this 48-year-old scientist how he and a fellow-researcher came up with a startling discovery that may soon lead to a whole new family of anticancer drugs, and he'll cheerfully point out that the breakthrough occurred while he and another biochemist sat relaxing over a beer.



Q. Ping Dou, Ph.D.

"We'd just finished a long, grueling day in the laboratory," explains the widely published molecule-splicer, while recalling the "Eureka! moment" of his 2001 discovery. "It was dinner-time, and the two of us were sitting in a restaurant, doing our best to relax. Somehow, we got onto the subject of antibiotics and their ability to kill bacteria.

"As we discussed the biochemical mechanisms that allow antibiotics like penicillin to destroy bacterial cells, we found ourselves wondering: What would happen if you modified an antibiotic substance in the laboratory – and then targeted it against cancer cells?"

Like most scientific discoveries, the new concept was based on a relatively simple question: If powerful antibiotics such as penicillin can be used routinely to kill even the hardest bacteria, why can't they be modified in the lab to wipe out the cancer cells?

The implications were huge. Why? Simply because, unlike most anticancer drugs, antibiotics aren't toxic to humans... and they wouldn't kill nearby healthy cells, along with the tumors.

Within a year or so, the two scientists were announcing their synthetic-drug breakthrough in the pages of *Molecular Pharmacology*.

With the publication of their article, the two investigators validated their concept – and then went on to predict that their new approach to fighting tumors might one day produce a "miracle drug" for millions of cancer-sufferers.

Soon thereafter, Dr. Dou was awarded several grants that would allow the project to continue at Karmanos, where he will soon begin testing his lab-created synthetic antibiotics on cultured human breast cancer cells, and later on mice.

"I'm very excited about this project," he says today, "because it will allow us to test our ideas with physical experiments." Adds the Chinese-born Dr. Dou, who studied molecular pharmacology via a postdoctoral fellowship at Harvard after earning his Rutgers doctorate in chemistry. "I think we now have an excellent chance to produce entirely new, non-toxic substances that will be powerful cancer-killers."

How did Dr. Dou become so passionate about cancer research? He says it began at Rutgers, where he spent many hours working in a campus lab to "uncover the molecular structure of cancer cells. . . . I remember being absolutely fascinated by that world, while going about my Ph.D. studies. I wanted to make a contribution to the battle against cancer – but I was also struck by the intellectual beauty of the science, as I experimented with compounds at the cellular level.

"By the time I left Rutgers, I knew I'd probably be doing cancer

research – in one form or another – for the rest of my career.”

Richard L.H. Rauscher, IT Networking Guru

At the tender age of 34, Richard Rauscher in May of 2003 was tapped to become the first-ever Vice President of Information Technology and Biomedical Informatics at the Karmanos Cancer Institute, where he’s now responsible for all internal and external communications. In essence, his job is to “weave together” the immense amounts of clinical data generated by treating 6,000 cancer patients yearly with the latest research findings from more than 200 ongoing scientific investigations at the Institute each year.

Among Rauscher’s pet projects is an enormously ambitious communications initiative – the “Biomedical Informatics Grid,” or “caBIG” – that was launched last year by the National Cancer Institute (NCI) in order to link up 50 different major U.S. cancer research facilities so they can share the latest research and clinical data generated by each. Now in its pilot phase, caBIG is unique in the annals of American cancer research, and promises to bring together “vast arrays of worldwide cancer data” at a level which has never been attempted before.



Richard L.H. Rauscher

Describing the project, the affable and youthful-looking Chief Information Officer doesn’t mince words. “For one thing, the sheer volume of post-publication data distributed between the 50 Cancer Centers is overwhelming. This project has the ambitious goal of bringing all of the intellectual capital and tools together to focus on curing cancer.

“Without hyperbole, I think it can be compared to a moonshot in terms of complexity!”

Ask the endlessly enthusiastic Rauscher to tell you where he developed his affection for the “elegance and intellectual beauty” of computer science, and he’ll regale you with stories about the nights he spent “sleeping on the sofa” at the Rutgers University Computer Services (RUCS) center on campus, during “programming marathons” that sometimes last two and three days at a stretch. “To tell you the truth,” he says today, “I think I probably learned as much by working at RUCS as I did in the classroom.

“I look back at those years [1988-91] with a lot of nostalgia today, because the world of computer science and computer processing was just taking off. And it was all very exciting, to spend half the night sitting in the lab with a few other ‘geeky’ computer types, doing my best to solve a software program or write the next section of code.”

While describing caBIG as “probably the largest computer-assisted medical research data management system ever created,” the upbeat Rauscher predicts that the new Internet-based network will soon trigger some fundamental changes in

both cancer treatment and research. "This is going to be data-crunching at a level never seen before," he says, "and I think the network is part of a fundamental change that is now taking place in biology.

"What we're seeing now is the convergence of new knowledge with new computational techniques. What's happening is that biological science is becoming quantitative, rather than qualitative – and the biologists are having to learn algorithms and other mathematical approaches in a new way, in order to conduct their research. If a researcher is working on a problem in DNA, let's say, the data will often be so vast and complex that the most important priority becomes finding a way to manage it with a computer program that's powerful enough to get the job done."

A native of south-New Jersey (Gloucester Township), Rauscher credits a Rutgers mentor – Computer Science Professor Eric Allender – with opening his eyes to the "endless creative possibilities" that are possible with state-of-the-art computing tools. Says the Karmanos software guru: "Dr. Allender was a very effective teacher – mainly because of the way he shared his excitement about computer science with his students.

"I had been fooling around with computers since I was 11 years old, and I knew that was an area I wanted to work in. But it was Dr. Allender who first began to show me the science involved in 'computer science,' and that excitement about the field has remained with me to this day."

Ask Richard Rauscher to peer into his crystal ball and describe the future of computer-assisted medicine, and he doesn't hesitate. "One of the most exciting computer tools on the horizon is a system we call the 'inference engine,'" he explains. "In this approach to computing, you ask the machine to analyze a series of facts and draw inferences from them.

"For example, let's say you read the computer a series of children's stories about 'Little Red Riding Hood,' and the computer looks at all of that data and then decides: 'All wolves are big and bad!' Okay, that may be true in the limited world of children's fairy tales.

"But what if you expand the topic being studied by the inference engine to medical research? What if you fed the computer information about a particular type of cancer – and then programmed in a person's entire genome, along with all of the other pertinent medical data? In that application – already being worked on, in many computer labs today – you could take the results and use them to custom-make a cancer drug for an individual patient. The drug would go after that specific cancer in that particular patient, and it would include no side effects.

"Can you imagine a medical facility like this, where a cancer patient gets this kind of custom-tailored treatment and then walks out the door without any more cancer? That kind of interaction may still be a decade or two off – but it's a good example of what the future may bring us, as the collaboration between state-of-the-art computers and medical research becomes more and more powerful in the years immediately up ahead."

The Karmanos Cancer Institute is a unique, urban-based integrated center of research, patient care and education, dedicated to the prevention, early detection, treatment and eventual eradication of cancer.

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