



Learning the Language

Interdisciplinary research at the
Center for Future Health

jur interviews Philippe Fauchet, Ph.D.

Professor Philippe Fauchet holds appointments as Chair and Distinguished Professor in the Department of Electrical and Computer Engineering, as a Professor of Optics and Biomedical Engineering, and as a Senior Scientist at the Laboratory for Laser Energetics. He is the director of the Center For Future Health, a joint venture between several departments in the College of Arts and Sciences, the School of Engineering and Applied Science, and the School of Medicine and Dentistry. He spoke with *jur* about cross-disciplinary research at the Center for Future Health.

jur: What is the Center for Future Health?

Fauchet: Dr. Alice Pentland, Chair of Dermatology, and I officially created the Center in 1998. It really spans both the School of Medicine and Dentistry and the College. We have participating faculty members from Electrical and Computer Engineering, Computer Science, Chemistry, and other departments as well – we even had somebody from religion at one time – and several of the departments in the School of Medicine and Dentistry; Dermatology, and so forth. We looked at the landscape and found that there are many places in universities and industry where engineers and medical doctors work alongside to develop, for example, a better CAT scan machine, a better MRI machine, a better this or a better that. When you go to the hospital all those gadgets really help you. But we decided that is not what we want because it has been done, so we asked ourselves, ‘How could we use technology in a different way?’ The analogy that I like is the following: suppose you buy a new car, and that’s your body. You buy a new car and it comes with all sorts of advice: every three thousand miles you change the oil, after ten thousand miles you have a major checkup and all that kind of stuff. But suppose that instead of following that advice, all those preventative measures, you just drove your car on the highway at whatever speed you wanted, ignoring the change oil sign, the maintenance, all that stuff, what will happen? Your car is going to have a major

breakdown, and then you have to haul it to the garage to fix it. It will certainly cost you a lot of money, and then you start again. Well, that’s sort of what we do with our bodies. We just don’t take many preventative measures. We don’t monitor subtle changes that may happen at a young age, when it doesn’t really matter. At my age, it starts to matter, and when you are sixty, seventy, or eighty years old it really matters a lot. Basically, we only intervene when something is obvious. That’s sort of the equivalent of waiting until the car is broken on the highway.

When you bring yourself in for a repair, they use the CAT scan machine, and all those kind of things. I’m not saying those machines should be replaced, I’m saying they should be complemented by something else. That something else is using technology to keep an eye on your health status every day.

Of course, you can’t do that consciously. You have to develop a system that, for example, measures simple things like heart rate, and more complicated things like the way you walk. If you do that over a long period of time, we can know what is normal for you, not just for the average population.

What this is really moving towards is medicine based not on the average population, but one that uses you as the reference. You’re wearing the sensors, and you can monitor and see subtle changes over periods of time. Instead of waiting until a disease like cancer is so fully developed that you can feel all your symptoms before going to the physician, at which point the physician says “we have to treat you right away,” the idea is to develop systems that can alert you to the fact that something is happening, even if you don’t realize it. We thought such systems are exactly what technology ought to do, and because it’s not that way today, we assembled this group and got a big gift from a major foundation on the West Coast to get these ideas started.



A panoramic view of the Smart House.

jur: What are some of the challenges in working with such a broad array of disciplines?

Fauchet: Well, the first challenge was learning the language. It's tough enough for a mechanical engineer to understand what a chemist has to say, but we had to put the two of them together and then try to talk to a medical doctor. What we have done is have several groups of people start meeting. We have these meetings weekly, with the ground rule of 'no jargon.' If anyone uses jargon, immediately someone yells "What is that?" and whoever said it has to be able to explain it to the other scientists. And, by the way, if you can explain something to somebody from a totally different discipline, then you can explain it to the public, which is a big advantage. Plus, with the explanations comes an appreciation of the other discipline. So I think that's a major accomplishment.

The other challenge is that on the global and national level, we were the first to start a project like this. And now there are at least a dozen groups nationwide and even internationally. I'm not saying that they have copied everything, but they are in the same domain. There are groups at MIT, the University of Virginia, Florida, Georgia Tech, someplace in Oregon, a couple of groups in Asia, and at least one in England. Every time we look around, there are more and more groups that are working on the same thing. It has begun to be accepted as an approach for the future by professional organizations such as the American Association of Housing and Services for the Aged. Those people want the same technology to help them because they don't have the manpower. For that reason, they have endorsed the approach that we began, and now other people know it is the direction to take.

Another one of the big challenges is that to do research, we have to be funded. In academia, you get funding from sources like the National Science Foundation (NSF), the Department of Defense, the Department of Energy, or the National Institutes of Health (NIH). Well, how are we going to find the "in between"? The NIH says what we do is science, so it should be funded by the NSF, and the NSF

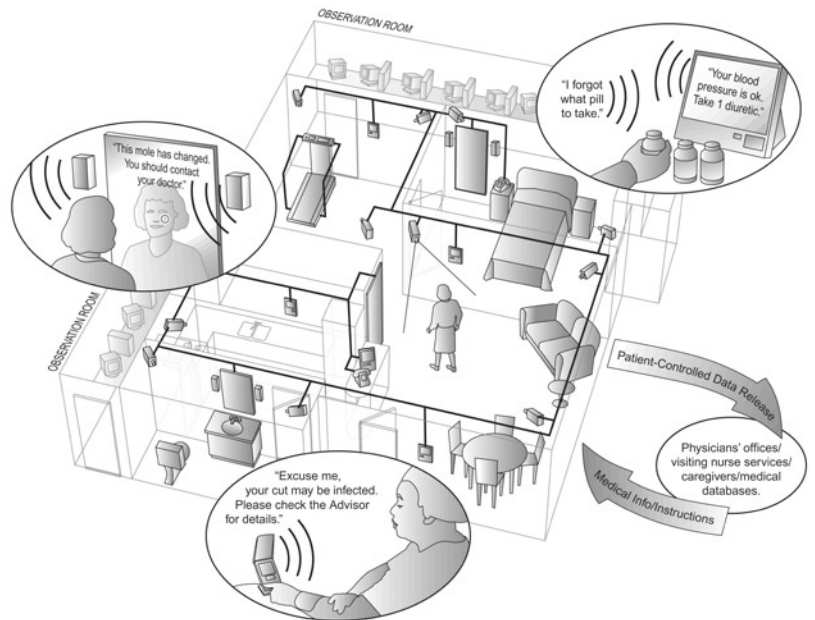
says the application is medicine and health, so should be funded by the NIH. As a result, all the groups have suffered the past few years from the fact that each agency says, "It's not uniquely in our domain, so you pay for it."

jur: How feasible do you think it is to get this technology into the majority of homes?

Fauchet: Some of it is feasible, not today, but probably within, say, five years. I think the benefit would be for people at high risks. With someone who is at high risk for something, it makes a lot of sense to invest money in monitoring whatever condition they have. There would be a progression of that kind of technology. We have had focus groups indicate willingness to use the gait detection system involving cameras in homes with people who are prone to falling. Of course, people very often don't like to have cameras in their homes. But if the choice is between that and leaving home for good after a fall, they are usually open to it. That's not that difficult, but I think again, the older population is the world that will accept that first. Also, some of those things need clinical trials to demonstrate that there are no dangers when the technology fails.

jur: Once this system is employed, what kind of impact do you see it having on the medical community?

Fauchet: You might think the medical community would say, "Well, this is going to take patients away from me," right? But in fact, the vast majority of the primary care, general practitioners, love this. They hate their job today; they see patients for five minutes and it becomes an assembly line kind of thing. And then they spend more and more time with insurance paper work. They would love to have this technology. Also, they very often will deal with patients who come and the conversation goes, "This is painful." "Well, how painful?" "Well, I don't know, but it's painful." What kind of information is that giving you? Suppose you have a couple of little machines that measure pain; when you come in, you can say, "It's painful, and this is what



Top Left: Cameras looking at a women through a Smart Mirror. **Above:** The Smart Bandage
Top Right: Schematic of a Smart House.

my chip says.” Put that information into the computer and the doctor can understand the problem right away, then apply the medical training. Right now, your health is being measured every time you go see a physician, which means you can go a full year or more without being checked. That’s pretty stupid. Your health can change drastically during a year. But also, not only do you have regular updates, but fine-grained information is available, and the finer the grain of the information, the better informed your decisions can be.

jur: So it helps to individualize medicine?

Faucher: That’s it! That’s the big key. We don’t want medicine to be the same for everybody. It’s going to be your own thing. What I envision is this, sort of; Radio Shack, or a store like Radio Shack, and you have a shelf with a whole array of devices for your house. And as your house changes and you have some new condition that you need to monitor, you can go buy the appropriate thing. You put it in your house, or a company puts it in your house, and it is integrated with whatever else is already there, just adding more value. That’s my vision of it. It may be a service industry like cable TV, you may never own the devices, they may come and install it as you need and you pay a monthly fee.

jur: Can you tell us about one product and how different departments are contributing to it?

Faucher: I’ll give you two examples. One is the gait detection system, where there are several cameras inserted in the ceiling; that’s a collaboration between Professor Tekalp who is in Electrical and Computer Engineering and Dr. Mike Berg who is a professor in Neurology in the School of Medicine and Dentistry. They have this joint project because Dr. Berg is in charge of

Parkinson’s and neurological problems and Prof. Tekalp is an engineer. They work together and supervise the students. Another example is where I collaborated with Prof. Miller, a chemist who is now in dermatology. I’m the device guy and he’s the one who makes the smart molecules, puts them in a device and we get a biosensor. Well, five years ago, I didn’t know what DNA looked like. But, now I have given talks at the American Chemical Society. It’s multi-disciplinary; you learn about a different language and different discipline.

jur: Are there any undergraduates working on it? How can undergraduates start working on it?

Faucher: Yes, we have undergrads in the summer and a couple during the academic year. We have a couple from MCC also, so the students are not just from U of R. We also have had seniors in Biomedical engineering who have actually started doing work on specific parts right in the center. The way to find out about getting involved is to contact me or Cecilia Horwitz, who is the associate director of the Center for Future Health. There are always possibilities for independent projects, senior theses, or summer employment.