All the way from my house to the Institute I kept listening intently to that news broadcast, but I was not able to make out from the reports exactly what had happened in New York other than that one of the Twin Towers had collapsed. As soon as I got to the Institute I asked Karen at the front desk what had happened. "Was it another bomb?" I asked, thinking about the previous attack on the World Trade Center.

"No," she told me. Then she told me about the jet planes and their suicide crashes into both towers. And about the third attack on the Pentagon. I felt my blood run cold, but not from fear. It was that almost forgotten feeling of icy rage. I had heard or read somewhere that fifty thousand people worked at the World Trade Center. How many had been killed? I thought about my graduate student, Major Mike Vlk, who worked at the Pentagon. Was he okay? I thought about Dave Thompson, who had taken over as dean of the college of engineering just two years back in the fall of '99. He was supposed to be in a meeting at the Pentagon that morning. Was he all right? How many people had been killed there? As the enormity of what had happened sank in, I clamped down tight on my feelings so I could think clearly. One thing was certain beyond any possible doubt. America had been attacked and we were at war.

Touraj was standing in the hallway too, grim faced and solemn. We talked briefly and then he asked, "What do you think will happen now?"

"We find out who did this," I said flatly. "Then we kill them all."

Touraj turned a little pale at this. He'd never heard me speak with such cold-blooded menace in my voice. But the cowards responsible for this had murdered who knew how many innocent Americans that morning and I meant every word of what I said. I wanted them all dead. Every last one of them.

The University observed a brief period of silence for the victims that morning at ten o'clock, and then we got on with classes and other business as usual. This was what had to be done. We were a country at war now, but we did not yet know who the enemy was. I fully expected we would soon know, and I fully expected that soon we would learn how our government would mobilize America's corps of university people to take part in the war effort. Until then, it was our duty to set the example for our students and to show the world the resolve of the people of the United States of America. No one talked about this. No one had to. It was a time for America to stand as one people and look our enemy in the face with all the courage and resolve and ferocity of our nation.

Periodically that day I would check the latest news updates using the Internet, and after work in the days following I followed the news broadcasts closely, waiting with the rest of the country to learn what course events were taking. The morning of 9/11 I had feared the casualties in New York would be much higher. They were awful enough as they were, but they could have been ten times worse and I was relieved to learn they were not. Dave Thompson was safe and unhurt. He had still been at his hotel when the plane struck the Pentagon. I had not yet heard any word on Mike Vlk, but the plane had struck a part of the Pentagon not staffed by his branch. I would later find out he hadn't been there at all. Only the week before his Pentagon assignment had ended and he had transferred to a base elsewhere in the country.

I listened with skepticism as a Bush administration spokesman floated the idea of Iraq and Hussein as likely suspects in the attack. Iraq? They were a contained enemy, their borders sealed off, our foot on Hussein's neck. This sounded like nothing more than wishful thinking, an excuse to strike at Hussein for his assassination attempt on the President's father. Whoever the enemy was, I was sure it could not have been Iraq. The Iraq suggestion was floated once, briefly, then disappeared again.

I listened, first with irritation and then with growing anger, as one cowardly news announcer after another said over and over again the country was quaking in fear over the attack. They made it sound like we were all cowering and weeping in dread. Yes, of course there would be some who would be afraid. There always are. But I saw no signs of terror and dread around me. I saw shock, yes, and anger even more so. But fear? Terror? Dread? Our nation does not react to attacks with fear. America gets mad. Didn't these spineless lily livers know even that much about us? The whole crowd of them disgusted me. Were they trying to create the national fear they were inventing? Where was their sense of duty? Whose

side were they on?

I listened, pride mingled with sadness, to the stories of the heroes in New York, in Washington, and on the plane that had gone down in Pennsylvania. I wondered if, had I been there in their places, I would have had the physical courage to do what they had done, to make the sacrifices they had made. This is something no one can know until standing face to face with danger. I hoped I would have done as they did. Surely here were the heroes whose example touched us all in the deep places of our hearts.

And I watched and listened, filled with a terrible resolve, as the identity of the enemy was finally unveiled. Al Qaeda. Now the enemy had a name. Now he had a face. And now we knew where he was skulking. President Bush told us and the world that any country, any government, that gave shelter and aid to these fatherless pigs would be treated equally as our enemy, and I grimly approved. I doubted if the Taliban fundamentalists tyrannizing Afghanistan would hand them over to us. But if they didn't, they could share the fate of the bin Laden and his malevolent brood. If the Taliban chose to stand by them, they could die with them and that was okay with me.

But not everything about Bush's policy was okay. He told us he was going to make it his personal mission to war on all terrorist organizations everywhere. I heard these words and at first could not believe I had heard him correctly. We had a specific enemy to crush. What was this about *his* personal mission? What was this about de-focusing our strength and squandering it across the globe in some general crusade against faceless, murderous thugs everywhere, even those who did not stand with our enemy?

That's not how to win a war. It's how to lose one. It is not the duty of our Commander in Chief to have a *personal* mission. The President does not get to declare who our enemies are. The President is not granted the power under the Constitution to hold his own private *jihad.* That is why the power to declare war is placed in the hands of the Congress.

But the Congress *again* refused to do its duty. The Congress *again* failed to issue the declaration of war they were bound by oath to declare. It did not matter Al Qaeda was not a country. They were still an identifiable enemy. I thought then, and I think now, their lack of action was shameful and cowardly. They handed the powers of a Roman dictator to George W. Bush and pretended they had not failed in their duty to all of us.

The war was starting off badly.

Concurrent with these events came the anthrax murders. It was not clear whether this was a part of the Al Qaeda attack against America or if this was something else altogether. Still, only a fool would assume it was not part of the attack, that it was some strange coincidence. It appeared to be a threat.

And this one, at least, was something my colleagues and I *could* do something about. Ron and I sat down together and talked about if our SOL method could be turned to task of detecting the presence of anthrax. It didn't take us long to decide it could. Our team would need to do some work to give it this capability, and it would mean some of our experiments would have to be done using anthrax – which posed risks to us and our students that had not existed in the Grand Challenge. But we were certain we could do this and could do it under the kind of rigorous safety precautions required.

Our government was not interested. I never understood why. We were politely, but definitely, turned down. The project never got off the ground.

As the weeks passed, it gradually became clear that – unbelievable as it was – the Bush administration had no intention of mobilizing the resources of America for the war effort. They certainly had no intention to mobilize America's research universities or its professors. This, too, defied all logic and all comprehension. Were we at war or weren't we? Did we face an enemy to be taken seriously or didn't we? To me the answers to these questions were so obvious a blind man could see it. What was Bush doing? I thought about how he had acted on election night and I hoped to God he wasn't in over his head on this.

Any doubts I had on that score were soon settled in Afghanistan. Land-locked Afghanistan looked like

it would be incredibly hard to reach. When our diplomatic efforts brought Pakistan in as our ally, I applauded the success of the administration in accomplishing this. When we found an erstwhile ally in the Northern Alliance, the enemies of the Taliban, I applauded this even more. Pakistan gave us the route to pour men and equipment into Afghanistan, and the territory of the Northern Alliance gave us the marshaling area we needed to bring to bear overwhelming force. Once these two diplomatic victories were in hand, the days of Al Qaeda and the Taliban should have been numbered.

But the overwhelming force wasn't applied. Yes, our armed forces were enough to crush the Taliban militarily, and we did. But instead of bringing to bear our own forces to wipe out our enemy, it looked more and more like the job was being *outsourced* to Afghan warlords and proxy forces whose allegiance to *us* was neither firm nor reliable. Bush and Rumsfeld failed to deploy our own armed might to finish the job. Our leaders took down the Taliban government, yes. But they allowed both the Al Qaeda and the Taliban leadership to escape. They failed to win the war when it was at its most winnable juncture. I blamed Bush and Rumsfeld for that. The responsibility for leading us in war was in the hands of incompetents, just as it had been in Vietnam. We should have won this war in 2002 and they blew it.

Mike Vlk was one of those deployed to Afghanistan. All the normal schedules and rules about course-work were set aside for our men and women serving our country. Many, like Mike, chose to finish out the classes they were taking that semester when and how they could, and whatever we needed to do to support them in this, that is what we did. Just after Christmas I received a letter from Mike dated December 22nd. It read, in part:

> Dr. Wells,
>
> Cold and crappy here, but hopefully doing some good. Flew a mission into Kandahar this afternoon to drop off some equipment and pick up some "customers."
>
> Unfortunately we can't say where we are. But 10 years ago during the cold war I never thought I'd be here. Mail is a bit slow and Email is not available and spare time is sparse. But when I get my last tapes and final [exam], I'll get them back as quick as possible. Have a happy holiday season.
>
> Hope to talk to you soon!
>
> Mike

In late January I received a package from Mike dated January 14th. In it was his final exam for my course and another letter:

> Dr. Wells,
>
> Don't know if this is a first or not, but this exam has several combat missions under its belt.
>
> Our missions into and around Afghanistan have been hauling cargo and troops. We've been flying every day – sometimes two or three missions. So I took the book, exam and some notes on every flight along with a spiral notebook. If we had some time waiting on the ground, or once we were at altitude out of range of the threat, I'd work on the exam.
>
> It's been all over the AOR – Kandahar, Masir-E-Sharif, Bagram, Kabul. It was on the mission where we had to emergency take-off out of Kandahar when the airfield came under fire. I had it when we carried the body of Sgt. Chapman out of Bagram. I had it when we did a twenty-two ton humanitarian airdrop on six drop zones.
>
> Anyway I thought it was pretty cool – Unfortunately, I don't think it helped my grade any!
>
> I won't be able to take a spring '02 class, but hopefully will be able to in the fall.
>
> Take care!
>
> Mike

It *was* a first. And Mike did just fine on it. On his exam I pasted a small silver star decal. □

Despite the assertion that '9/11 changed everything' repeated again and again by the talking heads of what had once been the news programs, it actually changed very little on the home front. Certainly our nation had not been mobilized. One week to the day after the Al Qaeda war began Jang, Kwan, and I were down in Boise at HP for, of all things, a 'science fair.'

I mentioned before that the face of HP under the Fiorina regime was visibly changing. The science fair seemed to me to be another reflection of this. It was essentially public relations on the part of the technology section intended to bring what in the corporate world is called 'visibility' to the R&D work being carried out in Ken's lab. It consisted of an all-day poster exhibition where every project, including those of the university researchers, was on display for HP's employees to come, see, and talk about with the folks who were doing this research. One year later it was being called the 'HP Technology Expo,' which I thought was a more grown up name for it than 'science fair.' In part, one of the objectives of the 'fair' was to stimulate discussions between the rank and file of HP's printer R&D operations and the researchers that would hopefully lead to ideas for future project work. In fact not a whole lot of this went on in any really productive way or led to any important new ventures.

The science fair meant a lot of extra work for me because it was being held during the academic year when classes were in session. Rather than canceling my classes – which would have been very unfair to my students up in Moscow – I took advantage of the fact that my classes were being run through EO and I could therefore pre-tape my lectures before leaving for Boise. That way the students still received their lectures and, for my undergraduate course at least, I could have one of my graduate students or another of my colleagues sit in on the taped lecture and answer students' questions afterwards. It generally wasn't possible to arrange for this kind of substitute for my graduate course, however. The problem there was that the graduate material is at the expert level and the simple fact was that I was the only expert around in this area.

Most technical conferences, even the most prestigious, are in large part social gatherings. Out of the hundreds of papers presented at any given conference, there is usually only a small handful that prove to be important or useful for any one attendee. The majority of papers presented are usually forgotten within a few days of the end of the conference. There are exceptions to this, of course, and there are a few cases where landmark discoveries are first unveiled at a conference. But landmark discoveries are fairly rare and most papers are at best incremental additions to knowledge. There was, however, one big difference between a normal conference and HP's tech expo. Conference papers are refereed in the peer review process and count as part of a researcher's portfolio of scientific accomplishments. The HP expo was not peer reviewed and therefore did not count for such things as promotions, salary raises, and so on. What it did count for was maintaining friendly relations with those who made the decisions about the continuation of my funding. In university terminology this is called 'development' – which is short for 'developing sources of external funding.'

But there was, at least, a social element of the 'science fair' that I liked. It had been eight years since I'd left HP and five years since we'd been run out of town. The 'science fair' was a setting where I got to see a great many of my old HP comrades again and do a little catching up on what had been going on in our lives since the last time we'd seen each other. One thing I heard a lot of were complaints about how HP was changing as a company, and these complaints increased in harshness every year while Ms. Fiorina was at HP's helm.

I could tell Ken was a little nervous during the 'science fair,' especially when HP's higher-ups strolled through the auditorium where the exhibit was being held. This was one of the things I took as a clue that his technology lab was coming under fire at targeting time, which just happened to be around the time of the exhibition. Indirectly this led to one of the more amusing events – amusing for me if not for Ken – that took place at that first exhibition.

One of HP's management folkways had long been that a manager is supposed to pretend he didn't know very much technical stuff. The idea behind this grew out of HP's doctrine that a manager is

supposed to tell his folks what the job at hand is supposed to accomplish but is not supposed to tell his people how to do their jobs. If a manager offers technical opinions or suggestions, it was feared, his people would take that as 'the boss wants it *this* way' and that would be tantamount to the manager telling his folks how to do things rather than what to do. Somebody forgot to tell Bill Hewlett this rule, but it was a rule for everybody else. Because most HP managers were pretty good engineers before becoming managers, the sudden disappearance of a guy's actual technical knowledge was very noticeable to the rest of the engineering staff. We used to joke that upon being promoted the company required the new manager to undergo a lobotomy and that was why he suddenly didn't know anything anymore.

For most of the day I had Jang and Kwan manning our exhibition booth, explaining what we were doing and answering people's questions. I would stand nearby, talking with various people and occasionally pitching the benefits of the HP-MRCI research partnership. At lunch time, though, I let them both take off to get something to eat and I manned our booth while they were away. It was just at this time when Greg Spohn, my old boss and Ken's current boss, strolled into the exhibit area.

Greg has kind of a dry sense of humor. We had been friends for twenty-two years at that point, and one of the things we had always done was kid each other. It was a game we both enjoyed immensely. So, as soon as he saw me standing at our booth, he came over, Ken trailing behind him a bit nervously, and fired the opening shot in our kidding game. "Oh, great," he moaned. "I come down here to learn something and I only find the guy who can't tell me anything." He was referring, tongue in cheek, to 'the manager's lobotomy.' Behind him, Ken's mouth dropped open a little.

I grinned and struck a dignified pose. "I can tell you everything about this," I replied serenely.

"Oh, sure," he said. We went back and forth a couple of rounds, the general ideas being his claim that I didn't know anything and my rejoinder that I knew everything. Ken was hovering in the background, kind of bouncing up and down a little from jitters. He couldn't tell from our tones that we were kidding each other. Finally, pointing at our exhibit, Greg said in a challenging tone, "Okay, then, smart guy, what's that?"

"That's a poster," I replied proudly, looking and acting like I thought I'd just answered his question.

Ken turned pale. Greg just laughed out loud. □

Managers out in the private sector have a tendency to think that anything that isn't run the same way a company is run isn't being run correctly. Perhaps this is because they don't know how to do anything else but in any case it is a peculiar species of ethnocentric thinking. My own observation, made over the eighteen years when I was out in private sector industry, is that companies usually aren't run all that well, so this corporate cultural bias on how to run things the right way is kind of arrogant. The main reason running a company the way they do works is because their competitors aren't any better at running a company than they are. In *Up the Organization* Robert Townsend made a couple of observations I've always thought were pretty good cases of whistle blowing when it comes to managerial group-think:

> Big successful institutions aren't successful *because* of the way they operate, but in spite of it. They didn't get to the top doing things the way they're doing them now.
>
> The National Industrial Conference Board is a sophisticated center of research on yesterday. . . NICB publishes all sorts of data about corporate practice. I've found it a valuable source for ideas – of what *not* to do. When the vast majority of big companies are in agreement on some practice or policy, you can be fairly certain that it's out of date. Ask yourself: "What's the opposite of this conventional wisdom?" And then work back to what makes sense.

Manufacturing and high tech companies also have a tendency to look at education in the same way as they look at assembly lines. They pretty much think the process of educating young people is more or less a process of opening up the students' presumably empty skulls and pouring in some volume of knowledge like the machines in a brewery fill beer bottles. The way you can tell is by looking at how ABET, the organization that accredits engineering education in the United States, evaluates engineering programs.

The ABET 'guidelines' (which aren't actually guidelines so much as modified process control documents borrowed from industry with a few minor changes in wording) are loaded up with manufacturing and managerial terminology such out 'outcomes assessment' and 'metrics' and 'deliverables.'

In fact – if one wants to use silly business analogies at all – the process of education much more closely resembles farming than it does manufacturing. A farmer doesn't 'grow corn.' The corn grows by itself. What the farmer does is provide the conditions under which the corn can best do this. Analogously, a teacher doesn't 'learn his students some math.' All that a teacher can do is provide the conditions under which the students *can* learn the subject matter. That's the difference between 'learning my students some math' and 'teaching my students some math.' Education isn't some kind of manufacturing process and schools aren't 'knowledge factories.' Perhaps to folks accustomed to thinking of 'human resources' as a sometimes irksome species of widgets it's hard to tell the difference. The main problem with being a teacher is that *everyone* thinks he's a teacher. The fact is that most people don't have any more idea of how to teach than they do of how to cure cancer. That's why teaching is a profession and management is not.

During the 2000-2002 school years one of the things we were doing that chewed up a great deal of time and effort was preparing for what was called 'ABET 2000.' A few years earlier, the ABET organization suffered an invasion by former industry people, the most influential of whom came out of that great overhead organization known in most companies by the name 'Quality Assurance.' Through the late 1980s and on into the 1990s, a lot of QA departments – and especially the one at DMD – occupied themselves with introducing such things as 'continuous process improvement' processes, 'control charts,' and other such sundry rituals and totem poles into the manufacturing environment. The overriding theme had been 'documentation' – a term that meant keeping records of what was done so someone else could look at what you'd done and 'suggest ways of making further improvements.' In DMD's case, the main end result of this was to give morale a punch in the stomach because no matter how well people had done their jobs, there was always a way to criticize what they'd done. An awful lot of people, strangely enough, took this as second guessing, nitpicking, and endless harping and, consequently, felt that no one appreciated what they did. Interestingly enough, one of the biggest drivers of this new way of assuring quality came out of the European Union, where the whole business was codified under the name ISO 9000. ISO 9000 had teeth in the U.S. because Europe refused to allow the importation of any products that didn't follow ISO 9000 in their manufacturing process. One of the interesting things I'd heard about on my trip to Sweden were the complaints the Swedes were making about the EU's product regulations, under which Swedish strawberries couldn't be called 'strawberries' because they were too small.

The first time I read the new 'ABET 2000' requirements document, I didn't have any trouble at all recognizing and understanding it. It was ISO 9000 reworded. Under the old ABET what the ABET inspectors inspected was the content of an engineering program plus they did a little probing to see if the faculty really taught that content and maintained standards. Under ABET 2000 this was replaced by 'outcomes assessment methodology' and other such similar ISO 9000 documentation trivia. Interestingly enough, the most direct tool for documenting 'outcomes' – the students' grades – was specifically excluded from being an assessment. Why? Good question. Instead it called for documenting a process for 'continuous process assessment and improvement' with more accompanying documents documenting that this process was actually being followed. My guess is the new crop of industry QA retreads now governing ABET thought that because industry had had to be bullwhipped into paying attention to what it was doing, college professors must even more obviously be in need of a like discipline. Clearly we weren't running a very tight factory. I thought it was interesting, and dumb, that ABET 2000 specifically said 'content' was no longer a criterion for accreditation. Accreditation now depended merely on documenting 'learning outcomes' regardless of what it was the students were actually learning. So long as the curriculum bore some plausible resemblance to electrical engineering, we could teach our students anything, including Abacus 101, and it would pass as an accredited electrical engineering education. The new ABET is a triumph of form over function designed by unqualified amateurs ignorant of education.

Well, the pronouncements of ABET can't be ignored. Loss of accreditation is just too big a disaster for any program to survive. So, during 2001 we were all kept pretty business inventing a QA documentation process for our 'outcomes' – all the while continuing as well to do what we'd always done as teaching professionals, namely making sure we were properly educating young electrical and computer engineers. In the end we were able to comply with the form of ABET's new QA requirements while still managing to take care of the matter of real quality education. The result was we could look like a factory to the QA inspectors from ABET while still attending to the 'agriculture' of education. □

Dr. Jean'ne Shreeve, captain of the EPSCoR program.

The day after Martin Luther King day, January 22nd, 2002, Jean'ne's six 'Fuzzies' sat down for our first meeting of the neurofuzzy project. This was a meeting I would chair every two weeks for the next three years. At this meeting in Moscow were myself, Jim Frenzel, Terry Soule, and James Foster. Dan Wilamowski in Boise and Vitit Kantabutra in Pocatello attended via a live TV link.

Funding for the project wouldn't actually start for another ten days, but the purpose of this first meeting was organizational so the team would be ready to roll the second the money was ours to start spending. Jean'ne had given us an exacting checklist of things each member of the team was expected to accomplish during the course of the project, along with a timeline for when she expected these to be accomplished. As I said before, one of the many things I like about Jean'ne is I never had to guess what she expected. Professors as a general rule don't like being told what to do, but Jean'ne had the answer to that easily anticipated factor ready at hand. Anyone who didn't deliver on her checklist would be summarily dropped from the program. A major agenda item for that meeting was our tactical discussion on how we would as a team deliver on these requirements.

The neurofuzzy project would turn out to be one of the most successful and productive projects I ever led at the UI from the perspective of research accomplishments. Over the next three years it would financially support and provide research experience for a total of twenty-six graduate students, thirty-five undergraduates, and two postdoctoral fellows. We would publish sixteen journal papers, thirty-one conference papers, and three book chapters. Four U.S. patents would result, along with a fifth patent still pending. Six professors, including myself, were funded by this program. Our research work would lead to later research proposals that would bring in a total of more than four million dollars, and one of the team members, James Foster, would help co-author yet another major proposal that brought in sixteen million dollars of funding from the National Institutes of Health. Not a bad return for the 1.4 million dollar EPSCoR investment. A lot of private sector companies would find that hard to match.

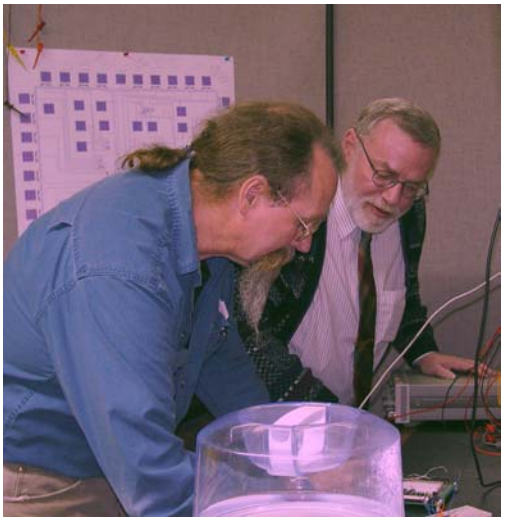
As a 'focus area' our team focused on a specialized branch of neural networks known as 'pulse coded' neural networks or PCNNs. These kinds of neural networks are particularly well suited to be implemented in microchip integrated circuit technology and were a relatively new area of neural network theory at that time. PCNN processors were known to have certain important advantages in image processing. The Army missile command had a particular interest in them for this reason. Why is probably fairly obvious from the first Gulf war, although whether or not PCNNs are currently in use or under development by the Army is something the Army won't be telling any of us any time soon. But despite their empirically demonstrated advantages, very little about how to design them or the extent of what they could do was known at that time because the mathematical theory of how they work is very complicated, much more so than is the case for traditional neural network systems. To figure out how to design them we turned to biology and, in particular, to neuroscience for guidance. You see, the brain and the rest of the nervous system is made up largely of pulsing neurons – a living example of PCNNs.

Terry Soule. Terry was a young assistant professor of computer science during the neurofuzzy project.

The team worked within the context of six primary objectives for the project. Broadly speaking, the objectives pertained to basic theory development, neurofuzzy computer organization, design methods, electronics, algorithms, and prototype chip development. Within this framework each of the six members pursued their own research directions. One of the principal problems we faced was coming up with design methods in the teeth of the enormously difficult mathematics that describes PCNN networks. This was where Terry Soule's evolutionary computing methods really showed their worth.

Terry and I ended up forming a kind of partnership – a little team-within-the-team – to address this problem. I supplied the system level organizational design – what we came to call the 'anatomy' of the networks – and the design of the basic electronic building blocks that went into it. Terry demonstrated that the EC algorithms he and his students were developing could overcome the mathematical difficulties and 'put the numbers' into the design. He accomplished this by discovering and developing new EC algorithms that ran on a very powerful kind of supercomputer known as a BEOWULF Cluster.

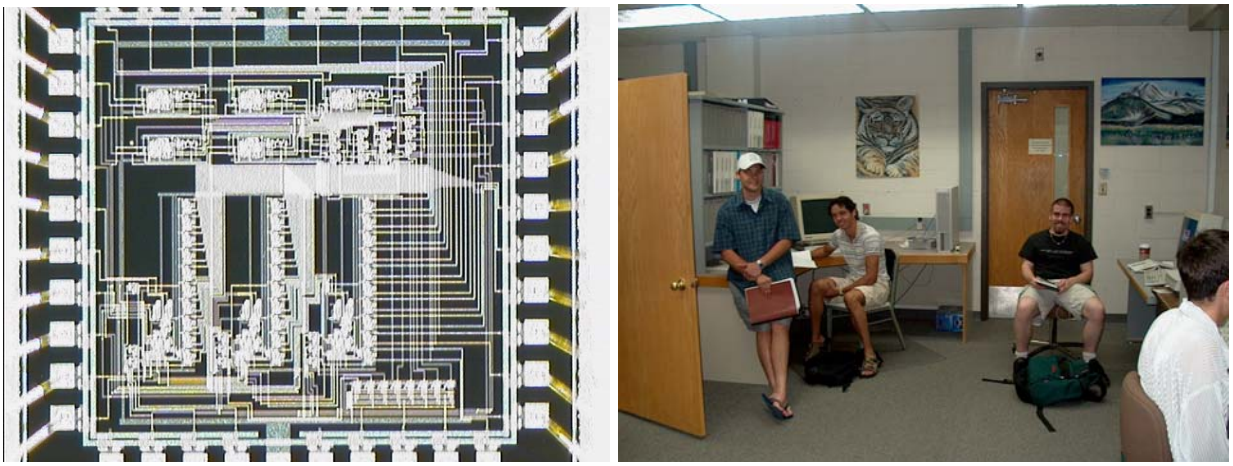
A BEOWULF is actually an array of relatively simple computers – the kind you might own yourself – modified to work together as one massive machine. A conventional computer does things one step at a time. This is called 'serial' computing. A BEOWULF performs many calculations simultaneously. This is called 'parallel' computing because the computers in the array work on different pieces of the computing problem and then cooperate to combine the results of these many individual computations. In computer jargon this is called a 'Multiple-instructions Multiple-data' or MIMD computer. The original BEOWULF concept was developed through NSF-funded research, and our first BEOWULF at the UI had been built by students in the computer science department with the support of NSF funding and a key donation of computer memory chips by Micron Technology. The first BEOWULF had sixty-four computers in its array and during the course of the neurofuzzy project two more BEOWULF machines were built, one of which had one hundred twenty-eight computers in its array. These machines provide an amazing amount of computational horsepower, and Terry's algorithms exploited this to the hilt.



Bruce Barnes and me testing one of our neural network chips in the electronics laboratory of the MRCI.

Terry's discovery solved one of the main design problems we faced but the numbers he supplied still had to be converted into electronic form. I wasn't out of a job yet. With my RA from the old SOL project, Bruce Barnes, we invented some new electronic circuits for implementing PCNNs. The circuits mimicked to a degree how biological neurons behave and so I called them 'biomimic artificial neurons' or BANs. One issue that had long been a problem for building neural networks was that direct implementation of the mathematical equations that described the network's function were also very expensive to build. It was one of our principal research objectives to find alternate ways of implementing functions like this that could avoid the expense by exploiting physical

properties inherent in transistors themselves. This was precisely what a BAN circuit did, and it resulted in a design that was much less costly than the direct approach and much more general than previous attempts to solve the cost problem had been. The BAN invention brought us two patents.



Left: Photograph taken under a microscope of one of our BAN neural networks. Right: Ben Sharon, Maurice Williams, and Bill Walker. Ben had been an undergraduate RI in the electrophotography program and became one of the graduate student RAs in the neurofuzzy project. Maurice and Bill were two of the many undergraduate research interns who worked on the project.

Because the circuits we were inventing were completely new, turning our circuit designs into actual working hardware required what is known as a 'full custom VLSI design.' What this means is the patterns of silicon and metal fabricated into a VLSI chip had to be designed from the transistor level on up rather than being able to re-use circuit layouts that had been previously developed. The photograph above-left illustrates what these patterns look like after a microchip is fabricated. While the circuit design itself for this project surpassed what undergraduate students could yet do, the physical layout design was another matter. I had an energetic corps of eager young undergrads working in my lab on this part of the design as well as on lab testing our prototypes and working on other closely related technical aspects of it. Their contributions were every bit as vital to our success as those of the professors and graduate students, and hiring them to work on the project greatly increased our overall research productivity. I think a lot of my young undergrads ended up amazing themselves with what they were able to accomplish. For most of them it was their first real work as engineers and their first real experience seeing how the theory they had learned in their classes was reduced to real engineering practice.

We also invented another new class of circuits to use in PCNNs, which I named 'forgetful logic.' It turns out that many key biological neural network functions critically depend on when different pulses occur in time relative to one another and on the rate at which these pulses are generated. Implementing these functions with conventional computer logic is pretty expensive. Forgetful logic circuits are designed so that these dependencies are built right into the circuit itself at the transistor level. In engineering jargon forgetful logic circuits are what is called a 'mixed signal' technology because in part they implement the 'digital' functions of normal computer chips and in part they implement what are called 'analog' functions such as those associated with circuits that implement mathematical operations like integration. By using forgetful logic we were able to greatly simplify the electronics needed to build PCNNs. Finding new approaches like the BAN or the forgetful logic circuit family is a central part of research in the art and science of electrical and computer engineering.

Most electrical engineering, computer engineering, and computer science students have little or no coursework in biology or neuroscience. Because what we were doing was so heavily based on biological neural networks, this was a hole in the backgrounds of the members of the neurofuzzy team. To remedy this, I wrote a series of tutorial papers to help my teammates learn what they had to know about neuro-

science. All in all there were eventually twelve of these tutorials written during the neurofuzzy project. I created a special web site for these 'tech briefs' and posted them there. One of the things NSF wants its researchers to do is to make project data, reports, and other scientific and educational material available to the public at large without waiting for the oftentimes slow peer review and journal publication process. In my field it is not uncommon for two or even more years to elapse between the time a manuscript is first submitted for publication and the time that paper actually appears in a journal. This is much too slow for the pace of modern science, and with the Internet now available to almost everyone, NSF likes to encourage researchers to make the best use of it. Today those neurofuzzy 'tech briefs' – as well as others I have written since then – are accessed hundreds of times each month by people from all over the world.

I think that in not too many years the Internet will produce fundamental changes in the scientific peer review and journal publication processes. There are signs of this happening already. The most important criticism of the Internet as a vehicle for disseminating scientific information is that the vast bulk of all such information posted on the web is not peer reviewed. This means that no one else has checked the author's work and confirmed the mathematics is correct, the experiments are reproducible, and the findings are verifiable. Ideally it should be the case that when you read a science paper downloaded from cyberspace, you should be able to trust that what you are reading is in fact true and commands agreement from other experts in the field. If the peer review process were perfect, the criticism that Internet publications aren't peer reviewed would be unanswerable.

Unfortunately, the peer review process is far from perfect, some of its referees aren't really all that expert in what they're reviewing, and the traditional publication process takes far too long and suffers from a great deal of censorship – often unintentional, sometimes not. The system we have today grew out of a need for a better, more efficient way to disseminate scientific information than in the early days of modern science when one scientist communicated his results to others by writing personal letters to them. Standard journals and the peer review process represented the best technologically viable answer to this issue available in the eighteenth century. But it might not be – in fact, it almost certainly isn't – the best technological solution today. After three hundred years of tradition, it's probably time for a change. The trick will be in figuring out how to prevent crackpots, charlatans, and bad scientists from clogging the information pipeline with bogus findings that just aren't true. And there is no doubt at all that the Internet today is riddled with papers and articles of this kind. On the other hand, today's journals aren't immune from this. It happens much, much less often than on the Internet, but it does happen. I know firsthand of a number of refereed, published papers from reputable journals that report things that just aren't true. How do I know they're not true? I went into my lab to verify the findings and found out the findings didn't hold up. I don't think this process of verification is used today as much as it ought to be; over time the journals have made us all a bit lazy. But 'trust me' is not an argument anyone can use in science. So perhaps someday in the not-too-distant future the Internet will force more of us to do *better* science. Perhaps the traditional journals will become the places where only the really, really significant papers, thoroughly examined, wrung out and verified to the highest degree, will be published and the trivial many will be relegated to cyberspace alone. Or maybe the journals will just fade away. Time will tell. □

Mom and me in 1953.

In late July of 2002 I flew back to Iowa for what would turn out to be my last summer vacation there. I stayed with Sherri and Ronnie out at their farm and Mom came out too so we could spend as much time together as possible. Mom was in pretty bad shape by then and had been going downhill pretty rapidly in the past few months. Since Dad had died I'd chatted with Mom over the phone every Sunday morning, and I already was aware of her deteriorating physical condition from these phone calls. I think my visit did do her some good. Sherri and Melody, who saw her all the time, told me she perked up quite a lot when I came out, and we had a very, very good visit. Even so, Mom

was a near invalid by then and her mind wandered off quite a lot. It tore me up inside to see it.

It's hard to watch the people you love grow old, sick, and enfeebled, to watch them robbed of their independence and eventually of their dignity. For me there has been nothing harder to do in my life than to watch Mom approaching the end of hers. When I think of her today, I don't think of the frail elderly woman of 2002. I think of and remember the strong, vibrant, loving mother of my boyhood and my youth. I think of my most important teacher, my caregiver, my protector in childhood, the one person who would always kiss the hurt and make it better. I think of the one person I knew would always remember my birthday and always made sure I got a Christmas present no matter how far away I might be. I think of the one person I know loved me more than any other person in the world ever would or ever could.

That visit was the last time I saw Mom alive. She died at the end of September, just a little over one month past her eighty-fifth birthday. Sherri and Melody were with her at the end and she went peacefully. We buried her the first week of October next to Dad in the little country cemetery and nothing in my life took more strength than did getting through those few heartbreaking days. I still miss her. Every single day. Just to write these words, years later, I have to stop every few moments to dry my eyes. I love you, Mom, and I miss you very, very much. □

The war and especially the question of Iraq were very much on the minds of my sister and brother-in-law during that last Iowa summer of mine. Sherri had been very frightened and alarmed by the Al Qaeda attack. She was pretty much operating in survivalist mode by then and had been hounding me off and on because I wasn't storing emergency food caches and so on against what she was convinced would be forthcoming strikes at power plants and whatever else. Of course, she had also been convinced that the 'millennium bug' was going to take down all the computers in the country come January 1st of 2000. She believes in being prepared for the worst, especially since she had no confidence at all that the government was really competent to deal with the threat. One time, after learning I still hadn't started stocking food, she challenged me to say what I was going to do when a terrorist attack started causing food shortages and the grocery store shelves became empty. I replied I'd shoot my next door neighbor and eat his dog. That earned me an exasperated "Honestly, Richard." Sherri is prone to see conspiracies everywhere. On her worries about me out in Idaho, I replied, "Look, no terrorist is going to steal a plane so he can kamikaze a corn silo." There actually aren't any corn silos in Idaho but I figured an Iowan would get the point of this metaphor.

Ronnie wasn't as overly nervous about the war as Sherri, but I could tell he did take the war seriously. The way I could tell was because he and I had an actual conversation about Iraq.

You see, Ronnie likes to argue just for the sake of debating. He's a pretty sharp guy and doesn't tend to jump to conclusions about things. But he does like to talk about them, especially political subjects. He usually doesn't actually take one side or the other on any political topic. He just likes the fun of debating. "What do you think about such-and-such?" is one of his typical openings. Then, whatever you reply, he takes the opposite side of the question. If he argues you into changing your point of view and you come over to the side he was arguing for, he immediately changes sides and starts arguing for the position he just talked you out of. It drives Sherri crazy because she takes most things very, very seriously.

But our conversation about Iraq didn't go this way. "Do you think we should invade Iraq?" he asked me. At first I thought this was just going to be another round of 'the debating game' but it wasn't. He didn't take a position one way or the other. He wasn't sure what we should do about Iraq and he was trying to make up his mind. He really was asking my opinion. That didn't mean my opinion would necessarily carry any weight with him on the matter. But he was trying to figure things out and one thing Ronnie does do is listen to both sides before making up his own mind.

My mind was already made up on this question. "No," I said. "Iraq doesn't have anything to do with the war. We have a war to win and that war is in Afghanistan and Pakistan. You don't win a war by starting another one someplace else against somebody who's no threat to us. If we go into Iraq, we'll

never get out there and it'll hurt the real war effort."

When the first President Bush had stopped the Gulf War rather than continuing on into Iraq to get rid of Saddam Hussein, I'd been initially upset by his decision. But since then I'd had a chance to learn a thing or two about the history of Iraq and had a chance to think about the broader political questions. It didn't take long to figure out President Bush had made the right decision and a wise decision. Nothing had changed since then to change how right he had been. I didn't buy into the 'weapons of mass destruction' propaganda line the second Bush was pushing. Iraq had no delivery vehicles. Its borders were sealed off tight. We'd already seen how vulnerable their army was to America's far superior military forces. And the risk any country takes in developing nuclear weapons isn't hard to state: If you use them first, you invite a nuclear-armed opponent to turn your whole country into glazed glass. There's only one use for nuclear weapons and it isn't to win a war; it's to annihilate an enemy totally. Any country that isn't capable of totally annihilating a nuclear-armed enemy on the first strike is stupid beyond all reason to develop nuclear weapons at all. No, Iraq was a contained threat. Our foot was on Hussein's neck.

And Bush had already bungled one war. We went to Afghanistan to get bin Laden and the other murderers of our citizens on 9/11. And by November 13th we had them cornered in a place called Tora Bora. Or, rather, we should have. But did Bush or his commanders in the field commit the forces required to root out and kill them? No. They *outsourced* this to a motley force of Afghan tribal militias supported only by U.S. air forces and twenty U.S. commandos. The enemy walked out of there and into Pakistan unmolested after leaving a sacrificial rearguard to cover their retreat. I had no confidence in Bush.

Back in January of '02, in his State of the Union address, Bush had declared a 'global War on Terror.' And nobody – not Congress, not the press, nobody – had challenged the illegality of a President of the United States usurping the Constitutional power of Congress to declare war. Instead the Republican Congress and its Caspar Milquetoast Democrats had sat there and applauded as this one man seized for himself the power to pervert his role as Commander in Chief into the role of military dictator.

The thin facade of legality Congress hid behind is the War Powers Act of 1973. This act states:

SEC. 2 (a)

> It is the purpose of this joint resolution to fulfill the intent of the framers of the Constitution of the United States and insure that the collective judgment of both the Congress and the President will apply to the introduction of United States Armed Forces into hostilities, or into situations where imminent involvement in hostilities is clearly indicated by the circumstances, and to the continued use of such forces in hostilities or in such situations.

There follows some language alluding to the provision that Congress has the power to "make all laws necessary and proper for carrying into execution" the powers of all branches of the U.S. government. When it was passed in 1973, the publicized intention of the Act could hardly have been more appropriate inasmuch as it was supposed to curb the power of a President to wage unauthorized war. But where the Act failed to 'fulfill the intent of the framers' came in section 5 (b):

> Within sixty calendar days after a report is submitted or is required to be submitted pursuant to section 4(a)(1), whichever is earlier, the President shall terminate any use of United States Armed Forces with respect to which such report was submitted (or required to be submitted), unless the Congress (1) has declared war *or has enacted a specific authorization for such use of United States Armed Forces . . .*

It is this clause I have italicized here that violates the Constitution. This is the clause Congress used to duck its responsibility for declaring our nation to be at war. They had already done so once when Congress had passed the Authorization for Use of United States Armed Forces in the days after 9/11. That resolution had stated in section 2, the key section,

> IN GENERAL – That the President is authorized to use all necessary and appropriate force against those nations, organizations, or persons he determines planned, authorized, committed,

> or aided the terrorist attacks that occurred on September 11, 2001, or harbored such organizations or persons, in order to prevent any future acts of international terrorism against the United States by such nations, organizations, or persons.

Under this wording, if Bush decides Des Moines harbors terrorists the language of the resolution permits him to attack Des Moines and Congress can claim, "Hey, *we* didn't do it!" It was cowardly.

Is this 'fulfilling the intent of the framers'? Did the framers intend for 'authorizations' to take the place of a declaration of war? I don't think so. In *The Federalist* (Number 41) James Madison had written

> Is the power of declaring war necessary? No man will answer this question in the negative. It would be superfluous, therefore, to enter into a proof of affirmation. The existing Confederation establishes this power in the most ample form.

The 'Confederation' he refers to is the Articles of Confederation. Aside from and in addition to the blunt statement of necessity he made, the statement of this 'most ample form' in the Confederation read

> No State shall engage in any war without the consent of the United States in Congress assembled, unless such State be actually invaded by enemies . . . and the dangers so imminent as to not admit of a delay till the United States in Congress assembled can be consulted; nor shall any State grant commissions to any ships or vessels of war, nor letters of marque or reprisal, except it be after a declaration of war by the United States in Congress assembled, and then only against the kingdom or state, and the subjects thereof, against which war has been so declared, and under such regulations as shall be established by the United States in Congress assembled . . .

This doesn't seem too ambiguous. It calls for the declaration and it calls for the enemy to be named. Nothing about it says it's okay for Congress to just tell a President, "sic 'em, boy!"

Afterward there followed the so-called 'Bush Doctrine' asserting his right *and his intention* to launch 'preemptive' wars against any nation he, Bush, declared to be a threat and an enemy in his 'global War on Terror.' Bush had succeeded in doing what Nixon had tried and failed to do. He had thrown the Constitution into the waste basket and grabbed the powers of a king. 2002 was a year when a cold, black wind swept across America. He had become a greater threat to America than Al Qaeda ever could be. I regarded him and his henchmen as traitors to republican government. And he had gotten away with it. □

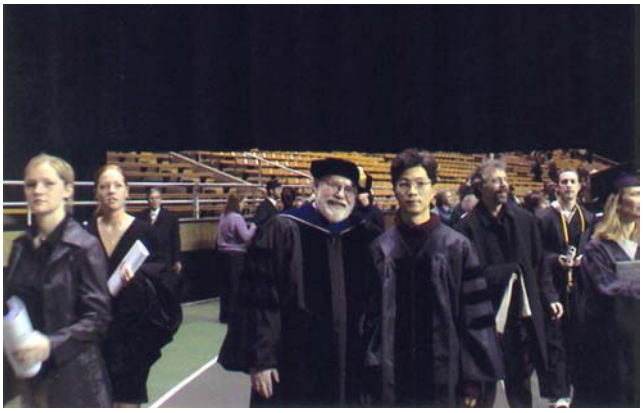
Jang Yi (standing) and Henis Mitro discussing an electrophotography experiment in my lab.

Electrophotography work under the HP contract also continued to grow during 2002. I still had only the two graduate students, Jang and Kwan, in my lab but the core of undergraduate Research Interns (RIs) had grown in number as the contract money had risen and I sought to give Jang and Kwan more leverage in carrying out their work. We began to see more and more signs of Bush's new Department of Homeland Security as we carried out our work. This didn't come from Bush mobilizing the academic resources of America; he had not and never did do that in any serious way. But now during our trips down to HP for review meetings and the September 'Tech Expo' I was having to submit the names of my students in advance to HP so HP could get permission from Homeland Security to allow my people to enter the HP site in Boise. How and why it came about that the government could require this from a non-defense-related company nobody ever explained to me. One of

my young students, Henis Mitro, was an international student from Albania, which was one of the countries on Bush's list of enemy countries. I had to get permission, via HP, from Homeland Security to take him along when we went down to Boise. The notion this young man, who wasn't even twenty years old, was somehow a potential threat to America was too ludicrous for words. Among ourselves we started jokingly calling him 'the spy' after a character on 'The Simpsons' TV cartoon show.

Down at HP there were further signs of internal problems developing for Ken's group. I learned that my old pal, Greg Spohn, had left HP. I'm under the impression he had opted to take one of the voluntary severance packages HP had started offering in order to cut its workforce, although I'm not sure whether or not that is what he did. I did know that he was taking care of his kids rather than taking another job elsewhere. I guess he could afford to do that because his wife, Nor Rae, continued to work at HP and, in fact, was a higher placed manager than he had been by then. I've known Nor Rae almost as long as I've known Greg. She first came to HP as an intern in the summer just before we took the HP 7908 into production and actually worked 'dotted line' for me under our matrix management setup during the transition team activities for the 7908 and 7911/12 products. Later on she went over to the laserjet printer side of the business, rising to general manager, then vice president and general manager of HP's Color LaserJet Business, and in April of 2007 became a senior vice president at HP. In October of 2006 she was inducted into the Women in Technology International Hall of Fame as one of the world's 'five most pioneering women.' With bringing home the bacon secure in Nor Rae's hands, Greg could afford to take on a 'Mr. Mom' role. Still, this change took me completely by surprise. Tom Camis, the engineer in Ken's group who had been most responsible for starting my research partnership with HP, also took one of their voluntary severance packages, and his departure was a big blow for Ken's group and for my lab as well. Tom had been our best ambassador to HP's rank and file engineers. He would later return as a paid external contractor, a tactic HP had started using more and more as it cut its own workforce.

After Greg's and Tom's departures, Ken told me I'd need to start finding 'customers' within HP for my lab's research activities. The general idea was for me to go around to meet and talk to more folks outside of Ken's group and find out what my lab could do for them. This isn't easy to do from three hundred miles away, and it was completely impractical for me to relocate to the HP site during the summers to engage in this sort of thing. Tony Anderson and I had landed a three hundred thousand dollar NSF grant to set up a small MEMS fabrication lab that past July, and Yang-Ki Hong's group had landed another seven hundred thousand dollar contract with the Office of Naval Research in August to continue the barium ferrite program. Then there was the neurofuzzy project. Although my HP contract had risen to two hundred thousand dollars per year by then, HP was now a very significant but still one of the smaller parts of my overall research program. I simply couldn't afford to devote my summers exclusively to HP.



With Dr. Jang Yi at winter commencement in 2002.

One thing Ken and I did readily agree on was Jang. Jang was graduating that semester and he hadn't laid in any particular plans for what he was going to do afterward. I wanted him to stay on as a postdoctoral fellow and Ken likewise was in favor of this. Jang's research had made him one of the world's top experts in the physics and modeling of electrophotography processes and by now his expertise in this surpassed my own. Since Jang didn't yet know what he wanted to do, he accepted this offer and joined the research staff of the MRC Institute. I counted on him to handle most of the day-to-day operations of the electro-photography lab since I was so busy with so many things. And, in truth, I was having some physical problems at this time. I didn't know it yet, but I'd done something to my back and the result was I was

very stiff, had chronic aches and pains, and I was having some problems just getting around. One clue had come in early September while I was walking up the stairs to my office at the Institute. I heard and felt a strange crackling noise that had run all the way down my spine. My body sounded like a bowl of Rice Krispies and, as the medical folks like to say, I 'experienced some discomfort.' I didn't know what had happened but at the time I chalked it up to not getting enough exercise. So, all things taken together, I was glad Jang was going to stick around and help me out. □

On the wider university stage things were about to get quite a bit tougher and in a very unexpected way. For the preceding few years, Idaho's Republican legislature had been systematically underfunding higher education each year despite the fact that Idaho itself was going through pretty good economic times. They had an interesting way of doing this while still being able to claim they were increasing higher ed funding each year. What would happen was the Legislature would pass their appropriations and then, awhile later that same year, our 'education Governor,' Governor Kempthorne, would announce hold backs – meaning the university wasn't allowed to spend all of the budget that had been passed. The next Legislative session, the Legislature would pass another budget that exceeded the previous year's amount *after* the holdback – thus 'raising' higher ed funding. Then the Governor would do another holdback. So it was that we got budget 'increases' each year and less or at best the same money to spend. All the while, the market manipulations by Enron and other energy companies had sent utility costs soaring and the cost of doing business for the UI had continued to climb. The SBOE responded to this by offering voluntary severance packages and early retirement packages to reduce the number of faculty. Faculty members who took advantage of this could not be replaced because of the budget situation. Eventually the ECE department lost around twenty-five percent of its members through this attrition process at a time when our enrollments were at record high levels. Naturally, faculty salaries were frozen as well, which was one of the things providing incentive for people to take the severance packages. Things were getting 'interesting' in the sense of the old Chinese curse, *'May you live in interesting times.'*

What no one expected was that on top of this a major financial scandal would burst into the open midway through the fall semester. But one did. It was called the Idaho Place scandal.

Idaho Place was one of President Hoover's high priority projects. It was planned to be a complex of three large buildings in Boise located near the BSU campus for research, support for southwest Idaho industry, and the UI's graduate outreach programs in southwest Idaho. It would allow the existing UI operation to move out of the rented quarters in the Morrison Knudsen building complex and greatly improve our laboratory facilities in Boise.

Money for the project was supposed to be raised by the University of Idaho Foundation and that's where the problem started. Our VP of finance was also the finance guy for the UI Foundation and to expedite the progress of the Idaho Place project he made a loan to the Foundation from some of the UI's funds, figuring the Foundation would repay this loan later (which it did). There were just two little problems. One, he hadn't cleared this with the SBOE beforehand. Two, it was against the law.

It always seemed to me that the scandal broke in slow motion over the last six months of 2002 and only really picked up speed in 2003 after that citadel of truth, *The Idaho Statesman*, reported it for all it was worth. That was when the foxes were set loose in the hen house and in no time at all we had a first-rate scandal on our hands and high placed politicians were running for cover. I don't believe any of the principals involved in this on the UI and Foundation side of things profited personally from this deal. But the VP of finance was forced to resign and later in 2003 President Hoover, assuming responsibility for what had happened on his watch, also resigned. The SBOE replaced him with an interim President, a retired businessman and UI alum named Gary Michael. Dr. Michael had never served a day working as a professor or university administrator, but the SBOE brought him in to deal with the huge budget problems now facing the UI as a consequence of the Idaho Place scandal. In this case, they felt, the UI needed a top executive and business man at the helm rather than an academic person. Dr. Michael served as interim President without pay and from a pure sense of civic duty from June 2003 until August in 2004.

The most immediate result of the scandal came in the form of huge budget cuts across all the colleges of the University. For awhile it was quite a mad scramble figuring out ways to make ends meet. One group that paid a heavy price was the group of assistant professors, who were not yet tenured. Quite a few of them were let go, including the one lone assistant professor in the ECE department. We became a department with no young junior faculty members.

Our Republican legislators seemed to think all we would have to do was take some of that big pot of externally funded research money the UI had been bringing in and reallocate it to cover teaching and the other routine educational functions and facility costs of the University. The fact that doing so would violate a whole host of federal laws didn't impress them very much. Perhaps they thought there was a legal way to embezzle from the federal agencies and we just hadn't looked hard enough to find it yet. In any case, we got zero help from the Republican Legislature or the SBOE after the scandal broke.

One thing neither the SBOE nor the Legislature nor the upper administration of the University had any problem with was raising student tuition. As it happens, tuition is illegal in Idaho under the State Constitution but the Legislature had long ago decided it was okay to charge 'fees.' Student 'fees' are tuition in everything but name, but that's the usual sort of lawyer dodge our legislature is pretty good at when they don't want to pay for something. 'Fees' started shooting up as if intent on catching up with the Ivy League, and this was a big hardship for our students and for their families. It made pulling in research dollars more important than ever because this is the money that funds jobs for students. They saw to it most students would graduate with crushing loan debts, forcing them to become serfs to bankers.

It was during this period numerous Republicans began talking about how higher education was a 'private good' and not a 'public good.' However much private good a person reaps from education – and it is considerable – it is none the less true that the public good is *vitally* served by it. Alexander Hamilton wrote, *the vigor of government is essential to the security of liberty; that, in the contemplation of a sound and well-informed judgment, their interest can never be separated; and that a dangerous ambition more often lurks behind the specious mask of zeal for the rights of the people than under the forbidding appearance of zeal for the firmness and efficiency of government. History will teach us that the former has been found a much more certain road to the introduction of despotism than the latter, and that of those men who have overturned the liberties of republics, the greatest number have begun their careers by paying an obsequious court to the people; commencing demagogues and ending tyrants.* Our republican form of government and our personal liberty cannot survive without an educated public capable of understanding the complex issues of government. But now the conservatives had a slogan to use in their war against education. Ignorance and inflamed passions are always the friends of tyrants. □

On October 16th Bush signed into law the Authorization for Use of Military Force Against Iraq Resolution of 2002, which handed over to him Congress' power to declare war against Iraq. The resolution contained twenty-three 'whereas' clauses, most of which were mere allegations made by Bush and later found to be lies. The key 'authorization' was section 3(a),

> The President is authorized to use the Armed Forces of the United States as he determines to be necessary and appropriate in order to –
>
> (1) defend the national security of the United States against the continuing threat posed by Iraq; and
>
> (2) enforce all relevant United Nations Security Council resolutions regarding Iraq.

The resolution went on to leave it to Bush to decide when 'diplomatic or other peaceful means alone' were inadequate to 'protect the national security of the United States against the continuing threat posed by Iraq,' a threat that never really existed.

In the House, two hundred fifteen Republicans voted in favor of the resolution, six against it. Eighty-one Democrats voted for it, one hundred twenty-six against it. The House's lone Independent, Vermont's Representative Sanders, voted against it. In the Senate, forty-eight Republicans voted for it, only one

against it. Twenty-nine Democrats voted for it, twenty-one against it. The lone Independent Senator, Senator Jeffords from Vermont, voted against it. Five amendments to the resolution had been proposed, and all five had been defeated. The Spratt amendment called for the U.N. Security Council to authorize any use of force against Iraq, and if it did not for Bush to come back to Congress for a second vote before he acted unilaterally. This was defeated 155-270. The Lee amendment urged the President to work through the United Nations to resolve things peacefully. It was defeated 72-355. The Byrd amendment stated that no additional constitutional authority was being ceded to Bush outside of that necessary to deal with 'the threat posed by Iraq.' It was defeated 14-86. The Levin amendment urged the U.N. Security Council to adopt a resolution demanding Iraq 'grant immediate and unconditional access to U.N. weapons inspectors.' It was defeated 24-75. The Durbin amendment tried to restrict the use of the force authorization to cover only an immediate threat from Iraq rather than a continuing threat. It was defeated 30-70. Having already bungled the real war against Al Qaeda, Bush was now free to bungle another. □

Early in the last week of October '02 I stopped at the county courthouse to file my first absentee ballot. When election day arrived the following week, I would be in southern Spain for the 2002 annual conference of the Industrial Electronics Society of the IEEE, which was being held in the historic old city of Seville (called Sevilla in Spain). I didn't expect my vote to do much in Idaho. Governor Kempthorne was a popular governor despite the fact the Republican Legislature more or less pushed him around, or maybe because he allowed himself to be pushed around. A commission appointed by the Legislature to 'independently' determine the election redistricting after the 2000 census had done nothing to undo the gerrymandering the Republicans had put in place after the 1990 census. Idaho was destined to remain a one-party state and everyone pretty much knew that. However, I did hope the Democrats would fare better nationally by obtaining a majority in the Senate and cutting the Republican majority in the House. Bush had, after all, failed to win the Al Qaeda war in Afghanistan. Before 9/11 few Americans had ever heard of the Taliban and fewer still had cared about them.

It was a busy week. Tuesday evening I flew down to Boise for the HP research meeting, getting back to Moscow Wednesday night. Friday morning I pre-taped my lectures for the following week and that night flew to Seattle in order to catch the flight to Spain on Saturday morning. We were taking a pretty big crew to the conference. Most of the professors on the neurofuzzy team along with some of the graduate students were going. The neurofuzzy team was presenting seven papers at the conference. Kwan also came along because we had two more papers on neural networks he was presenting. One of these papers won a 'best paper' award at the conference. In addition, I had been asked to co-chair one of the special sessions on neurofuzzy soft computing.

At that time the new security arrangement at the airports was still at the stage where they would pluck people out of the line for a full electronic frisk before getting on the plane. Supposedly those plucked out for a more thorough search were determined randomly by computer when you presented yourself at the check in counter. I had my doubts about how random this process was because I was frisked at every single airport. Every single time. Both ways, going and coming. It got to be fairly annoying pretty quickly, especially since methods like this are completely ineffective insofar as providing 'security' is concerned. It's a sampling process, which means the odds of actually catching a terrorist this way are pretty bad. The whole process was all for show so the Bush administration could look like it was doing something to protect the public. But as a counterterrorism measure it was worthless. I'm pretty sure they were actually using some kind of profiling criterion to figure out who was going to be searched; otherwise it's hard to explain why an Idaho college professor from Iowa would be so popular with the friskers. But if *I* fit some profile, it's hard to see how that profile could be geared up to catch any real terrorist. Maybe they figured a professor was likely to belong to that dread organization Al-Gebra; luckily, I carried no Weapons of Math Instruction with me.

The conference itself went very well but for me the best part of the trip was Seville itself. Seville is a large city – someone told me its population was around seven hundred thousand people – steeped in history. It had been captured in 45 BC by Julius Caesar, and the Roman emperors Hadrian, Trajan, and

Theodosius had been born in the nearby town of Italica (modern day Santiponce). The ruins of an old Roman aqueduct still stand in parts of the city. Although it was November, the weather in Seville was perfect, like summer days back home.

Jim Frenzel in the electronics lab at the Institute.

On days when not much of interest to us was going on at the conference Kwan, Jim Frenzel, Terry Soule, and I would set out from the Meliá Lebreros Hotel, where the conference was being held, and go on walking tours of the city. None of us had thought to bring a Spanish-English dictionary along – the language at the conference was English – and my old high school Spanish had gotten very rusty over the years. For the first few days we were getting some pretty strange looks from waiters when we asked for the check; it turned out that instead of asking for the check we were asking them to bring us the invoice. The Spaniards were a pretty laid back bunch who were never in any particular hurry. One afternoon we'd stopped off at a sidewalk cafe for lunch and after lounging about for awhile decided it was time to resume our tour. The trick was to get the attention of one of the waiters so we could pay our bill and be on our way. Kwan tried to wave one of them to come over to our table, and I guess he was a little too vigorous about it. The waiter jumped into the street, gave a sharp whistle, raised one hand high over his head, and yelled out in English, "Taxi!" Kwan's face turned red and the rest of us laughed until our sides split. It was hilarious and even the waiters gathered round and joined in.

Our little tours of Seville weren't exactly organized safaris. The hotel had tourist maps available and we'd more or less set out in the general direction of where the map indicated there were interesting things to see. We'd go until my body stiffened up to the point where I couldn't walk anymore, take a break until I could go some more, then we'd be off again. On days when I overdid it too much we'd take a taxi back to the hotel after we'd covered the area of the city we'd set out to see. Cab fare in Seville was cheap. A taxi cost only six euros and at the time the euro traded even up, one euro for one dollar.

I enjoyed seeing the regular, non-tourist parts of the city almost as much as the tourist attractions and I enjoyed trying to chat, as best I could in my broken and very limited Spanish, with the locals. There were several old houses owned by families who belonged to the Spanish nobility that were open to tours. I use the word 'old' in the calendar sense here; these houses were very well maintained and, truth be told, were in better shape and were better built than many of the much younger houses back in Moscow. Invariably they would feature an interior courtyard open to the sky, around which the rest of the house was built. The ones I saw were two story houses. I was told this architecture helped keep the air circulating inside the house and kept the house cool in the heat of the Spanish summer. Typically the courtyard would feature a fountain, a garden, or a tiled open space with a ring of marble statues placed around the periphery. The individual rooms in the house were smaller than is typical in a modern American house. Still, a person could be very comfortable living in one of these houses.

But for those hard to please, there was always the Real Alcázar, the Royal Palace that belonged to the King of Spain. This, too, was open to tourists and it was a gigantic place. We spent probably about two hours wandering around inside it and still didn't see everything. The palace contained within its outer wall numerous gardens and there were small little coffee shops and restaurants sprinkled about here and

there on the palace grounds. It had its own museum as well as many, many works of art adorning it pretty much everywhere. No complaints about the size of the rooms here; they were big enough to satisfy the most claustrophobic person. The Real Alcázar isn't the main palace in Spain. That one's in Madrid and the Real Alcázar was kind of the vacation get-away palace for His Majesty. I guess it's true what they say; it's good to be the king. The Real Alcázar made J.R. Simplot's house in Boise look like a log cabin.

Not far from the palace was a very nice little park that featured a huge statue of Christopher Columbus. Seville was the major jumping off point for Spanish expeditions to the New World and the city has a gigantic hall of records where documentation of Spain's bounty from its American expeditions is still kept, or so I was told. I saw the hall from the outside but it's still an operating government office building and we didn't go inside. Christopher Columbus is a local hero to the people of Seville.

Then there was Seville's gothic cathedral. That was one serious church. I'm told it is the third largest church in the Christian world, after the basilica in Vatican City and St. Paul's in London. Construction of the cathedral started in 1401 and today it contains five naves, twenty chapels, plus a Royal Chapel. It also holds numerous works of art by, among others, Murillo, Zurbaran, Valdes Leal, and Goya. Kwan and I took the opportunity there to do some serious climbing – all the way up a series of stairs that started to seem endless long before we got to the top and could look out over the city.

Not on the usual list of tourist attractions, but still of interest to us, was Seville's university. It was set back behind high stone walls in an attractive part of the city not too far from one of the many very nice little parks. We strolled inside and basically just wandered around for awhile. We didn't come across too many professors there – like elsewhere in Europe, the professors tend to kind of set themselves away in what I tend to think of as cloisters – but there were plenty of students. Young people are the same the world round. I saw serious ones, silly ones, gregarious ones, all in the full flush of youth and vigor in the High Summer of their lives. Just being around them was fun.

Back home the elections had come and gone, and from Seville it was hard to find out any details about the outcome. From what I could find out, though, things hadn't gone too well. The Senate was back firmly in Republican hands; that the Republicans kept their majority in the House was no surprise. I guess the Democrats' effort to look more like Republicans than Democrats hadn't paid off. Why the party leaders thought it would is something I never did figure out. Instead I was reminded of George Wallace's famous campaign line, "There's not a dime's worth of difference between the Democrats and the Republicans." I guess that was true in 2002 except for one thing. With full Republican control of both houses of Congress, Bush could now do anything he wanted and there was no opposition to rein in our bungling pseudo-Caesar.

I couldn't learn anything at all about how things had gone in Idaho, so I had to wait until we got home to find out how badly Republican things had gone there. On the local front in Moscow, one of the things that had happened was a stealth fundamentalist had managed to get elected to the school board. By stealth fundamentalist I mean a person who presents himself during the campaign as a supporter of public education and then, after being elected, proceeds to propose and support moves to hurt the public schools and supports having private religious schools, usually fundamentalist, paid for by taxpayer dollars. A less polite term for these folks is 'liar.' Kind of like those Democrats who were pretending to be Republicans. There was a lot of that going around those days. □

During the 2002-03 school year I found myself receiving a lot of invitations to give talks in various seminars and to attend an increasing number of meetings on various topics. One of these meetings was on Homeland Security Issues, although nothing of any consequence came out of that meeting so far as I know. Word had gotten around about my mental physics work, too, and I started getting invitations to deliver philosophical talks at different seminars, including a philosophy colloquium at Washington State. As I mentioned before, I think philosophy can and should be treated as a science – the first science, in fact – and I found my audiences enthusiastically receptive to the topics on which I was speaking whether my talk included anything about electronic brains or not.

In mid-December of ’02 the SBOE had approved our Notice of Intent to start our graduate program in neuroscience, and final approval of the program itself came during their January 20-21, 2003, meeting. Consequently, spring semester of ’03 found me doing the first offering of a new graduate course entitled ‘Biological Signal Processing.’ This course would become one of our three ‘core’ courses required of all graduate students in the neuroscience program, and it would also be cross-listed as a graduate course in electrical engineering, much like the course I had taken at Stanford many years before. It teaches students how to do computational models of biological and psychological phenomena with an emphasis on those phenomena of interest to neuroscience. The course is an introduction to computational neuroscience intended to serve a student audience drawn from biology, psychology, mathematics, and engineering. I am presently working on a new textbook for this course to replace the existing ones that I find to be not entirely appropriate for introducing this science to the broad audience my course intends to serve. When it is ready and has been adequately classroom tested, I intend to publish it for free over the Internet in the same manner as I published *The Critical Philosophy and the Phenomenon of Mind* in 2006.

On Wednesday, February 26th, Jang, Kwan, and I traveled down to Boise for the first of that year’s university research checkpoint meetings at HP. The plan was to follow our usual routine and meet in the parking lot in front of the lab for the drive to the Lewiston airport. Kwan showed up for our rendezvous that morning a bit excited and concerned. On his way over he’d run into a fairly big squad of police officers and FBI agents who were swarming around one of the married students’ housing complexes out at the edge of campus. He didn’t know what was going on, and we wondered about it all the way to the motel in Boise where we were staying during the HP conference.

We found out what it was about just as soon as we got there. The newspapers and radios throughout the Boise area were trumpeting the news that the FBI had arrested a terrorist on the UI campus. His name was Sami Omar Al-Hussayen and he was an international student from Saudi Arabia. Since the three of us were from the UI, the locals in Boise had quite a lot to say to us about what had happened. I thought I could detect just a hint of rebuke from them that the UI would have terrorists on its campus.

I knew Sami slightly, which is to say I’d seen him around campus every once and awhile. He was a Ph.D. student in computer science working for a professor whose office was next door to mine in the Institute. She was the director of our Center for Secure and Dependable Systems – CSDS for short – which was and is our research center that looks into security and protection issues for computer systems. CSDS was funded mainly by the National Security Agency and primarily investigates methods by which hackers break into computer systems and/or plant computer viruses, ‘worms,’ or carry out other such illegal actions. The feds charged Sami with seven counts of visa fraud and four counts of lying to officials – all of which stemmed from work he allegedly did as a webmaster for some web sites located in Michigan. To add spice to the whole affair, he was also charged in connection with a goat smuggling conspiracy (Huh?) but this charge was later dropped. You might notice that none of these charges would seem to have anything in particular to do with terrorism; those charges actually came about a year later when he was charged with two counts of conspiracy to provide material support to terrorists and one count of providing material support to Hamas (through donation links on the Web site he allegedly maintained). But although he had not yet been charged with any terrorism activities, the feds announced – and the news reported – that they had caught a terrorist. The next day out at HP, I didn’t run into one single person who hadn’t heard all about it and not a single person who wasn’t dead sure he was guilty. Sherri was absolutely convinced Sami was a terrorist. She still is.

It turned out there was just one little problem. He was innocent.

At his trial, in April of 2004, a jury acquitted him of all three terrorism charges and three of the eight total immigration charges. The jury deadlocked on the remaining five immigration charges. The terrorist charges against Sami came out of the misleadingly named USA Patriot Act, which had been rushed into law October 26th of 2001. In March of 2003 a judge ruled that he should be set free without bail and remain under house arrest until his trial. Sami was married and he had three sons up in Moscow.

Immediately after this ruling, immigration officials detained him on their charges and held him in their custody until he came to trial. I thought there was something more than a little Gestapo-like in that tactic. At a closed door immigration hearing in mid-2003, the INS ruled he was deportable. After his acquittal he remained incarcerated by the INS until he agreed not to appeal the deportation order in exchange for the prosecutors agreeing not to re-try him on the five deadlocked immigration charges. His wife and sons voluntarily returned to Saudi Arabia to meet him rather than wait to be deported themselves. Today he is an instructor at a technical university, in Riyadh I believe, and his wife teaches kindergarten. I think the feds deliberately railroaded an innocent young man; they certainly put an end to his graduate studies.

The terrorism charges against him came from the Patriot Act provision that authorizes the government to prosecute those who 'provide expert advice or assistance' to terrorist groups. This provision of the act was ruled to be in violation of the First and Fifth amendments in January 2004. The Republican Congress later amended the Act to fix up the vague definitions in the original Act so that they could restore the 'expert advice or assistance' clause. Not being a lawyer, I couldn't tell you exactly what would constitute 'providing expert advice or assistance' to terrorist groups. For all I know, publishing a scientific paper might do the trick if a terrorist read it and put something in it to use in some kind of terrorist act.

It sort of makes you think if you're a professor. □

On St. Patrick's Day I received a phone call from the NSF program officer in charge of the Research Experience for Undergraduates (REU) program. The previous September I had submitted a proposal to NSF for an REU site for computational neuroscience and technology research. The idea for this site had grown out of a melding of our new graduate program in neuroscience and the neurofuzzy research project we were carrying out under NSF EPSCoR funding. There are a great number of opportunities for findings in neuroscience to influence the engineering field of artificial neural networks and, likewise, for findings coming out of engineering research in neural networks to provide insights into brain science. In the language of modern management, this is called 'synergy.' The word basically means 'the whole is greater than merely the sum of the parts.' Synergy is something you see fairly often in athletics: A team without superstar players comes together and dominates the league that season to take the championship. Over the years I had often seen the same thing happen time and time again in R&D teams at HP and in research teams I had been part of at the university.

Synergy is the result of good team leadership and is always something to be highly desired and prized when it can achieved. Achieving synergy is the main reason why the best research results come from a good *team* of researchers rather than from individuals working off by themselves. With synergy in research you only need smart, dedicated people and do not have to rely on having a genius around. In my opinion, achieving synergy is the main job any leader has. All the rest of it – budgeting, scheduling, etc., etc. – is just a tiny piece of what a manager does and not nearly the most important part of the job. The minimum thing a leader or manager must do is prevent 'anti-synergy' – having the team disintegrate to the point where the whole is *less* than the sum of the capabilities of its members. But *good* leaders *create* synergy. It isn't easy to do, but it's always worth doing.

I had seen a golden opportunity to create some synergy between the engineering world of neurofuzzy research and the scientific world of neuroscience proper here at the UI, and the REU proposal was born of this opportunity. I had been working with folks from both sides of the picture to form a new research consortium within the MRC Institute, which we were calling the Laboratories for Computational Neuroscience and Technology Research (LCNTR). LCNTR was to be the organizational unit for the proposed REU site. The idea had been warmly received at NSF. Our REU site was – and I believe still is – the only one in the country where this melding of neuroscience and engineering into one team was a central focus. Today there are a number of REU sites for neuroscience, and there are a number of REU sites for the engineering and mathematical aspects of neural networks, but we were and are the only site where these are combined into one research organization.

Dr. Booker from NSF called me that day to talk about a problem that had cropped up when my REU

proposal had moved up the management ladder at NSF. It was the same old problem NSF usually faces: money. Our proposal had received a 'fund if possible' recommendation from NSF's panel of reviewers, but the 'if possible' part was proving to be tricky. The reason wasn't hard to figure out. The combination of Bush's massive tax cuts, passed in 2001, with the Al Qaeda war meant that money for non-war-related federal spending was tight. Dr. Booker called to propose an idea to me. She wouldn't be able to fund our REU site starting in 2003, but if I was willing to wait until 2004 she'd be able to put the funding for it through then. The Division Director at NSF had agreed to this plan. Would I be willing to agree to it? Well, that wasn't a tough decision: Agree to wait one year and know we'd get the funding or not agree to wait and know we wouldn't get the funding. It took me about two seconds to decide on that one. I appreciated Dr. Booker's willingness to innovate in solving the budget problems at NSF, and I wasn't about to whine about life's realities rather than get on with dealing with them. I agreed we could wait one year before starting the REU site. Jean'ne didn't like my decision too much on this one, but it was the right call and the next year we had ourselves an REU site. □

Bush's war on Iraq started three days later. Like it or not – and I didn't like it one little bit – America was now in a second shooting war and there was only one thing we could do about it: Win it so we could get back to fighting Al Qaeda, the real enemy. With the rest of the country, I was glued to the TV each night to catch the day's war news as our forces – ours and Great Britain's – advanced toward Baghdad. Compared to Afghanistan, this time we had clearly brought enough force to bear to crush the armed forces of the enemy. I couldn't help but think that if we'd brought this kind of force against Al Qaeda in Afghanistan the real war would be over already. The Iraq campaign has gone into the military textbooks as an example of a well-executed battle plan, and rightly so. From a purely military perspective, our young men and women fought magnificently. As our forces approached Baghdad, I waited with no little apprehension, along with the rest of the country, for that moment when Hussein would unleash the chemical weapons against us that Bush had told all of us Iraq possessed. I knew these wouldn't be able to stop us, no more than poison gas had been able to be a decisive weapon during World War I or Iraq's use of them had done anything to defeat Iran back in the 80s. But their introduction on the battlefield would almost certainly cause severe casualties.

Iraq's vaunted chemical weapons never made an appearance. I didn't think for a second this would be due to any restraint on Hussein's part. He was a butcher and we already knew from the first Gulf War that as commander of Iraq's armed forces he was nothing but a boob and a thug. No, if he didn't use them it meant he didn't have them. I wasn't surprised later on when no weapons of mass destruction nor even any facilities for producing them were found. It turned out to be just as I had said to Ronnie when we had talked about the question of Iraq. Iraq really had been contained and had never been a threat to America. This was an unnecessary war, an irrelevant war. All it accomplished in the end was to give Bush some personal revenge for Saddam Hussein's attempt to assassinate his father after the first Gulf War.

One other thing also became clear during the advance on Baghdad. We had brought to bear enough force to overpower Iraq's army, but not nearly enough to occupy and pacify a hostile country. This became clear when Iraqi 'militia forces' started their attacks in our rear areas. I had no doubt that some Iraqi civilians, the majority in fact, would welcome the fall of the dictator Hussein. I did not think this meant they would necessarily welcome *us*, an occupying power, on their home soil. Nor did I think a liberated Iraq would be a united Iraq. No one who has learned the least little bit about the history of Iraq and given it the least amount of thought should have expected that. Iraq was a united country for just one reason: all the military and secret police force their dictator had applied. Now, I felt to a certainty, we would be facing a costly and pernicious and lengthy counterinsurgency campaign in post-war Iraq. The doctrine of counterinsurgency had been much talked about in the mid-1960s because of Vietnam, and it was something we had studied a bit when I was a CAP cadet. There was also ample evidence from the history of post-colonialism after World War II when Great Britain lost piece after piece of their empire, and from the rout of the French in Indochina and their ejection from Algeria in Africa.

I had never believed for a single second Bush's pre-war claim that oil revenues from Iraq would pay

for the war and for the so-called 'nation building' he proposed to undertake. How could Iraqi oil resources pay for the war except by us either seizing them for ourselves or extorting the revenues from them at the barrel of a gun? What sort of 'infrastructure rebuilding' could anyone reasonably expect to result from the privileged companies to whom Bush had granted 'no bid' contracts and then given a free hand to feed at the pig trough of an Iraq in chaos? What kind of peaceful post-war Iraq could be expected after the Army had left massive caches of stockpiled weapons unguarded and Iraqi guerillas were left free to raid them and thereby arm themselves against us and against each other? The nineteenth century writer Antoine Boulay de la Meurthe had famously written, "It is worse than a crime, it is a blunder." That was the Iraq war. Bush had taken us into a counterinsurgency war that would drain our military resources for years to come and leave our real enemy, Al Qaeda, free to regroup and rebuild.

Our War Chief President had proven himself to be a blundering incompetent through and through. □

Ben Sharon at work in the my lab.

Spring semester and the summer of '03 were busy days for us. A total of seven graduate students whose committees I served on completed their theses or doctoral dissertations and graduated during this period, and I brought a new graduate student, Ben Sharon, aboard the neurofuzzy project. Ben had worked for me previously in the electrophotography lab as an undergraduate research intern and I had been impressed by his abilities as a young engineer and his practical approach to problem solving. When he decided to go to graduate school, I had just the research project for him: extending our basic biomimic artificial neuron circuit to implement a more powerful version of artificial neuron called the Eckhorn model. This model had been proposed earlier by a team of German neuroscientists as a model for neural signal processing in the visual cortex of the brain and had become an important part of pulse coded neural network theory in image processing applications. Up to that time no microchip circuit implementation of the Eckhorn neuron had been invented, and doing so was now Ben's job.

Jean'ne's EPSCoR program held annual program review meetings each September where the three focus area teams presented what they were doing to a distinguished panel of outside experts who comprised our Program Advisory Board. One thing the PAB members did was evaluate the different EPSCoR teams' performances and report this evaluation to Jean'ne. If they didn't like what they saw, Jean'ne had no hesitation about dropping non-performing professors from the Program. The second and more important role PAB members played was to advise the focus area leaders on things they thought would be of benefit to their particular team efforts. The neurofuzzy team was fortunate in having a very distinguished PAB subpanel led by Dr. Don Wunsch of the University of Missouri Rolla. Don was and is one of the world's foremost experts in artificial neural network research. He was at that time about to become the president of the IEEE's Neural Network Society (known these days as the Computational Intelligence Society) and would be named a Fellow of the IEEE in 2005.

One of the most important pieces of advice Don had given me at the September '02 PAB Review was that my team should establish a central application area that could be targeted by our work. Doing so would help to unify our individual efforts and, as it turned out, this was excellent advice and did a lot to increase the synergy of our individual efforts. After the review the team members sat down and we decided to target bipedal robots as an application area. Bipedal robots were not new at that time. For

example, the Japanese had come out with one called 'Asimo' – presumably named after Isaac Asimov, a science fiction writer whose robot stories had fascinated me when I was a boy. But robots like Asimo are really pretty clunky jobs whose ability to move around falls far short of human ability. What we decided to do was aim our work toward the eventual goal of bipedal robots capable of human-like locomotion. Such a robot would, for example, have been capable of going into the caves of Tora Bora after the enemy. This was something Asimo and others like it cannot do. Naturally, our approach would be 'biomimic'; our research would aim at uniting the biology of human locomotion with robotics engineering.

This, too, was not unique to what we were doing. Researchers at MIT and a few other places were then working on biologically-inspired robot 'fish' and 'insects' and were just then in the process of achieving some very impressive results. However, for numerous technical reasons the problem of natural bipedal movement is quite a bit more difficult than the problem of locomotion in fish or insects, and here we felt our methods and findings had a very good chance of overcoming these technical problems. On top of this, my own research into the mental physics of the human mind had by then produced a very relevant finding which stated that the development of intelligence and cognition is very tightly linked to the development of motor skills in infants and young children. Much earlier research work carried out primarily by the famous Swiss psychologist Jean Piaget and his co-workers had turned up experimental findings that this was so in child development. What my work added to this known fact was a more detailed theory that showed this linkage between motor skills and the development of cognition and intelligence was *fundamental* at the deepest levels of mental physics. As it happened, about the same time I had been coming to this conclusion the work of some noted biological neuroscientists – principally S. Murray Sherman and R.W. Guillery – was uncovering important findings in the neuroanatomy of the thalamus (a part of the brain through which all peripheral signals pass from the body to the higher brain centers) that also seemed to point toward this same result.

Piaget's work hasn't been very popular in the American psychological community – due in no small measure to opposition originating at Harvard – and the biologists, who are a very cautious breed, regarded and still regard the implications of the thalamus findings to be speculative. My own findings, which came out of very fundamental theoretical considerations that did not depend on the specifics of biological organization, had already convinced me of the truth of this underlying relationship. In fact, if Sherman and Guillery hadn't already made their findings, I would have published a prediction that something like what they had found would turn up if the anatomists looked for it. At the time I wasn't aware of their work but when I later looked for evidence of this sort of brain organization in the published literature of neuroscience I was delighted to find out what they had done and accomplished. It seems a marvelous confirmation of a key part of my theory. But I'm getting ahead of the story a bit.

The neurofuzzy team decided to start out with developing PCNN models of the human spinal cord and muscular system. The spinal sensorimotor system is basic to how our bodies are able to control our muscles and movements and we thought a focus on this aspect was the most logical starting point. One of the things that occupied a lot of my time during the summer of '03 was writing a series of detailed tutorial 'tech briefs' for my teammates on the biology of the spinal cord and muscular system. These tech briefs provided important background knowledge the other professors and graduate students would need for our newly defined application focus. I published these tutorials on our Web site, where they turned out to be surprisingly popular; they are among the most often downloaded materials from our Web site. In any particular month, from a hundred to as many as nine hundred copies of these various tech briefs are accessed from all over the world.

I also developed a detailed mathematical model of the kinetics of muscle action that Terry and his group used to further their work on evolutionary computing methods for neural network design. This model turned out to be an important contribution to our overall team efforts and, likewise, became a popular download from our Web site. One reason Asimo and other robots like it are so clunky is because they are built using fairly standard mechanical implementations that lack the flexibility provided by the compliant tissues that make up our muscles. Muscles stretch and contract and do so in a very nonlinear

way, and this significantly complicates the problem of controlling them. But this was precisely the sort of biological control system problem we were and are interested in solving.

Jang in his new office in the Institute. Jang doesn't like to smile when his picture is taken so for this one I stood behind the photographer and told him jokes until I finally got him to laugh.

We were continuing to make very good progress in our electrophotography research as well. Jang and I were at this time engaged in coming up with a number of important findings by applying the model we had developed for HP, and these results ended up in a mini-flood of published journal and conference papers with Jang as first author. I also asked Jang to develop a computer model of the mathematics I had worked out for the spinal-muscular system, and he put one together for us in an amazingly short time. I already knew he was an exceptionally talented researcher, but even I was amazed at how good he was turning out to be in his new role within the Institute. Touraj, too, was deeply impressed and he and I began planning how to get a Research Assistant Professor slot approved by the University for Jang after his postdoctoral fellow appointment. Guys like Jang don't come along very often, and we both knew a good man when we saw one. Getting this approved was going to be tricky because of the University's financial crisis brought on by the Idaho Place scandal, but we were confident we could eventually come up with a way to get this done. Jang was just that good.

HP was also making good use of the computer aided design software package we had delivered to them. HP buys its print engines from Canon in Japan, and during this period they were using the model to influence how Canon would design its next generation of print engines for HP. The eventual result was lower cost print engines and, therefore, lower cost LaserJet printers. □

In September of '03 I unexpectedly picked up a walk-on Ph.D. student and a new project. "Walk-on" is the term I use for graduate students who ask to work in my lab without the support of a research assistantship. These students usually have some kind of research project of their own in mind and what they want from me is generally coaching, advice, and training in how to conduct research. If what they want to do is something I think I can help them with, I generally agree to take them on under the theory that if walk-on players work out for the football coach there's no reason they wouldn't work out for me.

This case was a little different. Al was an older-than-average graduate student, married, and already had teenage boys and a daughter. He had been working for Dr. Deb Frincke, who at that time was the director of one of the Institute's two centers, the Center for Secure and Dependable Systems (CSDS). Deb had in fact been the major professor for Sami before his arrest. She came and asked me if I would take on Al as my student because his research involved cryptography, an area in which she had no expertise. This happened to be an area I knew a bit about from my work in information theory and also from some playing around with it I'd done when I was boy. I agreed I'd talk to Al and if I thought I could help, I would.

A couple days later he came to see me in my office. I listened as he described an encryption system he'd been working on. It was a complicated gizmo with all sorts of stuff being done to encrypt the original message (called the 'plain text' in the language of cryptography). "It's unbreakable," he bragged.

I looked at him for the good part of a minute and then replied, "You don't know that." He looked surprised and then started to explain it all again. I raised my hand and stopped him. "There's two kinds of security in encryption," I told him. "One is called 'perfect secrecy' and the other is called 'computational security.' Do you have a proof this system enjoys perfect secrecy?" He shook his head. "Do you have a

calculation estimating its computational security?" He shook his head again. "Then you don't know if this system is secure or not," I said. I went on to tell him a little story from the history of encryption systems. During World War II the Germans had a system for encrypting their military transmissions. When the African campaign was at its height, British bombers were sinking most of the supply ships bound for Africa with supplies for Rommel's Afrika Korps. One of Rommel's staff officers raised the question of whether the British might have broken the German code and if that might be how they were managing to sink most of the Afrika Korps' supplies. Field Marshal Rommel dismissed the idea out of hand. Breaking the German code, he said, was "a mathematical impossibility." But, in fact, the code had been broken and that was in fact the reason for the British success in sinking the supply ships. Many years later when documentaries were being done about the exploits of the British code breakers, a former German officer was indignant at the suggestion these guys had really been so successful. "If that is true," he demanded, "why didn't they win the war sooner?" The answer, of course, is *they did.*

It was pretty clear to me that Al had a lot to learn about encryption systems and their security, and it just happened that I had an idea for a new way to investigate this question. One of the mathematical methods I had been working with for about a decade by then is a little known area of systems theory that goes by the name 'set membership theory.' I had already used SMT to solve a number of otherwise fairly nasty problems, and it occurred to me that this theory might be just the thing to analyze how easy or hard it might be to break codes. You see, perfect secrecy is extremely difficult to achieve. There is only one kind of cipher system known to enjoy perfect secrecy. It is called the 'one time pad' and there is a formal mathematical proof that this system cannot be broken. The reason people don't use it is because it runs into a number of important practical issues that make it not very easy or convenient to use. The U.S. Armed Forces do sometimes use a version of it, or so I've been told. Pretty much nobody else does.

All other kinds of encryption systems – including the one in your computer – do not have perfect secrecy (which means they can be broken). The trick to making an encryption system secure is to build it so that the time required to break the code using the best known computer-aided techniques is so long that it might as well take forever so far as any snooper is concerned. However, computational security can only be evaluated in the light of the known methods for approaching a code breaking problem. If somebody comes up with a better code breaking algorithm, a system that was once believed to be secure might turn out to not be very secure at all. Computational security is achieved by making the calculations involved very complicated and time consuming. But no one had ever – again, so far as I know – tried to use SMT methods on this problem. SMT can be described as a method to 'roll your own math' – in other words, to concoct new mathematical structures in which what was a hard problem becomes a fairly easy one. I'd used it on three earlier occasions to solve problems that had defied clean solution by means of everyday mathematical methods. Why not, I suggested, try it on this problem?

Al had never heard of SMT before. Not too many people have. But he was willing to learn and I was willing to teach it to him. So, just like that, we had a new project going. Just a bit playfully, considering the topic, we came to call this one "Al's project." □

Our second annual EPSCoR PAB review was held in late September. By then we were twenty months into the neurofuzzy project and the team had a lot of exciting things to showcase for the members of the Program Advisory Board. Terry's first graduate student on the project had graduated the previous August and a bright, earnest, and somewhat nervous young man named Stan Gotshall had just joined Terry's lab to pick up the work. I like Stan a lot, not the least reason being the way he dived right into learning about the biology of the spinal cord and muscle system. Stan's job was to develop Evolutionary Computing techniques to design the neural network for our artificial 'spinal cord.' The team had produced a nice little stack of published research papers since the last review; papers, of course, are the currency of exchange for research and ultimately are what a research team's success is evaluated on. We had already filed for one patent on the BAN technology and a second patent disclosure was then in the works. Jean'ne actually beamed when she introduced her 'Fuzzies' at the review that year.

The one weak spot that year was Vitit, the professor from Idaho State. Vitit had turned out to be what I call a 'high maintenance' team member. It isn't unusual for a professor to be more than a little independent minded. The fact is, it's more usual than unusual. In Vitit's case, this independent mindedness took two forms. The first was a little rebellion against that list of requirements Jean'ne had issued to every EPSCoR participant at the start of the program. His basic attitude seemed to be that no 'administrator' – meaning Jean'ne – could tell *him* what to do. The second was a similar attitude taken toward his focus area leader – meaning me. I had originally brought Vitit aboard because his field of expertise was computer arithmetic, and the idea of bringing him aboard was to work on the problem of what the mathematical architecture of a neurocomputer needed to look like. What I hadn't counted on was that he would become enamored with elementary neural network theory (with which he hadn't been too familiar when the project started). He had gotten enthralled by one particular aspect of artificial neural network learning behavior and had drifted off into playing around with it. I'm sure he learned a lot doing this but there was just one problem. What he was learning wasn't new. Everybody who worked in the field already knew about it and so he was merely rediscovering some very, very old stuff. Neither Dan nor I were able to coax him back into participating as a team player.

The PAB members weren't too impressed either. After the formal presentations and other business of the review were over, the focus area leaders each took part in what were called the 'exit interviews.' These were meetings where specific PAB members provided feedback to us for where we should steer the projects during the next twelve months. Don Wunsch and Hao Ying, my two PAB advisors, gently suggested it was time I 'reallocated' the project's funding to more heavily promote those areas of the neurofuzzy project where the most productive results were being produced. I was planning to propose this to Jean'ne already, but Don's and Hao's feedback pretty much made this change a slam dunk. Jean'ne was a little less gentle about it when I met with her shortly after the review. I think she more than half expected me to defend Vitit's contributions to the project, but the unfortunate thing was he wasn't doing anything I felt like defending. We didn't need or want what he was doing and I did need and want what he wasn't doing. I knew Jean'ne already intended to drop him from the program but I spared her the need to argue with me about it because that was my intention as well. We went into the third and last year of the program without him, and I re-funneled the money to provide more support for Terry's efforts and to add more undergraduate research interns to the microchip design efforts. Vitit was now free to be as independent as he wished; he would just have to be independent using somebody else's money. □

I was still having chronic back problems when I turned fifty that September, and I still didn't know that the problems I was having *were* back problems. Mainly this was because from my neck down to my toes I felt stiff and had aches pretty much everywhere pretty much all the time. My back wasn't exactly sore but, like the rest of me, it did feel as stiff as an old board. The calendar said I was fifty, but I didn't feel one single day older than seventy-five.

By then I'd pretty much gotten used to feeling like an old man all the time. Most likely this might have been because by then I'd forgotten what feeling good felt like. For all I knew, it might have been normal to feel like this at the half-century mark. But in mid-October things took a change for the worse. It began one morning while I was sitting at my computer in my study working on a technical paper. All of a sudden and for no apparent reason, a burning sensation began in my right leg. It began as a strange kind of twinge and in a few seconds it felt like my leg was on fire. This didn't last for more than a few minutes but at the time it sure seemed like a lot longer. The hornet stings I'd received when I was a little boy were worse than this burning leg episode, but nothing else I'd ever felt had ever come close to this.

I had only the one episode that day, but in the days that followed the problem rapidly got worse. It was all completely unpredictable. Some days I would have no episodes at all, others I might have as many as four, mostly in the morning and spaced out at unpredictable intervals. One even hit while I was giving a lecture in one of my classes. During that one I really had to focus all my willpower to keep the pain off my face and out of my voice so I could deliver the rest of the lecture without alarming my students. I'm pretty sure none of them noticed.

It was pretty obvious something was very wrong, so that afternoon, after I'd finished my lecture and finished pre-taping the next lecture (I would be down in Boise that day for the HP autumn 'tech expo'), I paid a visit to my local doctor. He was the same guy I'd gone to for having that cyst removed from my back a couple of years before. He listened carefully while I told him what had been going on. I'd started keeping a log of when these episodes had occurred just in case there might have been some kind of pattern to them. But it turned out there was no particular pattern, and after he examined my leg he was as stumped about it as I was. He admitted this to me quite frankly, which I appreciated very much. I hate it when a doctor is clueless and still acts like he knows exactly what the problem is. He said the symptoms sounded like some sort of 'convulsion' but he'd never seen one like this before. Well, that made two of us. If it *was* a convulsion, he went on to say, there was a new anti-convulsant medicine that might help. He was very clear there were no guarantees, but he'd let me have some pills to try if I wanted to try it. Because having my leg catch on fire hurt like the dickens, I was game. He handed me a box labeled 'physician samples' to take home. The drug was called 'neurontin.' The box of samples was free.

When I got home that evening I found a very big piece of paper covered on both sides with very tiny print neatly folded up inside the box next to the pills. It was a summary of the complete description of the drug including the results of animal tests and a clinical trial that had been run on it. It turned out that this drug had been developed as an anticonvulsant for epileptic seizures. That gave me a lot of pause right there; whatever my leg problem was, I knew it wasn't due to epilepsy. I read the entire thing with mounting fascination. What was written on it would be gibberish to most people, but by that time I'd been studying neuroscience for years and consorting with biologists for the past two years, so I was able to follow what the thing was saying. Two things in particular really caught my attention. The first was a little section in which it was written, 'In standard preclinical *in vivo* lifetime carcinogenicity studies, an unexpectedly high incidence of pancreatic acinar adenocarcinomas was identified in male, but not female, rats. The clinical significance of this finding is unknown.'

In English: Some rats that had been given this drug developed pancreatic cancer and they didn't know if the same thing would happen to people.

The second thing that caught my eye read, 'During the course of premarketing of Neurontin, 8 sudden and unexpected deaths were recorded among a cohort of 2203 patients. . . Some of these could be seizure related deaths in which the seizure was not observed, e.g. at night.'

'Could be,' eh? Okay, I think I'll pass on taking this medicine.

The next day Jang, Kwan, and I flew down to Boise for the tech expo. All things considered, I thought it was better to put up with getting frisked again at the airport than to chance having my leg catch on fire while I was driving that winding goat trail we here in Idaho call U.S. Highway 95. The expo went off quite well, but I had two painful episodes during the first day of it and four the next day.

That weekend I spent quite a bit of time thinking about what might be wrong with me. Up until then I had thought of this as a 'leg problem,' but was that really what was going on? Except for the feeling that my leg was on fire, there were no other signs of anything at all being wrong with my leg. No discolorations, no swelling, no nothing. Maybe the problem was elsewhere. For the first time, I started to consider the possibility that this was really some kind of back problem. It made sense. Every single nerve in the human body passes in one way or another through the spinal cord on the way to the brain. I had a pretty fair picture of this spinal cord organization from the tutorial papers I had been writing for the neurofuzzy team members. All peripheral nerves enter the spinal cord via what is called the 'dorsal root ganglia,' a collection of neurons contained in a little sack-like arrangement just behind the adjacent vertebras. If something was pinching down on one or more of the dorsal root ganglia, the brain wouldn't be able to tell the difference between that and something in the peripheral nerve endings of the leg.

The next week I made an appointment to see a chiropractor in Moscow. If it was really a back problem instead of a leg problem, maybe a chiropractor could help. If not, well at least there wasn't a cancer risk.

My guy turned out to be a young, but not too young, fellow named Dr. Larry Hammond. His office was within walking distance of mine. I was by then making a practice of walking everywhere I could because I'd had a couple of episodes while driving my car, and they were each so painful I'd had to make an emergency stop and get out of the car to put the fire out. As I walked there I was mentally preparing myself to accept the normal chiropractic beating I'd taken back when I was thirteen. But I was in for a very pleasant surprise. Chiropractic had changed a lot in the almost forty years since I'd had my last adjustment. Larry listened very carefully as I described my symptoms. Then, just to be on the safe side, he took an x-ray of my back before he did anything else. Then the treatment began.

It was nothing like my earlier experience. In fact, it was almost as pleasant as getting a massage from my friend Ruth down in Boise. My favorite part of it was this blanket-like gizmo he put over my back that gently stimulated my back muscles. The idea behind this, he explained, was to tire those muscles out so they wouldn't fight the adjustment. After he finished, we made an appointment for me to return on Friday for a second adjustment. He warned me that he didn't think we had the problem licked yet.

I felt a bit better the rest of that day and for the day after. I had a couple fairly minor twinges that next morning at home but neither actually grew enough to be painful. Just a sensation of warmth in my leg. On Friday afternoon before the second appointment I had two bad ones. One happened while I was pre-taping a lecture, the other while I had a graduate student in my office. The second one was bad enough that I couldn't hide it and the student, Balaji Margabandu from India, did become alarmed. I had to spend some time calming him down. After he left, I had another meeting with the guy who ran the Idaho Research Foundation, which was handling our patents, and then it was time to walk over to see Larry.

I told Larry what had happened since our last treatment and he gave me another one, pretty much like the first. He wanted me to come back in on Monday, but I couldn't do that because I was spending the entire next week in Roanoke, Virginia at the IECON annual conference. I was presenting two papers there. Larry wasn't the least bit happy about that and he told me flat out that I shouldn't go. But that just wasn't an option. We made an appointment for me to come back the very first thing on the Monday morning after I got back from Virginia.

As it turned out, I didn't have any episodes while I was at the conference. There were a couple of very minor twinges that weren't painful, but nothing else. One of my papers won a 'best paper' award at the conference and I got to spend a lot of time talking with people who were very interested in what we were doing. One of these people was Dr. Paul Werbos, who was the NSF program officer handling engineering neural network funding and is a very famous guy in the world of neural networks. When I got back to Moscow I was pleased to tell Larry how well things had gone in Roanoke, but he still clucked at me a little bit for being so foolish as to take the chance. He gave me a third treatment and we scheduled another visit for Friday. All that week no bad episodes occurred, nor did any occur over that next weekend. Things were looking up, so we decided to skip the next week and have me come back on Monday, November 24th, which was the start of spring break.

Larry had instructed me to call him right away if I had any more episodes between then and the next appointment, and I was happy to promise him I would. But the week passed without incident and I was in pretty good spirits as I stretched out on my stomach on Larry's treatment table. He was less impressed. I guess his fingers must have been seeing something I wasn't. In any case, this time he gently started exploring higher up on my back than before. His fingers must have found something, because he gave me a push on the spine up between my shoulder blades. Previously, everything had been down in the lower back where the nerves associated with the upper right leg enter and leave the spine. There was a very loud *SNAP!* and both my feet shot into the air on their own so far and so fast that I almost kicked myself in the behind. If Larry had been standing one foot further back, I'd have knocked him to the floor. Larry stood there for a moment looking perplexed, then said to me, "What was *that* all about?"

"Hey, Doc," I replied cheerfully, "*you* did it, not me."

And he had done it. That was the adjustment that cured the problem. There was an unexpected fringe benefit, too. All that stiffness and all those feelings like my body was slowly turning into petrified wood vanished and I felt better than I had in a very, very long time. I might not have felt like I was twenty-five again, but I no longer felt like I was seventy-five either. It felt *good* to feel good again.

Talk about the laying on of the hands. All I can say is, *"Wow!"* □

Every now and then a strange year comes along and calendar year 2004 was one of those at the UI. The strangeness that particular year came in the form of a lot of personnel turnover. Joe Feeley, who had again become my department chair after David Egolf's term expired, had announced in the fall semester that he was retiring at the end of the 2003-04 school year. The announcement took all of us by surprise. As it happened, Joe had developed a heart condition and the stress of administering one of the largest departments in the university during a major budget crisis – brought on by the Idaho Place affair – wasn't doing him any good.

Joe's announcement touched off an internal political catfight within the department. For awhile it wasn't clear whether or not we'd be allowed to replace him because of the university's budget crisis; the main way the UI had been dealing with its budget problem had been through attrition. However, by the start of spring semester our college dean, Dave Thompson, had secured permission to replace Joe through a national search for a new ECE department chair. The catfight within the department was between part of the faculty who wanted the next chair to come from our own ranks and others who wanted to recruit a new chair from outside the university. At the heart of the controversy was how our department would deal with the budget problem.

Many professors at the UI took the position that the right thing to do in answer to the budget issue was to protect what they saw as the university's core mission – undergraduate education. All the various departments in the university were short-handed from the attrition process that had been going on, and the 'core mission' faction saw the situation as one where undergraduate education competed against research and graduate education. Everyone agreed that a land grant university like the UI was supposed to do both, but if both couldn't be done well then the quality of the undergraduate programs had to take priority over research and graduate education. Within the ECE department, our 'local chair' faction was inclined to take this position and they supported one of our own, an associate professor and excellent teacher named Joe Law. Joe was very forthright in saying that he would deal with the budget crisis by making sure that undergraduates would come first.

I found myself aligned with the other faction. My view was and is that research and graduate education are also core missions. It wasn't a matter of undergraduate vs. graduate education. We had to find a way to do both and to do both with uncompromising quality. Research enters in to this picture because research is how the university brings in non-state dollars that go to support graduate and undergraduate students alike. With university 'fees' climbing eight to ten percent each year, I believed that being able to provide meaningful jobs for students on various research projects was more important than ever. I also believed that if an organization responds to a crisis by cutting into its core mission right at the first step, that organization takes the first step on the path to failure. I was also certain that if we did not bring in an external candidate to fill the chair position, we'd lose yet another faculty position to the budget crisis and that was something I was certain would hurt everything we did in the department.

One of the things I had been working very hard at since moving to Moscow had been to increase the size of our graduate program. For many, many years the UI had been known much more as a teaching college than as a research university. Under Bob Hoover that had all changed and by January of 2004 the UI as a whole and our department in particular had established a large and robust graduate education and research program. The UI's research funding was now in the vicinity of one hundred million dollars per year university-wide. It hadn't been easy to build this program and I thought it was ludicrous to respond to a budget shortfall by doing things that reduced our income even more. So while I liked and respected Joe Law, I did not want to see him become chair of the department.

As spring semester got underway, the dean called for a search committee to be formed to look for our next department chair. As luck would have it, I found myself appointed to be one of the members of this committee. Following standard university procedures, a chair search committee is chaired by one of the other department chairs in the college, and for this committee we chose the chair of the civil engineering department, a guy named Sunil Sharma. We also had a representative from the UI's Human Resources department on the committee, as required by both university policy and the law, as well as a student representative, as required by both college policy and our own departmental By-Laws. The rest of the committee was made up of department faculty members, with both our internal factions being more or less evenly represented. Joe Law was not on the committee because he was formally applying for the chair position. Thus, in addition to everything else I was doing, I now found myself with the added responsibility and duty of helping to look for a new department chair. It was an assignment I couldn't turn down because participating in the faculty governance of the university is part of the social contract that comes with being a professor.

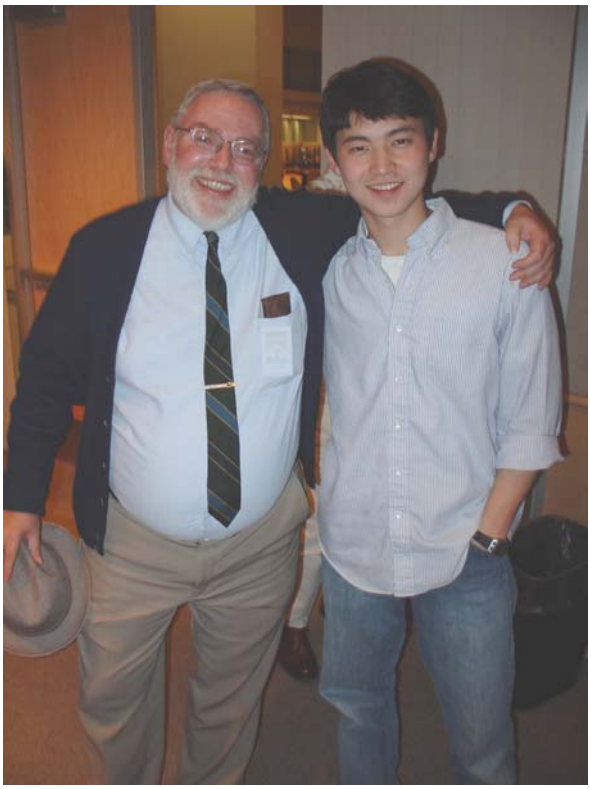
Even before this activity really got underway, another personnel crisis suddenly and unexpectedly erupted within my own laboratory. Jang Yi was resigning. That was a major loss for the Institute and a thunderbolt from the blue for me.

Jang is a big city boy with more than a little wanderlust in his heart. He was born in Seoul, Korea, and lived in San Jose after his family immigrated to the U.S. I had been trying to appease his wanderlust by sending him to our conferences and on professional visits to other institutions involved in HP's university research program. He likes to travel, I don't, and on the whole it seemed like a good arrangement. But by January of 2004 Jang had been living in Moscow for seven years and Moscow is a very small town. That can be a little tough on a young bachelor approaching the late summer of life. People of my parents generation used to speak of 'the seven year itch' – a tendency a lot of people have to make sudden big changes in their lives that at least anecdotally seems to come around on about seven year intervals, give or take. This might be more than mere folklore. In her 1976 book, *Passages,* anthropologist Gail Sheehy wrote of a series of somewhat characteristic changes in attitudes, goals, and directions that she found in a study of a large group of Americans, both men and women, at different times in their lives. According to Sheehy, these 'passages' occur at roughly ten year intervals from about age eighteen onward. I haven't especially noticed this particular pattern in my own life, but in Jang's case there were definite similarities to many of the things Sheehy wrote about.

Whatever the psychology of it might be, Jang had been re-evaluating his life and his goals. To my utter amazement, he had decided he wanted to get a law degree. Personally, I thought this didn't make sense, especially for a researcher of Jang's caliber, but it was what he wanted to do and there was no talking him out of it. Even trying to talk him out of it only irritated him. So it was that in late January he left us to move to the east coast (Boston). He succeeded in getting into the Hofstra law school on Long Island and he recently graduated with his J.D. He swung back through Moscow a few weeks ago on his way to San Francisco and we got together for a few drinks at The Quiet Bar, a little establishment in the University Inn where we used to go for a couple of drinks on Fridays after work when he lived here.

Jang had been running the day to day operations in my electrophotography lab for me, and this now fell back to me again. At the time we had two graduate students, Kwan and a young woman named Phik Wei Low, working in this lab along with a small corps of undergraduates. As a top notch researcher, Jang could not be replaced but the loss from his departure could be offset by hiring a couple more graduate students and parceling up the work. By now the electrophotography model was finished and the computer aided design tool released to HP. But we still had work to do on the neural network project and HP had asked for a couple more studies to be carried out. Phik Wei was working on one of these, a project to study toner consumption that was intended to better understand how fast a printer uses up its supply of toner in various typical printing applications. Another new project was looking into how temperature and humidity affected print quality. Jang's departure left this one uncovered. A third project involved how to take the results from Kwan's neural network and develop a cost-efficient way to implement what it did in

a LaserJet printer. The job of the neural network was to *design* the laser modulation template patterns the printer used in making, for instance, a 600 dots per inch print engine print at 1200 dots per inch. Once this is accomplished, there is no need to actually put a neural network into a printer. HP already had a standard computer chip design for implementing the modulation function, and the objective of this new project was to automatically convert the templates the neural network had come up with into HP's standard logic circuit implementation.



With Shingis Madakhmetov at a freshman Honors Program function. Shingis joined my lab as a research intern in January of 2004 while he was in his second semester of school.

Luckily for me, I was able to find four very sharp students able to step in and fill the hole in my lab, two graduate students and two undergraduate students. One of these was an Indian student named Balaji Margabandu, the same student who had been in my office the day I had that fiery leg episode. I had discovered him entirely by chance in one of my classes. Balaji was a tall, quiet graduate student whose facial expression always made him look like he was brooding about something. He never asked questions in class and in his day to day habits and mannerisms he seemed completely unremarkable, the kind of guy it is easy to overlook. The only reason I had taken real note of him was because my class required a research term project. When I read Balaji's term project report, I was in for a profound surprise. This unremarkable student had turned in one of the best research reports I'd ever seen come out of a term project. Entirely by accident, I'd discovered a diamond in the rough.

I hired Balaji to take on the temperature and humidity study, and I very quickly discovered he could handle that project and much more besides. A lot of unexpected things always pop up in the course of running a research lab – research tends to be like that – and I found out that I could put Balaji on these things and he'd handle them with calm efficiency and thorough-going excellence. I began referring to him as 'my go-to guy' because when a tough job came up I could go to him and he'd get the job done.

I teamed Balaji up with a brash and lovable young freshman named Shingis Madakhmetov. Shingis was, as they used to say, 'fresh as paint.' He was from Kazakhstan, one of the countries that had belonged to the old Soviet Union, and had come to America as a foreign exchange student while he was still in high school. He was a naturally bold and daring young man, only nineteen years old, who brimmed over with the kind of self-confidence coupled with youthful naivety – and, yes, with the sort of teenage arrogance – that old geezers like me often find amusing in a youngster when it is channeled into good and productive behaviors. Professors oftentimes find themselves feeling a bit paternal about students like this. That was the way I felt about Shingis from the day he first marched into my office from out of the blue and as much as told me to my face that hiring him would be the smartest thing I would ever do. Shingis thought there was no mountain too high for him climb.

Shingis had been a little boy when the Soviet Union fell and his country broke away. I was amused to learn he had been disappointed by the collapse. But not for any political reason, mind you. No, he had been a member of the Pioneers, the Soviet equivalent of the Cub Scouts. After communism collapsed this organization was disbanded in Kazakhstan before he was old enough to become a troop leader like his older brother was. He'd thought it hadn't been fair that he'd been cheated of his chance to become a

leader in the ‘scouts’ just because the Russians were nincompoops. It kind of reminded me a little of when the CAP in Maquoketa had disintegrated back in the sixties, so while I was amused I was also kind of sympathetic. It would seem that politics affects little kids no matter where in the world they live.

Like all Moslem students, Shingis had something of a balancing act to do when it came to classes. You see, most lecture classes at all U.S. universities meet on a Monday-Wednesday-Friday schedule. However, Friday is to Islam what Sunday is for most Christian faiths. Thus, while the normal university routine is set up to accommodate people of the Christian and Jewish faiths, it does not accommodate people of the Islamic faith. This is something I think we should do something to address because it puts Moslem students at a disadvantage, but so far there isn’t any sign on the horizon that the university system is going to change its ways in this regard. In my lab I don’t require my Moslem students to work on Friday and in my classes I try to accommodate them as best I can when they have to miss Friday lecture. For most of my regular classes, I ask for the class to be scheduled for Tuesdays and Thursdays.

The second graduate student I hired was Franco Fabile. Franco came from Boise and was newly arrived at the University of Idaho, having received his Bachelor’s degree from Gonzaga University if I remember correctly. He had applied for the RA position I had posted on the department’s bulletin board and had done the best of all the applicants in the technical interviews I conducted to fill the position. I also liked his ‘can do’ attitude and his practical-minded approach to engineering. His assignment was to work alongside Kwan on the problem of automating the conversion of the laser modulation templates produced by the neural network into the computer circuit implementation used by HP.

Lastly, I hired an undergraduate student named Prassana Upadhyaya, whose last name I never did figure out how to pronounce correctly. Prassana was an international student from Nepal and for him college at the UI was kind of a family affair. His older brother and his younger sister were both students here as well. I teamed Prassana up with Kwan and his job was to carry out the many laboratory experiments we were doing to test the quality of Kwan’s neural network results. He replaced Ning Choy, who was graduating at the end of the semester and planned to go to work for Boeing in Seattle. Along with Kwan, Phik Wei, and Henis, the holes in my lab were now filled and we could carry on without Jang. □

In late February Kwan, Balaji, and I flew down to Boise for the semiannual university research review meeting. The meeting itself was routine but by now this trip was lasting two full days, with the second day more or less going to ‘meeting with customers’ as Ken put it. The ‘customers’ were, of course, people from outside Ken’s group who we hoped to be able to serve by helping them with some research they needed. All in all, this trip left me with a very uneasy feeling about the direction my partnership with HP seemed to be taking. First, although he hid it well I could sense Ken was growing increasingly nervous about the future of his R&D section. I’d been a manager at HP long enough to spot the signs. Some key people had been pulled from his group to go work on ‘urgent’ product development projects. There was an increasing emphasis on periodic written ‘status reports’ documenting the ‘deliverables’ coming out of the research HP was funding. I knew what that meant. Ken was facing opposition at targeting time from a committee that had been formed to review his spending plans. When I was at HP targets weren’t reviewed by any committee; they were approved or not approved through the normal management chain. I took this as yet another sign of growing centralization of management by Ms. Fiorina and her staff down in Palo Alto. Or perhaps ‘growing centralized micromanagement’ would be a better term.

This new business of ‘go out and find new customers’ didn’t sit well with me either. It was a slam bang, hit or miss way to plan a research program. Research is almost by definition a forward-looking investment and this sort of Persian bazaar approach to identifying research needs was something one might do for product development, not for high tech research. I had absolutely no intention of letting my research lab get sucked into product development. That isn’t research and research is my business.

I also noticed that more and more of my old friends didn’t seem to be around any more. A couple of my pals in what I jokingly call my ‘spy network’ inside HP told me something that astounded me. There

had been a new policy implemented under which, when an R&D project came to an end, it was up to the people who had worked on that project to find new assignments to work on. If they didn't then they were 'excess' people and could lose their jobs no matter how good they were as employees. I had, and still have, a hard time believing such an incredibly stupid management policy was really being used, but whether it really was or it wasn't, HP employees believed it was. The HP Way – the soul of the company since its founding – was dead and buried once and for all. I was glad I no longer owned any shares of HP stock.

One manager down there told me confidentially that Ms. Fiorina had decreed HP was going to become a 'consumer electronics company.' I shuddered when I heard that. No company on the face of the earth was less suited or less qualified to be a consumer electronics company. It was the one marketplace HP had consistently failed to do well in decade after decade. They were a company that had lost their way and I was certain Ms. Fiorina was leading them all to disaster. I regarded her as a complete incompetent and a spectacular failure as a CEO. Under her the old HP where I had spent eighteen years had ceased to exist. This new entity was a doppelganger bearing no resemblance to the company that had been my life throughout the years of my youth. I thought it was the most massive case of identity theft in history.

After I got back to Moscow, I quietly began to re-plan my spending on the electrophotography budget. I no longer had any confidence it would be renewed when November rolled around, and I had four graduate students working under this contract that I needed to see through to graduation. I slashed spending on normal operating expenses and material and equipment purchases. I wanted every penny I could save in case I was going to need it for student salaries after November. □

During spring semester a lot of time was going into the search for the new chair. We had quite a few applicants for the position, including a good number of IEEE Fellows. Unfortunately, the best people we brought to Moscow for interviews took one look at the budget crisis they'd have to deal with and didn't want any part of it. My colleague Joe Law did make the short list of candidates by the skin of his teeth. The committee split right down the middle during the roll call vote and it turned out the deciding vote came down to me. As I said earlier, I did not support Joe becoming chair and I did not approve of what I thought his policies would be as chair. Nonetheless, with the department split the way it was I felt it would be unfair and unethical for me to take him out of the process instead of letting the full faculty debate and decide on the matter. I chose not to take advantage of the power that came into my hands by accident and voted to include him on the short list. Our dean was upset by this decision.

In the end, Joe did not become our chair and we ended up hiring an IEEE Fellow named Demetrios Kazakos. That turned out to lead to an interesting situation the following year. Interesting, that is, in the sense of that old Chinese curse. The political controversy dividing our faculty was by no means over. □

The Neuroscience & Neurofuzzy combined REU Participants and Mentors of the summer of 2004.

Our Neuroscience Research Experience for Undergraduates (REU) Site began its first summer program in 2004. In this program we bring an average of ten undergraduate students to campus for eight weeks each summer and the students carry out real neuroscience research under the guidance of a mentor from the UI neuroscience faculty. The REU participants are given the title of Research Intern, receive a salary for their work, we pay for their living expenses in Moscow and provide a travel reimbursement to help cover their costs in coming to Moscow from wherever in the U.S. they come in from. For the students it's a summer job but not a very usual summer job. Almost all the students come from small little colleges across America where the opportunity for undergraduates to find out what research is all about is very limited. All the students are American citizens or permanent residents, and they are among the very best and most intellectually gifted young people our country has to offer. Competition for getting an REU position in our program is very keen and if there is one thing I wish could be better it is only this: I wish our funding would let me hire all the fine, fine youngsters who apply each year.

The program session got underway the afternoon of Sunday, June 13, with a barbeque to welcome the kids, as I call them, to campus. That first session I had a large contingent of our local UI undergraduates working for the neurofuzzy program for the summer as well and I decided we'd combine the two groups on the theory 'the more, the merrier.' Research is one of the most fun professions there is and one of the things I made an objective for our REU program was that the students would have a social infrastructure so their hours outside of work could be as fun and supportive for each of them as the work itself. It can be very lonely for a young person to journey hundreds or thousands of miles from home and family to work in a strange new place doing something he or she has never done before under the supervision of people he or she has never met before. Some of our participants are as young as eighteen and just through their freshman year of college, and I organized our program to see to it that our kids would quickly feel right at home in Moscow. Before all else, our neuroscience REU program is all about the talented youngsters who participate in it and who will become America's next generation of scientists and doctors. Research really is also about teamwork, and my colleagues and I work hard to cultivate a social dynamic among the kids that teaches and encourages the spirit of teamwork and community.

The neuroscience REU program has come to be one of the most fun and personally rewarding things I do – so much so that I do it for free each summer. I have help, of course, from my colleagues in the UI neuroscience program. That first summer the team of mentors for our kids included Jim Frenzel, Terry Soule and Terry's graduate students, Stan Gotshall and Matt Settles, from the neurofuzzy team as well as Dr. Deborah Stenkamp, the Director of our neuroscience graduate program and a professor in our biological sciences department, and Dr. Mark DeSantis, one of our senior faculty members in neuroscience, the biological sciences department, and our medical education program. In the photo above, Terry, Stan, and Matt are at the far left in the picture and Jim and Deb are at the far right. All the other folks in the picture, except me of course, are participants from that first summer session.

Every single student in the program – right down to the very youngest – is assigned a real research project to work on. We don't have any make-work or phony projects; none of the kids end up being a glorified test tube washer. Every single project is about real research questions for which the answers are not yet known. Helping to find those answers is what the kids do. I organize the program so that many of the kids, especially the youngest ones, work in a two-person team and have a peer partner to work with in addition to their mentors. The students provide mutual support to one another and develop a real sense of comradeship. Nearly all the kids arrive scared green because this is their first experience with doing real research, and most of them are by no means sure they'll be able to succeed in this strange new job. Having a peer to lean on every once in awhile goes a long way toward building self confidence. All these human considerations in our program help to produce excellent research results in the very short amount of time available each summer, and these results are the attainments of the students themselves. They don't merely 'contribute to making' important findings; they *make* important findings. I couldn't be more proud of the dozens of young scientists who have come through our program since 2004 if they were my own kids. Nothing delights me more than watching all of them grow from uncertain, nervous youngsters

to confident and capable new scientists over the course of eight short weeks. These young men and women represent the very best of America. I have no doubt that one day some of their names will be known by people all over the world and some day there will be many people who owe their lives to my kids. I expect no less of them.

In addition to their research work, all our student participants take part in a workshop on ethics in science and engineering. My pal Michael O'Rourke designed this workshop for the program and he and I led it for the first three years. I think ethics education is one of the most important parts of a young person's development because every single person will eventually face ethical situations in life and it is important to be prepared to face these situations when they come. I know I owe a tremendous debt both to my parents and to the moral leadership education I received from the CAP when I was a boy. Ethics isn't about religion and it isn't about memorizing some list of do's and don'ts without understanding why the things on this list are do's and don'ts. It is about developing what Kant called *a good will:* the courage to do what is right for no other reason than because it *is* the right thing to do, the self control to *not* do what is wrong for no other reason than because doing it *is* wrong, the wisdom to understand the difference, and the self discipline to face life's challenges with moral resolve. *That* is what a good will is.

We also hold weekly luncheons and dinners featuring guest speakers who are exemplary role models for young scientists to emulate. Our speakers' topics range across the spectrum from how he or she got into research in the first place, how to select a graduate school and a major professor, how to plan for a career in science, how to work in interdisciplinary teams, and, of course, some of the exciting discoveries and accomplishments these speakers have achieved in their careers. For example, one of our regular speakers, Dr. Martin Pall of Washington State, has developed a new theory that may turn out to be the answer to the root cause of many debilitating diseases, possibly including post traumatic stress disorder. If Marty's theory turns out to be correct, I wouldn't be the least bit surprised to see him receive the Nobel Prize in medicine some day. If he does, our young scientists will be able to say, "I knew him when." □

At the end of July I took the entire electrophotography crew down to Boise for the second of the annual review meetings at HP. In the past these reviews had consisted of oral presentations made by the various research teams but the format was different this time. Instead of the usual oral presentations and question & answer sessions, Ken set this up as a poster presentation rather like those found at most other conferences. My team presented five different posters covering the various aspects of the work we were doing for HP.

The presentations were well received by those HP folks who came to it, but I couldn't help but notice that the attendance wasn't particularly large for this kind of a conference. I thought Ken looked worried about that. I stayed down there the next day for the usual round of discussions with potential 'customers' for research work, and by the time I departed for Moscow in the early afternoon I had a stronger sense than ever that the long and successful partnership between my lab and HP was coming to a close.

As it turned out, my instincts were correct. And what brought it about was something I had nothing to do with at all. At the same time as our graduate program in neuroscience had been established, the SBOE also approved the startup of another graduate program in Bioinformatics and Computational Biology. The amount of data collected in biological research is rather mind boggling, and a very important practical problem in this field is how to organize, search, and view the incredible amount of data that has been collected. Bioinformatics is the specialty field that researches new and better ways of doing this.

As you might guess, this is a task that makes heavy use of supercomputer resources and the BCB program had recently funded the construction of a third BEOWULF supercomputer. As required by state law, they sent out a request for quotes to the different manufacturers of personal computers, including HP. As it happened, HP chose not to respond to the RFQ and Dell Computer – one of HP's major competitors – came back with the low bid. Again, the UI is required by law to award contracts to the low bidder in the RFQ process and so our third BEOWULF was built using Dell computers. Somehow or other, word that the UI had bought a large number of computers from Dell seeped back to HP.

I found out later from one of my "spies" that this fact was brought up at the targeting approval meeting held a short time later down in Boise. Apparently the story got a little garbled or else the folks sitting on this committee were somehow under the impression that *I* controlled the purchases of computers by the University of Idaho or that I was the person who made this particular purchase. In point of fact I didn't even know at that time BCB was in the process of building a third BEOWULF. The bottom line, though, was that when my contract came up someone pointed out the fact that Dell computers had been purchased. Someone else sitting at the table responded, "Well, the heck with him then," and they voted down continuing to fund my program. The irony was that out of my various projects the MRC Institute had actually purchased a far greater dollar amount of HP computing equipment than any other entity at the UI over the past few years. They retaliated against their best UI customer for a purchase HP hadn't even elected to bid for. It's probably not a story they're very proud of, and I will say up front that I didn't learn these details from Ken. The identity of my particular 'Deep Throat' in this matter is and will always remain for the two of us alone to know.

So it was that my ten year partnership with HP finally came to an end. I found out about the decision just before classes began for the fall semester of the 2004-05 school year. I was, naturally, disappointed by the news and even more disappointed by HP's childish conduct that led to it. However, I had been anticipating the probability of bad news this time around from all the things I had been observing at HP for quite awhile and I had prepared my contingency plans just in case. I met with the members of my electrophotography lab on Tuesday morning, August 24th, and announced the bad news. I also assured my graduate students that I had the funding to see them through the time each of them had remaining for completing their graduate studies. Our activities now and for the next twelve months turned to finishing up the projects and getting their results written up in their theses or dissertations.

Kwan graduated in December of 2004 with his Ph.D. As circumstances had it, that was the commencement when Bruce Barnes – who had started out on the NASA Grand Challenge and finished up on the neuro-fuzzy project – also graduated. The UI has a rather nice tradition at commencement when a student graduates with a Ph.D. There is a hooding ceremony in which the student's major professor ceremonially adds the Ph.D. hood to the student's academic regalia, thus symbolizing the student's inauguration as a Doctor of Philosophy. At that December commencement I had two 'hoodings' to perform, which is a somewhat uncommon event that made it necessary for me to walk off one side of the stage with Bruce and then hustle back around to the other side to join up with Kwan so I could hood him. Fortunately, "B" and "V" have a good bit of spacing between them in the alphabet. Kwan returned home to Thailand and today he is a professor at his university back there. Bruce landed the teaching job he wanted at Eastern Washington University.

Balaji defended his thesis – which turned out to be based on additional follow-up research from that neural network term project of his I had so impressed with – in July of 2005 and graduated at the end of that summer session. I tried to talk him into staying on for his Ph.D., but he was tired of school and anxious to get out into the world to start making money. I hated to see him go. He was my 'go to' guy. Phik Wei defended her thesis in August of 2005 and went to work for Micron after graduation. Franco defended his thesis in December 2005, having successfully solved the problem of 'translation' from Kwan's neural network outcomes to the logic circuit implementation of modulation templates. He took a job with the Naval Weapons Lab at China Lake after graduation. I hear he works on neural networks for them but, of course, he can't tell me anything about what he is doing. It's classified. I was able to place the undergraduates on other projects, so in the end I was able to shield my kids from the effect of losing the electrophotography contract. □

Each time I visit Boise I always arrange to see Vern, my brother in all but blood, while I'm down there. In the summer of '04, the upcoming elections were much on our minds, and I think Vern was a little surprised to learn how vigorously I, like he, was supporting Senator Kerry for president. Over the years it had almost become a standing joke between us that we supported opposite candidates. I don't think the two of us had ever voted for the same guy prior to Bill Clinton. On my part, I couldn't see how

America could possibly vote to return Bush to the White House for a second term. By then we knew to a certainty that Iraq had never had weapons of mass destruction, that Al Qaeda had never been in Iraq prior to our invasion. By now the disgraceful scandal of the torture of prisoners in Abu Ghraib had broken. By now we knew that Bush had been briefed as early as August 6th, 2001, that bin Laden planned to attack America using hijacked airliners and that Bush had ignored the threat completely. Nearly three years after the attack on America, bin Laden was still free, Afghanistan was out of the news completely, and Al Qaeda was rebuilding while Bush did nothing about it. By now Iraq had descended into chaos as a direct consequence of Bush's bungling of the post-war situation there and America had taken one thousand casualties in Bush's private war. I couldn't conceive of his getting a second term.

But I also couldn't conceive of the effectiveness of the Republican smear machine nor the incredible, pussy-footed bungling of the leaders of the Democratic Party and the inept campaign they would run. By the time election day finally arrived, it was clear to me that the Party needed fresh new leadership. The ad men and hacks running the Party in 2004 failed us all. As everyone knows, Bush took fifty-one percent of the popular vote this time and two hundred seventy-four electoral votes against Kerry's two hundred fifty-two.

Congress, too, remained firmly in Republican hands, and so long as that was so I knew nothing at all would be done to rein in the bungling little Napoleon and his henchmen who were leading us to defeat and disgrace. The Democrats seemed hapless and impotent, and we had no leaders, only rulers.

Our country remained under the heel of the Party of Nixon. I hadn't been this pessimistic about the honor and future of my country since the days of Watergate. □

In the late summer of 2004 I had filed an invention disclosure for the biomimic artificial neuron circuit with the Idaho Research Foundation, the state-owned 'private' company that handles the UI's intellectual properties, and after the patent was submitted the IRF decided to publicize the event. The UI's public relations folks issued a press release that they must have sent to practically everyone on earth. We even got a call from a guy in Iran about it. If you didn't get your copy of it, sorry.

That press release generated a lot of phone calls from various reporters and because it said in my employment contract that I had to talk to them, I did. Reporters aren't my favorite people to talk to, but a professor has to do what a professor has to do. *The Idaho Statesman* ran a front page story on it under the headline "Neural network mimics human thought process." The first thing I'd like to say about this is: *I* didn't write that headline and in actual fact it isn't true. What this technology does is merely enable and support building neural networks that I hope to someday truthfully be able to say do this. The actual story they printed was reasonably accurate, but the headline was pure hype. I found it embarrassing. I greatly disapprove of 'newspaper science'; a great deal of it is misleading and very exaggerated. I hope this doesn't shock you too much, but you can't always believe what you read in the paper, especially when it has to do with new discoveries. If we really did what the newspapers often say we did, a lot more of us would have been to Sweden by now to pick up our Nobel Prizes.

A copy of the press release also somehow made its way to the Paul Harvey people. I'm guessing you've probably heard the Paul Harvey radio show; it's been on the air now forever. As luck would have it, the press release and the release of the movie *I, Robot* happened at more or less the same time. The movie is a science fiction movie very loosely based on an Isaac Asimov story, and it is about robots trying to take over the world. Paul Harvey's son, who has taken over the show for his dad, was reviewing the movie and at the end he said something like, "Think this can't happen?" Then he read off the UI's press release, my name included, with the same exaggerated hype as *The Statesman's* headline. His punch line was, "This is a *good* thing?"

I didn't happen to hear the broadcast, but about a hundred people told me about it the next day. I don't think of myself as a mad scientist, and all I could do was shake my head about it. It isn't every day a guy gets denounced on the Paul Harvey Show as a menace to humankind. □

Feng Xie working on our computer model of the micromagnetics of barium ferrite material.

With the end of the electrophotography program and with the neurofuzzy project drawing to a close at the end of January of 2005, it started to look like I was going to have more time available. In February of 2004 the leadership of the microwave ferrite project begun under Yang-Ki had moved to one of my colleagues in the electrical and computer engineering department, Dr. Jeff Young. Jeff's area is microwave engineering with his particular specialty being antenna design. The first two years of this project had been devoted to fairly basic barium ferrite materials research; the focus was now shifting to applications of this material for microwave communication systems. Jeff and his team, which included myself, Yang-Ki, and two professors from the physics department, had been awarded a one-and-a-quarter million dollar contract from the Office of Naval Research to move the research into the engineering phase, and the program had been re-named the Advanced Microwave Ferrite Research or AMFeR program.

I was still very much a bit player in this program; my piece of the funding was just over ten percent of the total. The main technological challenge facing us was still centered on the barium ferrite (BaFe) itself and here the challenge was to produce thick BaFe films that still possessed the desirable properties needed to meet the engineering goals of the research. You see, the properties of magnetic material are very dependent on how big the chunk of material is. It's called 'size dependency' and magnetic materials display it much more than any other type of material I know anything about. Chemicals like iron, nickel, and cobalt are what is known as 'ferromagnetic material.' BaFe is similar (it contains iron), but at the atomic level it's just different enough to get its own name ('ferrite') to distinguish it from things like iron. When BaFe is made in very thin films it possesses a property known as 'self biasing' which is one of the most important properties necessary for building the microwave devices we were after. Unfortunately, when BaFe is grown in thick films, it loses this self biasing property and the fundamental questions the team faced were 'why?' and 'how do we get this property back?' The reason this was important was because in order to use BaFe for a practical engineering application in communication systems the film *had* to be thick. A thin film just couldn't do the job.

If you talk to a typical physicist or materials scientist, quite likely he will tell you we know everything about the physics of magnetic materials. The reason you'll be told this is "because everything in the world is fundamentally explained by quantum mechanics and since we understand quantum mechanics (physics at the level of the atom), naturally we understand everything there is to know about magnetism and magnetic materials."

The problem is this just isn't true. It might be true if real materials came in the form of ideal, perfect solids known as 'single crystal material.' But in fact most real engineering materials come in a form known as 'polycrystalline.' The word means 'many crystals.' Just as soon as we're dealing with poly-crystals, the physics equations become so complicated that it's hard to even write them down in any meaningful expression and impossible to solve them starting with the basic laws as they would apply to a polycrystalline solid. The area of physics we're talking about here is called the theory of quantum magnetics. It's a very pretty theory and it's quite useless. It isn't even fundamental. The reason for this is that ferromagnetism (and also the magnetism of ferrites) is basically an effect that arises as a consequence of Einstein's relativity theory. This means that to really understand it requires an advanced level of quantum theory known as 'quantum electrodynamics' or QED theory. Richard Feynman, the famous Nobel Prize winner in physics, won his Nobel Prize for helping to develop QED theory. But applying QED to magnetic materials is an awesome task and nobody, not even Feynman, has ever done it. I've

tried to do this myself a couple of times over the years and I got absolutely nowhere with it.

To my way of thinking, if you can't solve the equations that make up your theory then you can't claim you understand the phenomenon your theory is supposed to describe. (Well, you can *claim* anything but just saying it doesn't make it true). Saying "we understand all about the physics of magnetic materials" is a bit like saying "God counts the tears of women." It's more a matter of faith than science. What we really do is guess at a set of mathematical equations, using some general principles from quantum mechanics to guide our guesses, that we hope will provide an adequate large-scale model of the magnetic behaviors we're interested in and which *can* be solved numerically using a computer. We stick various fudge factors into these equations and hope we can adjust these fudge factors to make the model match the reality. Of course, when we write scientific papers we give these fudge factors more intelligent sounding names than 'fudge factor' but in the end that's what they really are. It's called a 'semi-classical' model and the science – such as it is – in doing this for magnetic materials is called 'micromagnetics.'

I was the micromagnetics guy on the AMFeR team and in doing this work I was assisted by a sharp young Chinese graduate student named Feng Xie. Feng had been on the project from its inception and had already earned his Master's degree by the end of July in 2004. He continued to work on his Ph.D. and the two of us constituted the 'materials theory' team within AMFeR. There are two ways a person can carry out micromagnetic modeling. The first is to just play around with the fudge factors until you force the model to match the data. This is just glorified curve fitting and it is useless. The second way is to very carefully look at what your model does and does not do and try to guess at the form of the physics this implies when the model does not match the laboratory data. If you do this right and you put your physics hypothesis into the model, then the model becomes capable of making further predictions of things that haven't been looked for in the lab yet. If you then look for them in the lab and find that things happen the way the model said they would, you've really got something. Feng and I were taking this latter approach.

I had successfully used micromagnetics during my doctoral research back in the early 1980s, but the AMFeR problem was a much harder problem. This was because we were trying to do thick films, which required a three-dimensional micromagnetic model. This kind of model requires the solution of a far greater number of simultaneous equations and it takes a very long time to run simulations. Nonetheless, by late 2004 we were discovering some new and very interesting things about barium ferrite. What we were seeing in comparing micromagnetic models against laboratory data had led me to make a rather daring new hypothesis about the nature of polycrystalline BaFe material. We called this the 'hypothesis of multiple magnetic phases' and it flew in the face of conventional micromagnetic theory. Believe you me, we didn't make this hypothesis lightly. Feng and I had tried everything we could think of to get a conventional model to match up against the data coming mainly out of Yang-Ki's lab but the stubborn fact remained that a conventional micromagnetic model gave wrong answers, which meant something very important was missing from the theory. The 'magnetic phases' hypothesis succeeded where all else failed, and I am as convinced as any conservative scientist ever has the right to be that our new hypothesis is correct. Unfortunately, our new theory defied conventional thinking in the micromagnetics community and our papers were turned down for publication one after another. There is a certain degree of censorship the modern day peer review process imposes and the anonymous referees just wouldn't believe what we were reporting. Rather than tilting toward the side of letting us tell other people about what we'd found, so they could test our theory in their own laboratories to either verify or refute it, the referees and editors chose to silence the heretics. It is always a huge mistake in science to become complacent and to begin to think that custom or traditional thinking in any way validate an old theory or render new ideas unsound just because they are new. This especially is so in a field like micromagnetics, although micromagnetics is by no means the only case. Dealing with these self-appointed Bishops of Paris got to be pretty frustrating after awhile.

We had just received our latest bit of frustrating news from the IEEE in mid-October of 2004 when other news out of Iowa made all that unimportant. Uncle Wayne, my second dad, had passed away just a month before his 93rd birthday. Suddenly the IEEE didn't matter to me anymore. □

The MRC Institute's Autonomous Underwater Vehicle. The AUV is a tiny 'intelligent' submarine that operates in coordinated 'schools' to sweep for mines.

Word about the end of my electrophotography research program got around and in mid November my pal Mike Anderson from the mechanical engineering department dropped by my office for a visit. Mike was one of the co-principal investigators then working on another project, funded by a seven hundred thousand dollar contract with the Office of Naval Research, called the 'autonomous underwater vehicle' or AUV project. This project was being run out of the Center for Intelligent Systems Research (CISR), which is a division of our MRC Institute (the Institute of which I am the associate director). Joe Feeley, who was now retired, had been one of the members of the AUV team and his part of it was to look into more advanced underwater communication methods by which AUVs could 'talk' to each other. Mike had come to ask me if I'd be willing to step in and take Joe's place on this project.

The AUV project was a very cool project, and because these little submarines were supposed to be 'intelligent' systems – in the loose sense in which that word is used in the engineering world – it was one I would have dearly loved to have been involved with it right from the beginning. Unfortunately, at that time I had my hands full with the electrophotography, neurofuzzy, and barium ferrite programs and just couldn't take on any more projects. Now, however, I had an 'opening' due to the end of the HP contract and could take part. It was too late for me to participate in the 'intelligence' aspect of the AUV, but I thought I could still help out with the communication system aspect of it, so I agreed to join the team.

To appreciate how cool an AUV is it is necessary to describe it and what it does. Each AUV is a bit under four feet in length and around four inches in diameter. It is unmanned, obviously, and self-guided, operating independently of direct human control (that's the 'autonomous' part of its name). It is designed to work in 'schools' of typically five AUVs. It has its own custom-designed 'language' for communicating with the other AUVs in its school. The AUV language was developed by my pal Michael O'Rourke and graduate student Kaylani Merrill, who was working concurrently on her Master of Arts in philosophy along with her Master of Science degree in neuroscience. AUVs work as a team with one of them acting as team leader and the others taking up their positions in the school formation according to the leader's orders. If something happens to the leader, another member of the school automatically takes over as the new leader.

The AUVs are intended to sweep for mines. Being hit by a mine is one of the biggest dangers faced by Navy vessels. The AUVs can be put into the water from a ship and can be left to operate entirely on their own for days at a time, methodically sweeping a designated sea area and looking for a safe passage through any mines they find in that area before any of our ships enter it. This is an application that has some personal significance for me. Dad's ship, the destroyer U.S.S. Waller, had been hit by a magnetic mine a couple of months after the Japanese surrender. I knew this because I had found and read the story he'd written about it when I was a boy. The Waller had been in a harbor in China at the time when this happened. Now, almost sixty years later, his son was involved in a project aimed at helping to prevent this from happening to other ships. I had a feeling Dad would have liked that very much.

When I joined the AUV project they were already using an underwater acoustic modem designed by folks at the Oceanographic Institute. It is a fairly simple communication system and uses a method similar to sonar to send signals from one AUV to another. This system was sufficient for accomplishing the main research aims of the project at that stage, but there were several things about this system I saw as severely limiting future capabilities for AUV applications. The data rate – the speed with which one AUV can 'talk' to another – was very slow and the sonar-like signals they used could be picked up at distances a

very long way from where the school was operating. It isn't too hard to think up other applications our Navy or our intelligence agencies might come up with for AUV technology – I can think of half a dozen of them without even trying very hard – and in my judgment a faster, quieter communication method would have some important advantages for these applications. As it turned out, Joe hadn't gotten very far in looking into more advanced communication system methods for the AUV and I would be working with a pretty clean slate.

The low data rate was Mike's main concern and was the reason he had asked me to join the project. AUVs have to be able to operate in shallow waters, and this turns out to be an environment where there is a severe amount of reverberation of sound waves. Sound waves echo from the sea bottom as well as from the surface of the water, with the result that this operating environment acts like kind of a big echo chamber. If you've ever tried to hold a conversation with someone in a place that has lots of echoes, you already know what this implies. You have to speak slowly, one speaker at a time, and typically you need to be standing pretty close to the other person to make yourself understood and to understand him. More or less the same thing was true for the AUVs. Mike and his graduate student, Isaac Kodavaty, were working on the mathematical model for the underwater acoustic communication channel; the system I would be working on had to work reliably in this environment.

Because my piece of the project concerned something that would be important a few years down the road – the main efforts of the project were, naturally, going into just getting an AUV invented in the first place – my piece of the budget was very small, just enough to hire one Research Assistant to help with the work. With several big funded projects going on concurrently in the Institute, really good graduate students who weren't already working for someone else were hard to find, but I did come up with one promising young guy, an international student named Jianqiang Zeng. He had come to the UI on a full scholarship from his home government in China, which was the main reason he was still available. His scholarship money was running out and he needed a job to continue his studies. I was a little wary at first of using someone from the PRC on this particular project, but I spoke to Dean Edwards, the principal investigator and boss of the AUV project as well as the director of CISR, and it turned out there were no security issues that would prevent us from using Mr. Zeng on this project. (None of us had been able to get our tongues wrapped around his first name sufficiently well to pronounce it correctly, so we all just called him 'Mr. Zeng').

It also worked out by chance that I had a 'walk on' RA I could use on this project. Her name was Leili Baghaei Rad and she was an international student from New Zealand attending the UI on a full ride scholarship from an organization back in her home country. Her husband would be starting to attend Stanford University so it was a bit strange that he would be down in California while she was going to school up in Idaho, but I figured if that arrangement worked for them, who was I to question it? Leili came to graduate school with a specific interest already in mind. She wanted to study and work on a specific type of communication method known as a 'MIMO' communication system, which is a method used in satellite and mobile radio communications to combat what is known as 'multipath fade.' It's a problem in communication systems you've probably experienced while driving your car and listening to the radio. If you've ever been driving around in town and noticed your radio reception fading in and out as you passed through particular areas of town, you've experienced multipath fade. A lot of work on MIMO has been done for wireless radio systems, but in 2005 the method hadn't been tried for underwater acoustic communication systems. Leili's research work made a nice complement to the method I hired Mr. Zeng to work on and she didn't need a paid assistantship. With Franco and Phik Wei still finishing up, office accommodations in my lab were a bit cozy, but we found a way to make it work.

One thing that was a bit unusual on this project was what I had to do to get my new RAs trained up in the technical area in which they were working. Normally this is accomplished largely through our normal graduate level classes the department offered. However, in 2005 we were still very much suffering from the problems brought on by the university's budget crisis. Only a few years before our department had a whole group of professors whose areas of expertise were in system theory. It had been one of our strength

areas and I usually taught our advanced courses in communication theory. By 2005 our systems group had been decimated by retirements, as had our electronics group, and to fill the gaps this had created I had been obliged to cover other more central courses, leaving the advanced courses in communication signal processing untaught. What this meant was that I had to spend considerably more time than usual tutoring Mr. Zeng and Leili on the technical theory they needed to work on the AUV project. Just a year earlier this would have been an impossibility given all my other project work, but the neurofuzzy program came to a successful end in January of 2005, and this freed up more time for me to do this. □

With the start of the 2004-05 school year Tim White came to Moscow to take over as President of the University. Gary Michael, who had served without pay as interim President for a year after Bob Hoover's resignation, hadn't been greatly loved by the faculty, although I doubt if anyone would have been. He'd been brought in at a tough time and he'd probably handled our immediate budget crisis about as well as anyone could have. I'd known and liked Bob Hoover – I still like him despite the Idaho Place fiasco – but I hadn't gotten to know Dr. Michael at all. The day to day sort of administrative things that affected me had been dealt with by the Provost, Dr. Brian Pitcher. Faculty morale going into the '04-05 school year was about as low as I've seen it and things in the College of Engineering were in a pretty unsettled state after our Dean, Dave Thompson, had been abruptly removed as Dean by Dr. Pitcher. Why this had happened had been the subject of any number of rumors and counter-rumors, but the most widely believed of these rumors was that Dean Thompson hadn't been successful enough at getting local industry support for the university in the form of large financial gifts and research contracts. I'm not so sure that rumor was true; economic times were fairly tough right then for both HP and Micron, Idaho's two largest high tech companies, and in those circumstances Sister Teresa couldn't have gotten them to pony up large amounts of money for the university. Whatever the reason, Dave's dismissal had shocked me. I liked Dave and had gotten along with him very well. Provost Pitcher didn't seem to be in any big hurry to find a new dean of engineering either, so we were fairly uncertain about what was going on.

It was in the teeth of this uncertainty and low morale that Dr. White took the reins. Tim is a big man, soft spoken, and always impeccably dressed – in contrast to Bob Hoover, who always looked just a little bit rumpled. Most importantly, Tim is a real leader. His first move upon becoming president was to launch what became known as the Plan for Renewal. And he hadn't come to town with this plan in his pocket either. Instead, he succeeded in rallying the university's faculty and staff to participate in coming up with this plan, and to do so within the framework of fiscal reality. Lao Tsu had written *when the best leader's job is done the people say 'we did it ourselves.'* That's the kind of leadership Tim brought to Moscow. With Tim, a kind of Fort Apache siege mentality that had beset the UI ended and a real turn-around began. We were finally on our way back from Idaho Place.

Then in February of 2005 another event took place a thousand miles away, down in Palo Alto, that didn't have any direct effect on us but which I greeted with a smile and a sense of satisfaction nonetheless when the news arrived. Carly Fiorina had been fired as Chairman and CEO of HP. *Better late than never,* I thought when I heard the news. In my imagination I thought I heard cheering coming up faintly on the wind from Boise. As soon as I heard about it, I dashed off an Email to Vern. His reply came back almost right away. As I had guessed, there was dancing in the aisles going on at HP in Boise. It was and is my opinion that Ms. Fiorina was the greatest disaster ever to befall my old company, and while I don't think anyone will ever succeed in bringing back the old HP – which was a very, very special company – or in restoring life to the HP Way, at least now maybe they could get on with their own Plan for Renewal. Time will tell. I was happy for my many friends who still worked at HP.

Still, not everything would go so well in my world that year. Demetrios Kazakos had come aboard as department chair at the start of the 2004-05 academic year. It was no surprise to anyone that he joined us eager to expand and grow the department's research activities; during the interview process he had told us this would be his main goal and that was something we expected from a chair who was an IEEE Fellow by stint of his own research contributions to his field (which did happen to be in the systems area). Personally, I liked Demetrios and the two of us got along quite well. Unfortunately, the same wasn't true

between Demetrios and a lot of other people. Demetrios was born in Greece and, like a lot of other Greeks I've known over the years, he had kind of a fiery and sometimes bellicose personality (something else not rare among IEEE Fellows). This probably isn't unusual on the east coast, as witness my experience with John from EMC Corporation my final year with HP, but it's not something that goes over too well in the Inland Northwest. Here the culture puts a very high premium on politeness and even the language is nuanced so that disagreements are discussed in such a gentle sounding way a New Yorker or Bostonian probably wouldn't realize two people were having a heated disagreement. A society not really all that many decades past an era when a serious argument was likely to result in a gunfight tends to become pretty studiously friendly and polite.

In terms of folkways, Idahoans often tend to regard Californians as insufferably rude, New Yorkers as barbarians, and even Iowans as lacking in the social graces. When you move here you either adjust or you make enemies. I'd gotten my first hint of this early in 1979 when I'd first moved to Boise and noticed a lot of cars bearing bumper stickers that read, 'Don't Californicate Idaho.' It sort of provided an extra incentive to get the California license plates off my car as quickly as possible. One of the reasons I and others became so furious during the Engineering in Boise smear campaign had been that most of the language being hurled at us was the kind of language used deliberately out here to make enemies. And it did. Our Idaho culture was something Demetrios wasn't prepared for and had trouble understanding.

On top of this, there was still the problem of the underlying split in our faculty over the chair issue. This issue hadn't healed. On one end there were those who had wanted one of our own to take over for Joe Feeley and who thought we needed to sacrifice other areas to preserve the undergraduate program. At the other end were those, including me, who thought it was best to bring in a new person and who thought both the graduate and undergraduate programs were equally important. Then there was a third group in the middle who agreed with some but not all of the positions taken by the other two factions. They were the 'swing' group that had come down on the side of bringing in Demetrios.

I think Demetrios never had much chance of winning the one group over – not, at least, without using a nearly superhuman amount of personal charm, which I don't think he possessed – but he had every chance of alienating folks in the middle group. And that turned out to be exactly what he did. By April of '05 he had committed several interpersonal gaffs that even I found incredible and disturbing. There were still some of us who wanted to give him a chance to mend his ways, but we were now definitely in the minority. Some of the faculty members were so offended that they wanted to get rid of him – as chair at least – right then. And there were a couple who took their complaints directly to the Provost. That was something that offended me greatly because I felt it amounted to dirty politics and an outright violation of the social contract within our department. To me, it was a case of Rusty all over again.

My personal anger over that was also colored by the fact that the guys who did this end-around to the Provost were fundamentalists (they call themselves evangelicals). I get along well enough with evangelicals as long as they behave themselves, act like the Christians they're supposed to be, and at least outwardly don't disrespect *my* religious faith to my face. As long as they are tolerant of my faith, I'm tolerant of theirs. But I don't particularly trust them. I've met too many over the years who seem to feel it's perfectly okay to screw the infidels – meaning me – and so I watch my back around them. When my nephew Aaron was still in college, one of the students in a class he was taking was a slightly older woman who didn't hide her extremist fundamentalist views. In one class session she had gotten on a self-righteous and absurd rant that 'Christians' are very badly 'persecuted' by 'non-Christians.' Aaron was in her mind one such 'persecutor' and she accused him of being 'hateful' towards Christians. When he pointed out that this was absurd because he was a Catholic, her response had been "Catholics aren't Christians." It isn't without reason that I don't trust fundamentalists whether they profess to be Christian, Jewish, or Islamic. In the Demetrios affair, I felt very strongly that 'screw the infidel' was playing a big part in the shameful and dishonorable tactic of trying to use the Provost to ram through a power play rather than respecting the rest of us enough to work things out in a democratic fashion. I felt *I* was being disrespected by this and it got my back up. A lot. The controversy was taking on a very personal flavor

and turning ugly. I was ready for as nasty a fight as any one cared to make it, and I was equally resolved to resign and leave the department after it was over if honor, mutual respect, and civility didn't return before then. Quite frankly, only my duty to my students was letting me control my anger over the Demetrios affair. I don't like fighting, but I won't back down from one and I won't surrender. Anybody who thinks I'd do otherwise doesn't know me at all.

In the end the faculty came to a sort of compromise, largely due to the efforts of the members of the middle faction, and Demetrios ended up being in kind of an 'on probation' status as chair. There was a reasonable corrective action process worked out, the purpose of which was to correct those mannerisms and actions of his that had led to this crisis in the first place, and a timeline was set to review the progress he made in cleaning up his act. I suspected nothing he did would ever win over some of my fellow faculty members, but if he could win back the respect of the middle folks and not do anything to entirely lose the respect of 'his' faction, I thought things would work out okay for him and for us. Time would tell. In the meantime, a fair and honorable compromise had been reached and was in place. A fragile truce it was, but it was an honorable truce nonetheless. □

Al, my graduate student working on encryption research, and his wife are both veterans of the U.S. Army and devout Mormons. During Christmas break of 2004-05, while Al and his wife were in Chicago at a Boy Scouts conference, Al's daughter stepped out of the shower in their home with nothing but a towel wrapped around her to find three strange men hunched over her computer. The men bolted out the front door of the house and sped away in a black SUV. Because the burglars got away, we don't know for sure who these particular guys were, but Al did find out who they were with. They were FBI agents. What they had been doing was attempting to plant a key logger – a form of spy software that logs all the key strokes you make on your computer so that everything you do is recorded – on the computers in Al's house.

As it happened, this whole story had begun in 2003 when Al was working in our Center for Secure and Dependable Systems. In that year he was lead author of a conference paper entitled "Railway Security Issues: A Survey of Developing Railway Technology." As per normal procedure, Al had first contacted the Federal Railway Administration before submitting his paper for publication to make sure the FRA didn't have a problem with anything that would be in this paper. The people at the FRA told him they didn't care about this paper and gave him the go-ahead to present it at the conference. Apparently they felt that no terrorist was going to mess with the railroad.

The paper itself isn't exactly stop-the-presses news. The railway system in the U.S. is controlled by a distributed network of computers that keep track of where trains are, control the traffic signals used for such things as preventing two trains from coming straight at each other on the same track at the same time, and do other necessary control and communication functions. Not too surprisingly, this system has begun to use the Internet to facilitate communications in the computer network. Also not too surprisingly, this means that the railway system is vulnerable to the same kinds of computer attacks that your own computer is vulnerable to if you have it hooked to the Internet. That is in essence what Al's paper said and he had suggested several standard precautions that should be adopted to protect the system. This is known as 'helping to combat cyber terrorism' and that's what we do in CSDS.

The paper was presented in August of '03 and appeared in print in the conference proceedings in early 2004. One month after that, someone slipped a virus into the CSX traffic computer that controls railway traffic signals in thirty-three states. The virus brought the traffic control system to a screeching halt and shut down rail traffic east of the Mississippi River for about a week. A guy in Montana who worked off and on as a security consultant for the FRA had read Al's paper and called the FRA to tell them about it (again). This time the FRA called the FBI. We found out about this story because the Montana guy's son works with Al in the Boy Scouts and he told Al about it afterwards.

Al returned home from Chicago two days after the burglary, and at eight o'clock the next morning the FBI called him. The agent wanted to know why Al hadn't submitted his paper through the FRA. Al told

him he had. My guess is that a sort of selective amnesia is afflicting the folks at the FRA. After all, who wants to own up to ignoring a warning that something like what had happened to the CSX computer could happen? In any case, the agent asked Al for a copy of his paper and Al gave him one.

We had a pair of undergraduate students who worked for Al on the encryption project. These students have continued to do some routine work for us after graduation from their homes up in Coeur d'Alene, Idaho. In the summer of 2006, they found key logger spyware planted in their computers, too. Al tells me he thinks there might have been three or four more break-ins at his house since the original one, but he can't verify this for sure. The most recent suspected one was in May of 2007.

I don't think it takes any great amount of genius to figure out what's going on. Having no suspects for the cyber attack on the railway system back in 2004, Bush's black bag men are investigating the guy who warned that this could happen. After the way Sami was railroaded previously, I have no reason to doubt they're trying to do the same thing again, this time to one of my students and, likely, the kids who worked for us. For all I know, they might be secretly investigating me as well. I haven't seen any evidence of this at my house or in my office so far, but I'm keeping an eye out for it.

What I do know is neither the FBI nor any other federal agency has ever called or come to talk with me to find out what our research is about. Let them come see us. Let them bring as many experts with them as they wish. We'll show them every single thing we're doing, every result we've found so far, every piece of research software we've written. My students and I have absolutely nothing to hide from them nor anything we wish to hide from them. We'll even tell them about what we *haven't* and don't intend to publish because of the potential for danger we feel it might pose to America. What I do know is that when the government responds to warnings with black op burglaries in the homes of the experts who warn them, it doesn't exactly make a person eager to warn the government of dangers.

I do know I hate the Bush administration's violation of the constitutional process – which is what the so-called 'Patriot Act' permits Bush and his Gestapo to do – and I do deeply resent the Bush administration choosing to wage a covert war against the very people in academia they should have called upon to help in the war against Al Qaeda from the very beginning. I do know I resent the Republican Congress sanctioning the establishment of a secret police in America and Bush's use of it to commit burglary against American citizens. Next to all this, Nixon was a rank amateur. Do you think the Patriot Act is a good thing? You wouldn't if you had my job. The FBI isn't trying to solve a crime here; they aren't trying to prevent a future act of cyber terrorism; they're trying to find an easy scapegoat to hide the FRA's bungling. It's just that simple and that's what's going on in America right now. And now you know why I'm not telling you Al's full name nor the names of my undergraduates at all. None of us are too keen about the idea of taking a little covert vacation, all expenses paid by Uncle Sam with free water boarding included, down in sunny Guantánamo Bay or scenic Syria. □

2005 Neuroscience REU students holding a birthday party for Participant Ricky Blatter.

Our 2005 session of the neuroscience REU got under way on June 6th. By this time the neurofuzzy project was over so we had a smaller but still terrific group of youngsters conducting research that summer. Topics ranged from three different neural network projects, a psychological study of the effect of heavy snowfall on a driver's ability to navigate his car, a few anatomical studies, and the synthesis of some new organic compounds that might some day prove useful in treating certain neurological diseases.

Like the year before, the youngsters in the 2005 session were all splendid young researchers and a number of findings came out of their work, several of

which were subsequently included in some major journal publications by their mentoring professors. To highlight just one of their many achievements in 2005, students in the program successfully synthesized six brand new molecules that no one had ever done before. These molecules may some day allow brain researchers to specifically target, identify, and distinguish among an important class of protein receptors in the brain, known as NMDA receptors, that play a central role in learning and memory.

Later, in November of 2005, ten of our REU participants attended the annual Sigma Xi National Student Research Competition, which that year was held in Seattle. This is the most prestigious research conference for undergraduates in America. A couple hundred student research posters are presented at it each year. Our kids presented six different research posters at the 2005 conference and brought home six gold ribbons for outstanding research work. One of our students also had her work accepted for presentation at the annual conference of the American Chemical Society that year.

I was very, very proud of my kids. Again. □

Immediately following the end of the 2005 REU session I was off to Montreal to attend the 2005 International Joint Conference on Neural Networks. We were presenting two papers at this conference. One was by Stan Gotshall, Terry's Ph.D. student, on his work using evolutionary computing to design biologically realistic artificial neural networks that implement spinal cord functions. The other was a paper I was presenting on behalf of my team which introduced our forgetful logic circuits.

They speak French in Montreal, which is a language I do not know more than a couple of phrases in. I arrived after dark at the Montreal airport and it took me awhile to figure out where the bus to the hotel was. The bus driver was an interesting character who bore an eerie resemblance, both in appearance and mannerisms, to Charles de Gaulle. It turned out he did speak English, with a pretty thick accent, but at first he wasn't letting out any hint of that.

I'd never been to Montreal before. The bus stopped a few blocks from the hotel and I didn't relish the idea of bumbling around a strange city in the dark where I couldn't speak the language. I figured I could use all the guidance and help I could get. The trick was getting it in simple enough terms that I'd be able to follow the directions and find the hotel. One thing I've found works pretty well for this in foreign countries is to be dumb. I've got a pretty good dumb act and I decided to use it on the stern looking gentleman piloting the bus. By the time we finally reached downtown Montreal, I had him convinced I was the dumbest old geezer ever to visit his fair city. He ended up practically leading me by the hand to a place from where I could see the hotel. Good thing, as it turned out. The hotel was only the top couple of floors of a high-rise building; in the dark I'd never have been able to recognize that building as a hotel.

At the conference the next day I had the great pleasure of seeing my old teacher, Bernie Widrow, again. He didn't remember me, of course. It had been more than twenty-five years since I'd been his student and nearly two decades since the last time we'd spoken. I didn't look like the brash young man of my Stanford days any more either. Bernie had changed a bit, too. He was quite a bit older now, of course, had shed his trademark beard and put on a few pounds. But he was otherwise pretty much the same old Bernie I'd looked up to and admired when I was a student. Like most of the guys at the very top of the neural networks world, he had a kind of entourage that tagged along with him everywhere he went, and that was different from when I'd known him at Stanford.

I attended Stan's paper presentation and got quite a kick out of it. Stan is another of those folks who tends to be a bit on the nervous side, and it turned out that the audience listening to his talk included some of the biggest names in the field. Fortunately for Stan, he didn't know who these guys were or I doubt if he'd have been able to talk at all. At the end of his talk he got grilled a little bit by a short, skinny, sad-looking old guy. Stan did okay in his answers, although I could tell he was more than a little abashed by the harshness of his inquisitor's tone. I didn't tell him until afterward who that guy was. His name was Stephen Grossberg, and he's one of the very top big shots in the neural network field. If Stan had known who he was, he'd have melted into a little puddle right on the spot.

Montreal is a beautiful city, and on the third day of the conference there was a break in the action so far as papers I was interested in were concerned. Stan's sister had come with him to Montreal, and the three of us went on a walking tour of the old city. We visited a number of museums and exhibitions and generally had a pretty good time. My legs were sore by the time we got back to the hotel, but it was worth it.

My friend Don Wunsch, who had led our Program Advisory Board during the neurofuzzy project, was at the conference. Don was the current president of the neural network society, and at the awards banquet he was honored by being inducted as a Fellow of the IEEE. Paul Werbos, the neural networks guy at the National Science Foundation, was also made an IEEE Fellow at that banquet, which was an honor I thought long overdue. Don was delighted to see me there, and Paul remembered me also. I couldn't help joshing them a little bit about the honor that had just had bestowed upon them, so I greeted each of them with, "Hail, Fellow. Well met." They both grinned. It was a big night for both of them.

All in all, it was a pretty good conference and I was in a good mood on Friday when I flew back to Spokane from Montreal. Until, that is, my suitcase came up the conveyer. At first I didn't recognize it for all the gray tape wrapped around it. But it was mine all right. The tag on the handle said so. The tape had been added by the TSA people after they had broken into it. That tape was all that was holding it shut. It was an expensive suitcase, and now it was completely ruined. Inside was a note that said 'We're sorry we had to damage your luggage.' It went on to say they had the right to break into it and there was nothing I could do about it, including getting reimbursed for the damage. I was furious.

And I don't think they meant it. I don't think they were sorry at all. □

The beginning of the fall semester of the 2005-06 school year brought a few new faces into my lab and saw the departures of many old ones as a number of my graduate students completed their degree programs. One departure I didn't welcome was Mr. Zeng. Although he had support for his schooling in the form of a research assistantship, his wife hadn't been able to find one. Earlier that summer, she was offered one at the University of Texas and Mr. Zeng was likewise offered one as a kind of package deal. So it was that UT recruited him away from me. Funding for the AUV project had been renewed by ONR, to the tune of one million three hundred thousand dollars, and I had to hire a replacement for him. Luckily, there was a new face on campus. His name is Ron Crummett. Ron had received his Bachelor's degree in electrical engineering from Utah State and had started out in his Master's study in the program the SBOE had allowed Boise State to start. Ron had very quickly discovered that the BSU program was presenting him with no challenges. As he put it to me, "I wasn't learning anything new." As a consequence, he had transferred to our graduate program and moved up to Moscow. He is a bright, hard-working guy and his undergraduate training in Utah had prepared him well for graduate work. I hired him to replace Mr. Zeng on the AUV project.

Lan Nguyen with me in my office.

Another new face on campus was Lan Nguyen. Lan was an older student who had been working on his Ph.D. in much the same fashion as I had worked on mine over twenty years earlier. He had taken most of his coursework through our Engineering Outreach Program while living and working in southern California. We require all Ph.D. students to spend a minimum of one academic year in residence on campus where they work closely with their major professor – me in this case – in finishing up their doctoral research. Lan had come to campus to do just that.

Lan is an interesting guy on many levels. He works for a southern California company that does

defense related work, much of which is classified. His particular research project with me wasn't classified (doctoral research can't be because it's published in the form of a doctoral dissertation), and it had to do with the use of adaptive signal processing to remove certain types of signal distortion often found in satellite communications. It happened that no one had studied the problem of removing multiple simultaneous distortion effects all at the same time, and that's what Lan's research was about. It was an interesting problem because these distortion effects (known as Doppler shift, phase jitter, and amplitude jitter) interact in a non-linear way when you try to cancel them out, making a closed-form mathematical solution to the problem ill-posed. That, of course, is just the territory where an adaptive system shines and although the system Lan came up with isn't a neural network, it uses many of the same principles.

Lan had arrived in America as a boy with his family after the fall of Saigon. He and they were among the many boat people who fled Vietnam ahead of the communist takeover. Like most of these people, Lan's family worked hard to build a new life in America. For him earning a Ph.D. was something of a family tradition. He's a very sharp guy. He is also something of a worrier. I don't believe I've ever met another man who worries about things as much as Lan does. Whether that has anything to do with the experiences he went through as a child I can't say, but the good side of his worry-wart nature is that it makes him a careful and thorough researcher. About all I had to do was teach, coach, and occasionally dampen out the excesses when he'd get to worrying too much about things and point him back in the right direction. In this he and I have somewhat different personalities. It isn't that I don't worry about anything. I do. But I tend to focus on the positive – what can go right – while Lan tends to zero in on what can go wrong. In a way you could say I watch for the sunrise while Lan watches for the sunset. But despite this difference in our personalities, we made a pretty good team and Lan made extraordinarily rapid progress in his research work after coming to campus.

I also started doing a little coaching and technical advising that semester for one of our young assistant professors in the Chemical Engineering department, which sits just down the hall from the MRC Institute. My young colleague, Dr. Eric Aston, had a research contract to fabricate what are known as 'nanowires' – very, very tiny little wires intended for use in microscopic-scale engineering systems. He had a Master's student helping him in this, and because part of the project involved characterizing the electrical properties of his nanowires, he had asked me to sit in on his status meetings with his student and consult on such EE things as measurement techniques and other non-chemical aspects of the project. I was happy to do it for him, glad for the chance to learn a little more about 'nano technology,' and this activity only took up about an hour or so each week and so for me at least it was pretty painless.

There were a few committee assignments that came my way beginning in that semester as well. Demetrios had appointed me to chair our department's curriculum committee. That assignment automatically also made me a member of the curriculum committee for the College of Engineering, so I got two committee assignments for the price of one. In addition, I was asked to serve on the university committee that reviewed EPSCoR proposals for the branch of EPSCoR involved with research funded by the Department of Defense. This committee was chaired by Jean'ne Shreeve, who was still as feisty and hard-nosed as ever and still fun to work with. At least *I* think it's fun to work with her. Folks with timid, tender spirits sometimes don't think so. But I always like working with people I don't need a secret decoder ring to talk to. It saves a lot of time.

The AMFeR program under Jeff Young had also been renewed by ONR, this time to the tune of a little over a million dollars. My part of this program was starting to draw to a close. Feng would be graduating this academic year and there wasn't too much more micromagnetics work that needed doing for AMFeR. It was a fun project, but I was becoming eager to be done with it so I could put more time into my own electronic brains work, which was still unfunded.

The most unusual and, for me, the most fun thing that came up in the fall semester was my philosophy class. Earlier that year, during the summer, my pal Michael O'Rourke and Doug Lind, the chair of the philosophy department, had approached me to ask if I'd be willing to do a senior level special topics class

on the philosophy of Kant. Undergraduate students in philosophy get just enough exposure to Kant in their coursework to learn he is an important figure in Western philosophy. But Kant's work is also very, very deep weeds technical metaphysics and even most philosophy professors don't claim to understand it. At the UI we had guys who were well versed in Kant's moral philosophy – Doug is one of these – but no one who felt comfortable about trying to teach his metaphysics doctrine. However, there was a fair sized contingent of philosophy undergraduates who were begging the department to offer them something on Kant, rightly feeling that Kant's work was something that, as philosophy majors, they ought to know more about.

Michael knew that my work on mental physics drew heavily from Kant's technical metaphysics and he had heard me discuss particular aspects of this work from time to time. He was therefore aware that I had become something of a Kant scholar, hence the invitation to accept an appointment as an adjunct professor of philosophy and provide the course their students were begging to have offered. I thought this would be a lot of fun and certainly a big change of pace from my usual work. I cleared it with Demetrios and so as fall semester got underway I found myself teaching our junior level course in electronics on the one hand and the senior level Kant course on the other. In the latter class we went through Kant's most famous work, *Critique of Pure Reason,* from cover to cover. The students loved it, although it took them a little while to adjust to level of hard work I demanded from them. This was philosophy in its most technical and intricate form.

Finally, 2005-06 was the year I was due up for consideration for promotion to full professor. I wasn't any more well informed about whether my record qualified me for this promotion than I had been about my chances for tenure and promotion back in 1998-99. The big difference this time was that it didn't matter that much to me whether I got promoted or not. The first time my job had been on the line; this time the consequences of not making it weren't at all so severe. Either I'd make it, which would be a nice bit of ego inflation since full professor is the highest academic rank, or I wouldn't, in which case nothing would change for me. Full professor pays more than associate professor, but at this stage in my life that didn't matter much to me. I was already a millionaire. Consequently, I didn't worry about it. I just turned in the documentation demanded by the process and promptly forgot about it. I'd find out near the end of the school year how it all went.

To the small extent that I did think about it, I didn't see anything to be concerned about. My academic resume (called a 'curriculum vita' in academia) looked fairly decent. I had a nice list of publications on my record and now, with the adjunct appointment to the philosophy department, I could claim five academic appointments: associate professor of electrical & computer engineering; associate professor of neuroscience; adjunct professor of material science & engineering; adjunct professor of philosophy; and affiliate professor of physiology and biophysics at the University of Washington School of Medicine. I had consistently excellent teaching evaluations from my students, a nice list of courses I had developed over the years, a long, long list of graduate students I had mentored, and a few million dollars of external research funding I was credited with bringing in. The only other thing I needed to do was get some outside review letters from reputable people at other universities, which is something the UI takes into consideration for tenure and promotion. I turned in a couple of names to Demetrios – Don Wunsch and a professor at Purdue named Jan Allebach, who I knew from HP's university research program and who was likewise an IEEE Fellow – for him to use in soliciting my outsiders' review. He needed a couple more names for this list so I asked him to just pick some from among the many people he knew professionally and whose opinions he trusted. I figured that if this outsiders' review was to be useful and meaningful, it should involve the opinions of scholars who didn't know me personally. After all, what's the point of having only your pals involved in something like this? Demetrios picked a few more names and that was that. When the outside reviews finally came back they were favorable and near the end of the school year I got the word that I would become a full professor effective July 1, 2006. □

On Monday, August 29th, Hurricane Katrina slammed into the Gulf Coast and largely destroyed New Orleans in one of the greatest natural disasters ever to hit the United States. As the full extent of the

emergency started becoming clear, a large group of UI students set their books aside and headed for Louisiana to help with the rescue and relief efforts. President White sent a letter to all the UI's faculty members telling us about what our students were doing and informing us that the University would do all it could to support their efforts. This included excusing our student volunteers from class during the emergency and doing everything possible to support their volunteer efforts as well as helping them get their own academic studies back on track after the emergency was over and they returned to campus. I was filled with pride in our young people and with pride in my University for responding so quickly and unconditionally to help in this time of disaster. Katrina brought out in our young people what is best and finest, most virtuous and unselfish in America. In America we walk the streets with heroes every day.

If only the same could be said for Bush and his administration. Along with the rest of the country, I was appalled by the bungling incompetence with which FEMA failed to respond to the Katrina disaster. It is for emergencies precisely like this that FEMA exists at all, and we were all able to witness the stunning incapacity of our government to deal with this most basic of government functions. Katrina marked the beginning of a groundswell shift in how the American people saw our rulers in Washington. The state government of Louisiana didn't exactly distinguish itself either in this emergency. At least a part of that was due to the fact that most of the Louisiana National Guard wasn't home in Louisiana; they had been shipped off to fight Bush's private war in Iraq, which continued to go badly.

Some other things came into the full glare of the light of day before 2005 was over. Republican majority leader Tom Delay was indicted in Texas at the end of September for violation of Texas' election laws. Cheney's chief of staff, Lewis Libby, was indicted for felony perjury over the Bush administration's treasonous outing of one of our important undercover CIA operatives, whose husband had criticized the administration. Republican Representative Randy Cunningham resigned after pleading guilty to accepting more than two million dollars in bribes relating to defense contracts. Lastly, Bush himself admitted that he had ordered the National Security Agency to conduct eavesdropping on American citizens without obtaining legal warrants, and he defiantly stated he would continue to do so. This is outright defiance of the laws of this country and an arrogant trampling of the Constitution. If this doesn't fall into the category of 'high crimes and misdemeanors' I can't imagine what would. And neither the Republican Congress nor its gutless Democratic members did anything about it. We were under the heel of an incompetent dictator and criminally betrayed by Congress. There's no other way to say it. □

In Moscow after the disruptions caused by Hurricane Katrina, things settled back into a routine that I found to be outright relaxing after the hectic five years that had gone on before. Among other pleasures, I had no out of town trips I needed to make that year, which meant I wouldn't be getting frisked at airports all the time nor would I have to buy a new suitcase. I could focus on my teaching, my graduate students and projects, and on putting the finishing touches on the first draft of *The Critical Philosophy and the Phenomenon of Mind,* the soon-to-be E-book that would introduce mental physics to the wider world.

Jeff had appointed an Advisory Board for the AMFeR program to review our progress and, naturally, give advice. One of the members was an old, old friend of mine from HP, Dr. Ralph Simmons. Ralph is a physicist and by 2005 I had known him for pretty close to a quarter of a century. His specialty was the physics of quantum thermodynamics by training and that of magnetic materials by experience. In mid-September he came up to Moscow for the Advisory Board meeting and we had a fun little reunion. I really enjoyed chatting and joking with him again; it had been awhile since the last time we bumped into each other.

I had first gotten to know him back in the early 1980s when he had been the chief designer of HP's ill-fated magnetoresistive disk drive head. Ralph has a terrific if somewhat technical sense of humor I've always greatly enjoyed. One day I had dropped by his office and found him giggling over a little card the alumni association from his alma mater had sent him. On it his degree was listed as 'Ph.D. in Psychology' and that's what he was giggling about. He showed it to me and I got a pretty good laugh out of it, too. At that moment Ralph's boss had strolled over to see what was so funny. Ralph showed him the card, and as

he was looking at it with a kind of puzzlement on his face, I chimed in with, "See, Mike. That's the problem down here. You hired the wrong kind of head doctor!" Ralph laughed out loud, but Mike, his boss, didn't think it was too funny. He was one of those unfortunate people who are humor-challenged.

Ralph is also the guy from whom I first learned that interdisciplinary work involves, among other things, a good facility with language. You see, different technical specialties develop their own technical language, and different specialties often use the very same words to mean very different things. This was something I hadn't really appreciated until one day in 1983 or so when I trotted down to Ralph's work area to see him about a concern I had with the MR head design. I'd been carrying out an analysis of how the proposed head design would impact the read-write circuit design of a disk drive. The analysis method I was using is called 'Fourier analysis' and part of this analysis involves something called the 'phase transfer function.' The term refers to how signals are delayed in time as they pass through a system. In data communication and in disk drive work, there is an important property called a 'linear phase characteristic' and the proposed head design didn't have it. I figured that was going to make some problems for the electrical engineers, and so I wanted to talk to Ralph about it.

I strolled into his area and after an exchange of pleasantries I said, "Ralph, I need to talk to you about the non-linear phase characteristics of this head design."

Ralph gave me a puzzled look and then launched into a long, interesting, but not particularly pertinent discussion about the material properties of the MR head. He looked at me as if to ask, 'Does this answer your question?' It didn't.

"That's really interesting, Ralph," I said, "but getting back to these non-linear phase characteristics in the head design . . ." Ralph gave me another puzzled look and told me some more about material physics. We probably spent about ten minutes or so talking past each other until all of a sudden I realized that every time I used the EE's word "phase" Ralph was hearing "solid, liquid, and gas" – the 'phases' of physical materials. As soon as I realized what was going on I started to laugh, and when I explained it to Ralph he joined in just as heartily. The incident was an important lesson for me, and one I never forgot. It has served me well for many, many years now. Today I have a whole row in one of my bookshelves dedicated to technical dictionaries from a number of different fields including philosophy, physics, math, chemistry, biology, and psychology. The pages of these books have gotten a bit thumb-worn over the years. □

One sign that the UI was finally emerging from the budget crisis the Idaho Place affair had touched off was the university slowly started hiring people again. Ever since the Provost had removed Dave Thompson as dean of engineering, the search for a new dean had been in the deep freeze. Chuck Peterson, who had originally planned to retire at the end of the year Dave was removed, had agreed to stay on one more year as interim dean. Well, this *was* that extra year, Chuck wasn't going to stay for another, and so a new dean search was underway. One by one prospective candidates began arriving on campus for the interview process. I didn't think much of the early crop of would-be deans and apparently not too many others thought much better of them. The search went on.

I'd seen Chuck around campus here and there over the years, but I hadn't gotten to know him all that well before he became acting dean. Once in that position, though, normal business tended to bring me in contact with him more and more and I came to like him quite a bit. One of the things he liked to do, which impressed me, was read the thesis or dissertation works written by our upcoming new graduates who were completing their Master's or Doctoral programs. I was managing to do a pretty good job at keeping him busy with this all by myself since I had five graduate students who were finishing and would graduate at winter commencement in December. Additionally, three more graduate students whose committees I sat on were also finishing that semester.

One of my guys, Steve Cohen, was a medical doctor from Richboro, Pennsylvania who had become interested in electrical engineering as a result of things he regularly encountered in his medical practice.

He had no intention of giving up his practice, of course; he just wanted to know more about EE. Steve was one of the very, very few graduate students who took on a thesis Master's through Engineering Outreach. Most EO students opt for a 'professional' Master's, an option that does not require writing a thesis. Supervising thesis research work being done in Pennsylvania from all the way out in Idaho had its challenges, but Steve and I kept in close contact and his project worked out quite well. He was interested in a medical instrumentation application that involved removing excessive noise from electrogastrograms. From where he lived, he could get hold of experimental data taken from dogs to use in developing an adaptive system for removing other unrelated sounds normally picked up during this procedure. He'd gotten the idea for doing this when he took my graduate course in adaptive signal processing, and he managed to work his term project for that course into a full blown thesis project afterwards. It was a fine piece of work, which he successfully defended when he came to Moscow in early November for his final exam and thesis defense.

My philosophy class on Kant went well enough that Doug Lind asked me if I'd be willing to help teach the junior level history of philosophy course when spring semester began. This course was team taught, with different lectures being delivered by faculty members who specialized to a greater or lesser extent in the different historical figures being discussed. Doug asked me to take the lecture on Kant's metaphysics. Since this was an evening class that met only once a week, it didn't conflict with my other two courses that semester (our senior course in system theory and my graduate course in biological signal processing), so I was happy to do it. Just for fun I sat in on that course for the whole semester, both to learn more about other famous philosophers and to get to know the folks in the philosophy department better. Technically this course was an 'overload' for me, and Doug offered to pay me a little something extra for agreeing to do it. But I turned down this offer and told him to use the money as a donation to the philosophy department instead. It was too much fun to want to get paid for doing it.

The philosophy department was one of the departments on campus that had received approval to hire a new faculty member. Candidates for the position began showing up on campus soon after spring semester began, and I was asked to take part in the interviewing process. This particular faculty position was a philosophy of science position, and they asked me to take part because I was involved in both the neuro-science program as well as the college of engineering. Plus, of course, I was adjunct faculty in the department myself. It was a tiny favor to ask, and I was glad to do it.

One unexpected thing *did* turn up as the spring semester got underway. Deb Stenkamp had been the director of our neuroscience graduate program since its inception, and spring of 2006 would be the end of her three-year term as director. I was all for re-electing her for another term, but Deb was planning to take sabbatical leave the following year and, in addition, they were planning to adopt a baby. She therefore felt continuing as director would be too much to handle on top of these things, and so we'd need a new director for the next three years. The election was slated for January 19th at our first faculty meeting of the new semester.

I had barely begun thinking about who to support for the new director when I got a call from Deb. Someone had nominated me to succeed Deb in the post. Somebody else – it turned out to be Deb – had seconded the nomination, and Deb was calling to ask if I'd accept the nomination.

Director of the program is an administration job – albeit only a quarter-time job in our program – and the last thing in the world I wanted to do was spend time being an administrator. That wasn't why I came to the university. Not at all. But our program was still a very young one and it is part of the social contract in a university for faculty members to do their part in governing our academics. That put the whole thing very squarely in the category of Duty so I felt I couldn't refuse the nomination just because I didn't want to do any administrative work. Besides, there would surely be other nominees and I figured I could throw my support to one of them. After all, being nominated isn't the same thing as being elected.

No such luck. We gathered for the faculty meeting at two o'clock in the afternoon and Deb opened the floor for nominations. Mine was put in officially – it turned out to be Jim Frenzel who nominated me –

and it was formally seconded. Then there was an awkward silence. Then somebody moved to close the nominations. There I was, sitting there, the sole nominee. All of a sudden my chances of losing weren't looking too good. Deb asked me to leave the room – the usual formality – while the vote was taken. Then she brought me back in the room, grinned mischievously, and told me I now had a 'mandate.' Well, there wasn't much I could do at this point; accepting this post was a Duty. I was asked to make an acceptance speech, so I made about the shortest one on record. "I can't promise to be perfect," I told my colleagues. "All I can promise is to do my best." Speech concluded. They applauded anyway. Come July 1, I was going to become director of the neuroscience program for the next three years. □

With Dr. Lan Nguyen and Dr. Feng Xie after the spring 2006 commencement ceremony.

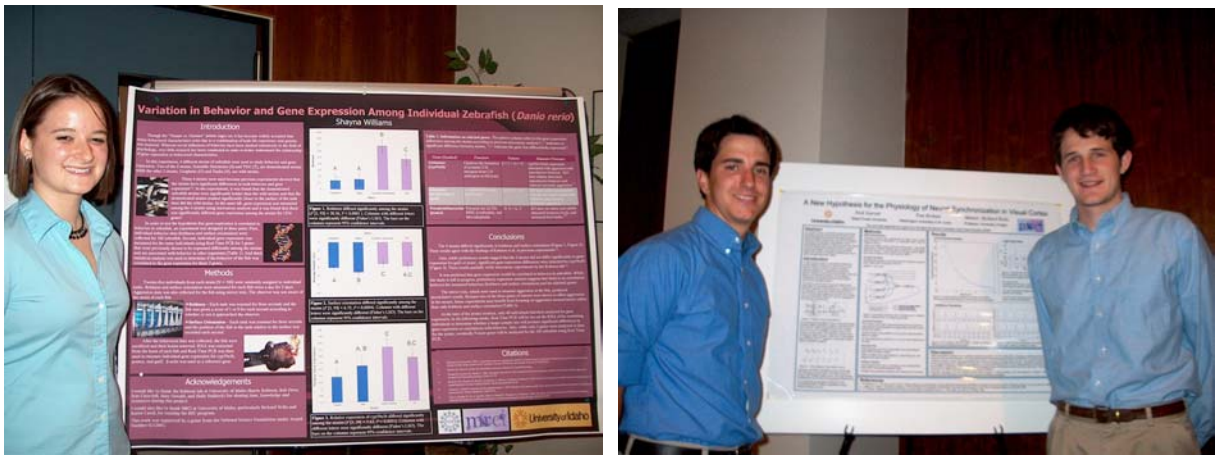
Most of the rest of the 2006 spring semester was entirely routine. Both Lan and Feng finished up their doctoral research, as expected, and graduated at the spring commencement. Lan went home to Mission Viejo, CA and Feng got a job in industry. With Feng's graduation my participation in the AMFeR program also came to an end. The micromagnetics part of that program had made all the contributions it could and I was able to free up my time for the other things on my plate, particularly neuroscience. In addition to my two Ph.D. students, spring semester saw the graduation of two of my professional Master's students, Stan Buelt and Diane Nelson, as well as a Ph.D. student in computer science, Dong Yu, whose committee I had served on. Dong's dissertation, entitled "A Novel Alert Correlation and Confidence Fusion Framework in Intrusion Detection Systems," addressed certain computer security issues related to defending computer systems against cyber attacks. It used a form of artificial intelligence known as a 'colored Petri network' and I had helped Dong a little with the mathematical formalism involved in his system.

The search for a new Dean of Engineering finally netted one. Her name is Dr. Aicha Elshabini and she is an electrical engineer and a Fellow of the IEEE. This made the first time since I had been associated with the UI that the Dean of Engineering was an electrical engineer. Aicha originally came from Egypt so she was also the first Moslem dean of the college as well as the first woman to hold that post. As part of the hiring package she negotiated with the university, she brought with her a colleague, Dr. Fred Barlow, who joined our department, and she was able to negotiate opening two other new faculty positions for us, which allowed us to start rebuilding after the losses we had taken during the budget crisis. All that was very welcome news for the ECE department.

After the school year ended and before Aicha came on board, Chuck Peterson called for a faculty review of Demetrios' performance as chair. Personally, I thought Demetrios had gone a long way in correcting the behaviors that had led to the original brouhaha and had earned the right to continue as chair of the department. Unfortunately, a majority of my colleagues didn't share that opinion and Chuck removed Demetrios as chair. I wasn't happy with that decision, but it had all been done according to the agreement that had been worked out earlier, there was nothing underhanded in any of it, and the will of the majority prevailed. The workings of a democracy usually don't please everyone but either a person has faith in democracy or he doesn't. You don't get to believe in democracy only when it works out your way and in this case I ended up being in the minority. Our faculty closed ranks and that was that.

The decision meant we needed a new chair. I nominated Brian Johnson, my colleague who had taken over the NIATT CID project for me a few years earlier, and someone nominated Jeff Young, my office next door neighbor who was running the AMFeR program. There was no national search this time. Brian wasn't too eager to become chair and I'm not so sure he wasn't surprised about how popular he was with the faculty members, but we had called on him to serve and he accepted it as a duty. Jeff and Brian each

presented their views and what they would try to do as chair, and when the votes were counted Brian won the majority and became our new chair. I apologized to him for nominating him; I knew what it felt like to land in an administration job one hadn't sought. As for Demetrios, he landed on his feet, becoming a dean at a Texas university. My guess is he must have had this in the works even prior to the end of the school year, although I don't know this for sure. He left us prior to the end of the summer.



Three of the 2006 Neuroscience REU participants. Left: Shayna Williams. Right: Nick Garrett and Tom Richner. Shayna won a blue ribbon at the 2006 Sigma Xi student research competition while Nick and Tom brought home a gold ribbon.

The summer 2006 neuroscience REU session was the third session of that contract and the last one for that round of funding. One of the big things I had to do that summer was prepare and submit a new NSF proposal to renew the funding for our REU site. We had eleven more extremely sharp kids participating that summer doing projects spanning biological neuroscience, cognitive neuroscience, computational neuroscience, and neuro-pharmacology. Once again all the kids turned in excellent research results. The Sigma Xi student research competition later that year was held in Detroit, which turned out to be quite a long distance from the home universities of most of our participants. Participation in this research competition by our REU students is voluntary; by the time the Sigma Xi meeting is held the kids are back in school and while we encourage them to go to it by providing some reimbursement for their travel, it's a free country and we can't make students do it. That year only two of our projects elected to go to Sigma Xi, but they represented our program with distinction.

Shayna Williams had come to us that summer after completing her sophomore year at Claremont-McKenna College in California. Her REU project involved the study of the genetic basis of boldness exhibited in zebrafish. As it happens, zebrafish taken from the wild and zebrafish that are grown in domestic laboratories exhibit very different behaviors. Wild type zebrafish will shy away when a person approaches the fish tank, putting as much distance between themselves and the human as possible. Domestic zebrafish raised in the laboratory will do just the opposite. They will approach the human and, thus, they are said to be 'bold' in comparison to the wild type. What Shayna found was that there are genetic differences between the two that correlate to this behavior. This might mean that behavioral qualities such as courage or timidity could have a genetic basis. It's too soon to call this more than just an hypothesis, but if further research bears this out it will be a very significant new finding of fundamental importance. Shayna went to Detroit for the Sigma Xi competition and won a blue ribbon, denoting 'superior' research (best in the conference in that subject area), an accomplishment that places her in a pretty elite class as one of the best young scientists in the nation.

Nick Garrett, a biology major, and Tom Richner, a math major, did a team project that summer that investigated the relationship between physiology and an important type of mathematical neuron model known as 'the Eckhorn neuron.' In the 2005 REU session two of my kids – Tim Montoya, an electrical

engineering major, and Tian Lai Lu, a biomedical engineering major – had constructed a neural network model of the neocortex (the thin outer layer of the brain where higher cognitive processes are carried out). Their model had demonstrated neural dynamics that closely matched experimental data taken from human subjects, thus suggesting a possible explanation for how neural 'circuits' in the brain are organized. The model used Eckhorn neurons in the neural network, and their results immediately raised the question of how biological neurons at the cell level might be interconnected to produce the more abstract mathematical properties of the Eckhorn model. That was the question Nick and Tom worked on in the summer of 2006. They constructed small networks ('netlets') of biologically accurate neuron cell models and succeeded in explaining some of the physiology that could act to produce an Eckhorn behavior. They also succeeded in demonstrating to what I regard as a near certainty that 'the Eckhorn neuron' itself does not actually exist in biology but rather must be the result of interactions among a fairly large population of biological neurons. Their findings will help us to pinpoint more details about how the human brain is organized so far as the neocortex is concerned. Nick and Tom brought a gold ribbon ('excellent' research) home from Detroit. □

Other REU students in the 2006 session with their posters at the REU expo on the UI campus.
Upper left: Beia Gomez and Kristina Eells; Upper right: Zach Maier and Geoff Basore; Lower left: John Rudolph and Stephen Smith; Lower right: Katie McNabb and Tshering Sherpa.

My new duties as the neuroscience program director automatically made me a member of a council known as the University-Wide Programs or UWP council, which works for the Dean of the College of Graduate Studies. This is the college in which the Neuroscience, Bioinformatics & Computational Biology, and Environmental Science programs were lodged. It meant that in addition to reporting to Brian in my role as an electrical & computer engineering professor and Touraj in my role as associate director of the Institute, I now also reported to the Dean of COGS in my role as neuroscience director.

The Dean of COGS is Dr. Margrit von Braun. If that name sounds familiar to you, it is because she is the daughter of Wernher von Braun, the rocket scientist. I first met Margrit back in 1996 when I moved to the Moscow campus following the Engineering in Boise fiasco. Margrit is a chemical engineer by training and when I first met her she was in the process of founding our Environmental Science program, the oldest and largest of the UI's interdisciplinary and university-wide programs. Her office was then right next door to mine, where Jeff Young now resides. *My, my,* I thought at the time, *it really is a small world, isn't it?* Her dad was one of my boyhood heroes.

I think Margrit is an exceptional leader. She has a clear vision for the graduate college, knows where she wants to take it, and does an outstanding job of building consensus among the UWP directors. She has a deep concern for putting our students first – something I don't think can be said of every dean – and an equally strong commitment to the highest quality of graduate education and research. She is able to be a very active and involved Dean without being a micromanager. Of course, from time to time this activity and involvement means my twenty-five-percent-time duties as neuroscience director add up to something a bit more than twenty-five percent. That's the downside of working with a dynamic leader but ah, well, life is like that sometimes and I'd sure rather work for an outstanding leader than for an administrator. Margrit is one of the few deans who doesn't fit the mold of the old academic saying, 'If you don't tell the dean it's a joke, he won't laugh.' It's a privilege to work with her. □

As the summer of '06 drew to a close, Leili completed her thesis research and graduated with her Master's degree. She had been working on the MIMO idea for the AUV and turned up some rather interesting results, which we published at a communication system symposium in the Netherlands. What I found to be the most interesting result was the finding that, rather surprisingly, what is usually regarded as the optimum signal processing method in most applications was very poor when applied to underwater acoustic communications for our little submarines. A slightly different method, usually regarded as suboptimal, performed much, much better. The reason is linked to the dynamics that take place when an adaptive system is used in this application and it has to do with maintaining a robust communication link when the submarines are moving relative to each other. The findings left us with some very interesting food for thought, and I don't think all of the implications of this work are fully appreciated yet.

After completing her degree, Leili was off to Stanford to join her husband. She had been accepted into Stanford's Ph.D. program in electrical engineering and I was curious about how well she'd do down at my old alma mater. Leili was kind of a high maintenance graduate student when she was working for me, and my colleagues down at Stanford aren't exactly known for their unlimited patience. I hoped she'd find a good mentor down there.

Ron, having started on the project later, was still busily engaged in his research work for the AUV. His research centered on a method to greatly improve the capacity for our 'schools' of AUVs to communicate more rapidly. He succeeded in coming up with an adaptive system – quite different from Leili's – to do this and graduated at the end of the spring '07 semester. We haven't published this work yet. One of the things I'd hoped to do was to find a way to combine the methods Leili and Ron had used, but this proved to be more difficult than I had anticipated. The problem of combining the methods is still unsolved. □

One of the aspects of my job I enjoy the most is talking to high school kids and their parents who come to Moscow scouting for a college and a major for after high school graduation. For me these chats pretty much always involve prospective engineering students. Unless at least one parent is an engineer, the majority of folks I see don't know precisely what an 'engineer' is or how engineering differs from, say, being a physicist or being a mathematician. What they do know is that a young person with a Bachelor's degree in engineering is likely to make more money than a person with a Bachelor's degree in physics or math or chemistry, but most of the time that's about as far as it goes.

Most of the time mom and dad – especially dad – do a lot more talking and ask a lot more questions than the student does. Dad especially is usually concerned about bottom line things like 'what are the job opportunities like for this profession?' Since we offer degrees in both electrical engineering and in

computer engineering, dad also usually wants to know which of the two fields has more and better job opportunities. These are very practical questions, they're very pertinent, and I'm always happy to explain the various opportunities and the differences. I've noticed that even if the student doesn't do much talking, he or she usually perks up the ears when we're talking about this topic. Dad also usually wants to know what the post-graduation employment placement rates are like, and this is one of my favorite easy questions because the job placement rate in real engineering jobs – as opposed to flipping burgers – is very high for our graduates.

Mom, if she talks at all (which sometimes is not the case), is usually more interested in what I tend to think of as 'the humanity' of the program. She wants to know what sort of academic help is available, who teaches the courses, that sort of thing. I explain how each and every student has his or her own academic advisor whose job it is to explain what the different courses are, how the curriculum works, and so forth. I'm also always proud to be able to say that in the ECE department the professors – not the graduate students – teach the lower division classes that are foundational to the student's success. Of course, I also point out this isn't universally true in all departments of the university. There are some departments, like the math department, that are known to use graduate students for freshman level courses. I don't approve of the practice, but it does happen and I don't hide that from parents or students. But on the whole the students learn from the professors. That's why we came to the UI; we *like* to teach.

To draw the student more into the discussion, I usually describe what the profession is like by talking about some of the research projects we have going on. This tends to mean a lot more to the student than any dry discussions about jobs or advising or classes. The student typically wants to know what he or she will be *doing* after graduation. So I talk about my own work with neural networks – which visitors usually find utterly fascinating – as well as whatever other projects happen to be going on or just completed in the MRC Institute. Unless the family is pressed for time on their tour schedule, we'll go to several of the labs where they can see and touch the actual real *things* themselves. The AUVs, for example, have a clear plastic outer skin – the lab units do, anyway – that lets folks see inside. With a small bit of luck, we'll also usually bump into some of the undergraduates who work in our labs, and they are usually eager to talk about the cool things they're working on. It usually surprises both parents and student that undergraduates have an opportunity to actually participate in real project work. Most folks assume only graduate students get to do this. That's true in a lot of universities, but at the UI we teach the *practice* as well as the theory.

Students are usually a lot more animated and ask a lot more questions when they visit me without their parents. A lot of times they ask better questions than mom and dad do so long as mom and dad aren't there. I think a lot of people greatly underestimate teenagers. It's true that most of them are pretty naive, but I've usually found them to also be very practical and to possess much better judgment than they're usually given credit for having. Basically, what I've seen time and again over the years is if you treat them like children, they'll behave like children; if you treat them like adults, they'll behave like adults. Last year there was an interesting article related to this in *Scientific American Reports*. The article was entitled "The Myth of the Teen Brain," and it bears out what I've seen for myself over the years. There's a lot of pop talk these days about the teenager's brain, particularly the prefrontal cortex, being 'immature.' Depends on what you mean by 'immature.' I've noticed most folks who talk about this aren't too clear about what they mean by 'immature brain.' I can tell you that 'mature brain' *doesn't* mean 'all hardwired and set to go.' The brain never stops making and re-making neural connections for as long as you're alive. It just does more of it when you're young. Why? Young people haven't had the chance to gain as much *experience* as an older person has. They have more to learn. If a teen makes a bad judgment call – and they do from time to time, more often than older people – I think it's mostly because they lack experience. Put rather bluntly, they aren't old enough to have had very many *bad* things happen to them yet so they haven't yet developed the neural connections that give us what is popularly called 'gut feel.' If anything, teenagers are *too* logical, *too* rational, and tend more often than older people to assume they've got all the bases covered and nothing can go wrong. I treat my young students with respect, I listen to them, I treat them like adults and subtly let them know I expect them to act like adults. And they do.

Ninety-some percent of the time. As for naivety and inexperience, well, that's why we have teachers. □

On September 6th, 2006, I posted *The Critical Philosophy and the Phenomenon of Mind* on the Internet. This book, twenty-four chapters in length plus numerous appendices and a preface, marked the culmination of ten years of intense research into fundamental issues that had been stumbling blocks over all my previous years of research on electronic brains. Its roughly twenty-four hundred pages set down in detail the fundamentals of the phenomenon of mind, its scientific treatment, and the foundations for a new science I call mental physics. The book isn't a blueprint for an electronic brain; it is the operational definition of what a 'mind' – specifically a human mind – is and does. As such, it is also the operational definition of the capabilities anything deserving to be called an 'electronic brain' must possess.

Some forty years had elapsed between the time when the idea of an electronic brain had fired my imagination as a junior high school student in Maquoketa and the time when *CPPM* was ready for its first publication. For the first time in all those years, I finally felt I had accomplished something of fundamental significance. When I began the research that culminated in this book I hadn't had any plan so grand as to hope to find a systematic treatment of the human mind, but in the end it turned out that way and, in retrospect, it really had to because of what I meant for an electronic brain to be able to do.

It's not an easy book to read although I did my best to make the theory as comprehensible to the reader as I knew how. I'm not under any illusion that the theory will catch on quickly. Mind is a complicated thing and cannot be understood by a casual and light reading of this book. It takes hard, concentrated study and a spirit of open-mindedness to master the many fundamentally new ideas in the doctrine. That is one reason, the main reason, I expect it will be younger scholars, not the old timers like myself, who will be the ones to bring this new theory forward into the mainstream of science. Science has always seemed to work that way throughout its history. I see no reason history will not repeat in this case.

I don't even expect to see the theory become popular in my lifetime; there probably aren't enough years left to me for that. But I think it will become the accepted theory eventually. That, at least, is my hope and purpose in giving this work to the world. I do know there are a lot of people out there who are at least reading the book; copies of it have been downloaded at a rate of a few hundred copies a month since the day it went on line. Time will tell if this work makes the difference in science I think it will some day. Meanwhile, I now have a clear direction and clear goals for my on-going work in pursuit of my forty year old dream. There are still countless details to be worked out, but at least I now know what those details involve and I know that *these* problems yet to be solved are *the* problems that have to be solved. And, in the end, that in itself is not such a small accomplishment. □

I don't know if it's something that gets into the air, or into the water, or if God just decides to have a little fun with us every now and then. But over the years I've noticed that events, not clearly related to one another or to what a person's plans happen to be, have a habit of popping up from out of nowhere and converging at a single point – all too often at my desk. We were barely into the start of the fall term when one of these 'harmonic convergences' fell from the sky with a big *plop* and sprayed new meetings all over my calendar.

The opening gong came in the form of an Email from Maryann, Aicha's chief admin (secretary) person for the College of Engineering. It was time for the college to elect a new representative to the university's Research Council and, it seemed, I had been nominated. The UI Research Council is a council of representatives from all the colleges and is chaired by the Vice President of Research. Its purpose is to evaluate research policies, advise the VPR, and act as the conduit for communication between the faculty of the university and the upper administration on research policy matters. It is to research what the Faculty Council of the university is for curriculum and academic policy matters. The Research Council also administers seed grants to faculty members and determines who is going to get seed grant money and who is not.

When I asked, Maryann assured me I was *not* the only nominee this time. There would be an actual,

honest to gosh election for me to lose. That being the case, it was easy to answer the call of Duty this time. I told her I'd accept the nomination. Then I did absolutely nothing. No campaigning, no platform statements, nothing. There were a couple of guys who apparently wanted the job and they did plenty of campaigning for everybody. I figured I was a shoe-in to lose this election. My time for carrying on with my electronic brain research was safe.

No such luck. I won anyway. Now I was a councilman.

The next *kerplop* came in the form of a visit by a consulting company called The Yardley Group. They are a consulting firm that goes around assessing university graduate programs and advising universities on how they stack up against other universities. Part of Tim White's Plan for Renewal called for taking a fresh look at how the UI prioritizes its graduate and research programs, and Yardley was step one. Because I was now the director of the neuroscience program, I was one of the lucky ones who got to spend a considerable amount of 'face time' talking to the people Yardley sent out. They were nice, friendly people and we did have some interesting conversations. Then they went away. But I knew they would be back. Somewhere down the road near the end of the rainbow there'd be a report of some kind. I had no doubt that whatever else that report said, it was sure to say 'And here's the work Wells has to do now.' I urged the Yardley folks to take their time and do a *thorough* and *thoughtful* report. "Take all the time you like," I urged them. Their report came out recently and, sure enough, I now have things to do.

The third *kerplop* was a phone call from my old friend, Mike Kyte. He was calling to ask me what days and times I had available for our regular meetings. "What regular meetings?" I asked.

"The meetings of the College Strategic Planning Committee," he answered.

"What Strategic Planning Committee?" I replied. "And why would I want to attend their meetings?"

"Because you're on the Committee," Mike said simply. Since when? It turned out to be since when Aicha had told Mike I was on the Committee. Somehow she had forgotten to tell *me*.

The irony of it is: I don't really believe in strategic planning. I'd been involved in countless strategic planning exercises in my years as a project leader and a project manager at HP. Almost always a strategic plan turns into either a list of platitudes and praises for mom and apple pie, or else it turns into a *tactical* plan and has about the longevity of a mayfly. Robert Townsend called *long range* planning a 'happening' and wrote that it should always be carried out by the boss (the dean in our case) and his/her key people (the department chairs and associate deans in our case). In *Up the Organization* he wrote, *Once I was asked to head up a new long-range planning effort. My wife listened to my glowing description of my new job. Next evening she blew the whole schmeer out of the water by asking: 'What did you plan today, dear?' Bless her.* In this, as in so many things, Bob Townsend was right. Of all the people Aicha could have picked to be on her Strategic Planning Committee, she picked the one guy in the college who thought such a committee was useless. I told Brian about what had happened.

He laughed. □

Something I had to spend a lot of time on that fall semester was writing NSF proposals. All of the research contracts supplying my funding were drawing to a close, including the one that funded the REU program. I was pretty confident of getting the funding for the REU renewed. It had been a very successful program over its first three years and had an impressive list of statistical accomplishments to its credit. Program officers at NSF have their performance evaluations based in part on how many publications are generated by the people who received funding (publish or perish exists at NSF, too), and the REU had produced a long list of publications. Most of our young participants who were now old enough to have graduated from their home institutions had gone on to graduate school, which is another goal of NSF's REU program, so we were looking pretty good in that department, too. I figured if the REU proposal for the next three years didn't get funded there had to be something very out of whack at the National Science Foundation.

I was less confident about the other proposals I was writing. These had to do with electronic brain research. I had been trying without success to raise funds for this since before the neurofuzzy project had ended. A big part of the problem in getting this funded was the novelty of the kind of system I want to build. I couldn't expect anyone on one of the review panels to know anything about the new theory I had just published, and that made it pretty tough since I had to write the proposals in language NSF's panel of experts understood. For the same reason, I likewise had to find a way to put the research work in the context of more mainstream neural network research. One bit of useful advice Paul Werbos had given me was this: Proposals that propose to do everything don't get funded; proposals that don't propose to do very much don't get funded. The trick was in finding some way to propose significant sub-projects I need to do in a way such that the importance of the work could be understood by the review panel. For technical reasons, that is easier said than done.

The biggest factor looming over all of this is the level of funding NSF has available each year. In the 1960s NSF was much better funded by Congress, or so I'm told. Today the real purchasing power of the dollar is much less and science funding in the U.S. simply hasn't kept up with inflation over the years. Today NSF can only afford to fund about one out of every fifteen of the proposals they receive each year. The fiscal picture is made even tougher by the combination of the huge Bush tax cuts combined with his out of control deficit spending to pay for his Iraq war. There was a time when I thought the Republicans were the party of fiscal responsibility, but I no longer think so. What kind of fools cut government income during a war? I can only think of two historical examples: Czarist Russia during World War I and today's Republican Party. Well, we know how the first example worked out in the end; the Russian economy collapsed and the communists seized power. Time will tell how the second example will go, but I'm not optimistic about it. Nor do I think the liberal wing of the Democrats is any more friendly to science than the Republicans are. Our American system doesn't work when those we elect want to rule us rather than lead us and serve our country.

These factors all combine to make the National Science Foundation a pretty conservative – that is to say, timid – entity when it comes to which proposals they are willing to risk investing in. Dan Wilamowski had an interesting strategy for NSF 'grantsmanship.' Dan's basic idea is to write proposals for things he's already done – thereby being able to prove his ideas will work – and then use the money to do what he wants to do next. It amounts to a kind of retroactive funding. In terms of playing the system, Dan's suggestion is probably the smart play, but I can't do that. I think it's unethical for me to say I'm going to do one thing and then do something else, and I won't play the game that way.

It would probably be easier for me to get 'applications' funding. Very specific applications are easier for review panels to understand and these days the lion's share of engineering funding from NSF goes for projects of this sort. My friend Don Wunsch has advised me to take this approach to obtaining research funding and, circumstances being otherwise, it's good advice that I'd follow. But on the other hand, I'm not getting any younger and with each swiftly passing year I'm more and more inclined, research-wise, to only be interested in achieving my life-long goal of making electronic brains a reality. There is just *so* much yet to do before this can happen. Somebody else can work on new and improved bar code readers. If this means I have to work without the external funding that would help make the work go faster, so be it. One of Gandhi's favorite sayings was a line from a poem by Rabindranath Tagore, "If they answer not your call walk alone, walk alone." I think the Mahatma got it right with this one.

And so I wrote proposals that fall. I did the REU renewal first and then, although I figured it was most likely a waste of time, I did some proposals aimed at some fundamental work needing to be done for my electronic brains program. I sent them in and then I waited. The 2006-07 NSF funding round got to be pretty interesting – again in the Chinese sense – because Congress hadn't bothered that year to pass any budget for the National Science Foundation. NSF had been operating on what is known as a 'continuing resolution' – which is Congress' way of saying "Go ahead and spend money we haven't given you yet; we'll fix it later. Trust us." By January of 2007 I guess trust must have been wearing thin at NSF because the head of the National Science Foundation issued a 'Dear Colleagues' letter in which all actions on

proposals not yet funded were frozen until Congress got around to actually doing its job. That left everything pretty much up in the air for awhile.

Eventually, though, the new Democratic Congress did get around to giving NSF an actual budget, things unfroze, and the process lurched forward. The REU proposal was funded, which elicited a whoop from me the day I got word of that decision. I made such a loud, happy sound that Jeff and Touraj, who were having a meeting in Jeff's office next door, stuck their heads out to see what was going on. As it turned out, this time the REU Program was being jointly funded by NSF and the Department of Defense. NSF and DoD had an agreement to partner up in funding certain kinds of programs and, as it happens, REU programs like mine were one of these kinds.

I felt a very warm glow of personal satisfaction when the REU was renewed. These programs are pretty prestigious and I'm not above feeling awfully proud that our REU 'report card' was good enough for NSF to want the Program to continue. I knew of other REU programs that didn't fare so well and were dropped by NSF after the first three years. The Institute's own center, CSDS, had had an REU program that failed to win renewal only a couple years earlier. I was also happy when I learned DoD was helping to fund the program. The DoD program partnering with NSF is administered by the Air Force Office of Scientific Research (AFOSR), and the Air Force has always been the most consistent supporter of the kind of research into neural networks and 'computational intelligence' at the core of what I do. Having AFOSR involved with the neuroscience REU program raises a spark of hope that I might one day be able to get the electronic brains work funded through a source other than NSF. I keep my fingers crossed.

The other proposals turned out about the way I'd expected, which is to say NSF declined to fund them. I really can't criticize NSF for those decisions. They really do have to operate under some pretty tough budget constraints and it's very hard for a radical new theory such as mine to compete against the kinds of proposals that fit more neatly into the contexts our present-day experts in the field are used to seeing. Paul gave me some informal tips on what I might be able to do next time to improve my chances, which I appreciated. But it still remains a pretty tough sell. As Richard Feynman remarked one time about the resistance his new idea of quantum electrodynamics had been met with by J. Robert Oppenheimer and Niels Bohr, "My machines came from too far away." □

When the 2006 mid-term elections arrived, I felt pretty optimistic about the chances of unseating the Republican control of Congress. The bungled war in Iraq, the spat of scandals involving high-ranking Republican members of Congress, the treasonous outing of a CIA undercover operator by *at least* one high-ranking member of Bush's administration, Bush's bungled handling of the Katrina disaster – all of these were, I thought, ripping the mask from the face of our Republican rulers and exposing the hypocrisy beneath. I didn't actually expect to see enormous, great things come from the Democrats. Throughout the Bush years they'd been a gutless lot afraid to stand up to the little Caesar living at 1600 Pennsylvania Avenue. No, what I was looking for was an end to unrestrained Republican rule, the repeal of the onerous crimes against our constitutional rights, an end to the appalling and shameful use of torture by the Bush administration, at least some restoration of fiscal sanity in funding the government of a country at war, and – as a long shot – the beginning of the end of Bush's private war in Iraq and a return to fighting our real enemy. That was the most I dared to hoped for. Still, although I was optimistic I wasn't sanguine about the election. After all, I'd been very, very wrong about the prospects of ending Bush's reign in 2004. The Republican propaganda machine wasn't to be underestimated.

As the returns came in on election night the results, I thought, were good but not as good as our country was going to need. The Democrats did manage to re-capture a 233-202 majority in the House, enough to end twelve straight years of total dominance by the extreme right wing of the Republican Party but not nearly enough to override Bush's probable veto of any changes to the laws that were empowering him to spy on Americans or burglarize our homes or wage his private war in Iraq. Over in the Senate the news was less encouraging. The Democrats did manage to pull off a 49-49 tie with the Republicans, leaving the swing vote to two Independents in the Senate. It was an improvement, but not nearly enough.

One good thing, long overdue, did come out in the aftermath of the election. Secretary of Defense Rumsfeld was finally sacked. He was the man I held most responsible for failing to bring enough force to Afghanistan to end the Al Qaeda war when it was at its most winnable. He was the man I held most responsible for the tactical bungling that led to the quagmire in Iraq and for aiding and abetting Bush in starting that private war in the first place. He was the man I blamed for sacking competent generals in the Pentagon and replacing them with officers reminiscent of those in the Vietnam War era who had acted more like third-tier corporate managers than like leaders of our Armed Forces. In my opinion, he had run the Defense Department like it was a corporation, and nothing is more stupid and incompetent than that. War isn't a business like manufacturing some widget or retailing bric-a-bracs. It's the most deadly and serious and dangerously unpredictable thing in the world. As Gwynne Dyer observed in his 1985 book, *War,* a company can take it for granted that its salesmen won't be ambushed and killed on their way to their afternoon appointments. Armies can't. Carl von Clausewitz, in the classic book *On War,* wrote

> Kind-hearted people might of course think there was some ingenious way to disarm or defeat an enemy without too much bloodshed, and might imagine this is the true goal of the art of war. Pleasant as it sounds, it is a fallacy that must be exposed: war is such a dangerous business that the mistakes that come from kindness are the very worst. The maximum use of force is in no way incompatible with the use of the intellect. If one side uses force without compunction, undeterred by the bloodshed it involves, while the other side refrains, the first will gain the upper hand. That side will force the other to follow suit; each will drive its opponent toward extremes, and the only limiting factors are the counterpoises inherent in war.
>
> This is how the matter must be seen. It would be futile – even wrong – to try and shut one's eyes to what war really is from sheer distress at its brutality.
>
> If wars between civilized nations are far less cruel and destructive than wars between savages, the reason lies in the social conditions of the states themselves and in their relationships to one another. These are the forces that give rise to war; the same forces circumscribe and moderate it. They themselves however are not part of war; they already exist before the fighting starts. To introduce the principle of moderation into the theory of war itself would always lead to a logical absurdity. . .
>
> If, then, civilized nations do not put their prisoners to death or devastate cities and countries, it is because intelligence plays a larger part in their methods of warfare and has taught them more effective ways of using force than the crude expression of instinct.

It isn't pleasant; it isn't easy to admit; but von Clausewitz was and is still correct. That is why war is always something to try to avoid, never something to start, but always, always something to bring to the swiftest end possible through the application of sheer, naked, brutal, and overwhelming force when once our country is dragged into it. This is a brutal truth I do not like, and I expect you don't like it either. But not liking it doesn't make it go away. The only antidote to war is peace and the only path to prevention of war is diplomacy.

There are many well-meaning and intelligent people today who think our use of the atomic bomb on Japan is something shameful. I do not agree. Quite apart from the now known fact that Japan itself was also working on the atomic bomb and would have used it against us if we hadn't gotten there first, I know what the use of this most destructive of weapons meant to Americans fighting the war with Japan. I know because Dad set it down in his diary:

> August 8, 1945: Today they dropped the atomic bomb on Japan and really knocked hell out of things. They say it's out of this world. Was dropped on a city of 300,000 and there isn't supposed to be anything left of it. That's what we need to save American boys.
>
> August 9: Still at Leyte. Went out for A.A. firing today and did real well at hitting sleeves. Sort of taking the new off the new men we got aboard. Good news today. Russia declared war on Japan. Boy, that also makes things look good for an early homecoming.
>
> August 10: Went out today for more A.A. firing. Half the fantail is covered with empty 5-inch

> and 40 mm [casings]. Did more good shooting today and the best in the Banzai setup. News that Russia is 82 miles into Manchuria already. Dropped the second atomic bomb on Japan. This time on the 12th largest city. Really must be out of this world.
>
> August 11: News came last night about 10:00 PM that the war was over. All the horns and sirens in the harbor began to blow and flares and rockets lit up the darkness. Every searchlight on every ship also went into action lighting up each other and the sky. All the shows [movies] had to stop because nobody wanted to watch it and couldn't hear if they did. The captain served whiskey to the crew in the mess hall and some got drunk. Today we hear the government [of Japan] has refused their ultimatum so the war is still raging. Probably will last another year now.
>
> August 14: Left Leyte Harbor at 6:00 AM with three ammunition ships and one tanker. Only escort vessels are us and one D.E. [destroyer escort]. Headed for a rendezvous with other ships 300 miles south of Tokyo. This should be some trip. About 1300 miles. Hope we miss the typhoons. No word yet about the Jap reply to the peace terms.
>
> August 15: Still underway for 300 miles south of Tokyo to rendezvous with other ships. Received the word today to cease hostilities and use only defensive actions from now on. That means the war is over except for cleaning up the rough edges. Have a cold and don't feel a bit good. Passed two Jap subs surfaced on the water. Went on past as if they weren't there.

I think it's awfully easy for people whose lives were never on the line to take shelter in an abstract world that doesn't exist and decry the use of overwhelming force to end a war. And something I know for a certainty is: I'm glad my Dad came home alive. The bomb made sure that happened. □

Fall semester chugged ahead fairly routinely except for the unusual number of meetings I had to take part in and the unpleasant but necessary amount of administrative work attending Tim's Plan for Renewal activities, the engineering college's strategic planning stuff, and various activities attending putting into place a wider set of documentation and assessment tools for accreditation. Ron and I were making pretty good progress on the AUV project work, and I was enjoying teaching our senior-level class in electronics. The December commencement brought the graduation of two of my Master's students, Leili and Ben Sharon, as well as half a dozen undergraduates I'd grown to know very well over their years in college. One of these students was Tim Montoya, who had worked for me in my lab in both the neurofuzzy and the neuroscience REU summer programs and who had been one of my advisees over the years. I would have loved to see Tim stay on for graduate school, but he elected to take a job with Micron instead.

One very special graduate – special for me, that is – was Scott Carter, son of a dear friend of mine in Boise, whom I'd known ever since he was a little, little boy. You've seen a picture of little Scotty earlier in these memoirs, at the trailhead during a hiking trip we'd taken. I hadn't seen much of Scott while he was in school. He'd majored in computer science and our paths seldom crossed, although I wish they had much more often. When Uncle Wayne had passed away in 2004 it had felt strange to me to find myself an 'elder' in the sense of now being in the oldest living generation of my family. Scotty's graduation brought that feeling back to me again and even stronger. I'd had a feeling of being more elderly than my years back in 2003 during the graduation of the eldest son of one of my long-time close friends. I can remember holding little Timmy Wilson in my arms when he was barely more than a few days old just as if it were yesterday; seeing him cross the stage, grown to a fine, tall young man, and receive his diploma in '03 had made me feel old. Scotty's graduation made me feel as proud as an uncle and, at the same time, made me feel like a relic from another time long ago. Where had all the years gone? □

January 2007 brought the beginning of a spring semester at the UI that was almost dull compared to the immediately preceding years and a year of mounting, on-going scandals in Washington, DC. It started with great fanfare as the Democrats took control of the House and Representative Nancy Pelosi became the first woman to be Speaker of the House. Despite all the hoopla, I almost immediately had my doubts. Almost the first thing Speaker Pelosi announced was there would be no impeachment hearings and no inquiries into misconduct by the Bush administration. My reaction was cynicism. Did she think it was

possible to woo the ultra-right wing Republicans over to support the things the Democrats campaigned for during the election? I thought that idea was sheer nonsense. Perhaps there was a risk that hearings would throw too much light on the gutless way the Democrats had knuckled under in granting Bush those unconstitutional powers in the so-called Patriot Act he now enjoyed? Maybe. If so, it was a cowardly act. Was she worried that the political turmoil any impeachment hearings would bring might endanger the war effort? We were already losing the war. How much more endangered could it get? Or were the Democrats just planning to play it politically cagey? If so, I had nothing but contempt for them. As far as I was concerned, the House Democrats were off to a bad start.

The first day of classes we had two visitors from HP corporate in Palo Alto. That in itself was an encouraging sign that maybe they were starting to repair some of the damage left in the wake of Ms. Fiorina. For years the UI had been one of the top recruiting campuses for HP and HP philanthropy had been an important source of support for the college of engineering. All that had stopped under Ms. Fiorina as HP had slid out of the mold of being a high tech company into whatever it has become now. I was asked to attend a meeting with the HP guys that afternoon, and I looked forward to it.

Unfortunately, I neglected to bring my secret decoder ring with me and whatever their purpose for the visit was, I failed to catch on to it. We discussed no areas of possible mutual interest, nothing substantial about how we might serve HP's educational needs. Indeed nothing I heard them say even hinted HP *had* any educational or research needs. The only thing I clearly understood them to say was they wanted the UI to enroll more women in engineering.

Duh. It is true that women were and continue to be underrepresented in engineering. Everybody knows that, everybody wants to find a way to change that, everybody's been trying to change it for a long time now. I've never heard anyone come up with a plan for doing it that worked nor pony up any money to figure out and then carry out such a plan. It's an easy goal to state; accomplishing it has proven to be another matter. If HP knows how to do it, I'm all ears. But I think they and the rest of the industry are as clueless as we are. When I was with HP the company didn't know how to do it and wasn't interested in ponying up any grant money to get somebody else to figure out how. Our big plan was just to outbid everyone else in trying to hire what women engineers there were. Scholarships, outreach to the junior highs and high schools, advertising: all these are things that might help influence the future plans of young girls and women. But all these things take money. I thought to myself, *Put your money where your mouth is, guys. What are <u>you</u> willing to do to make this happen? Besides just give orders?*

Nothing whatsoever came of that meeting. It was a complete waste of time.

One week to the day after that useless meeting with the HP guys, Bush made a surprise announcement that he was going to generously agree to let a secret court have jurisdiction over the NSA's program of wiretapping and eavesdropping on Americans suspected of ties to terrorists and would end his practice of doing so without warrants. I noticed he hadn't mentioned the FBI. "Suspected" is a convenient word. J. Robert Oppenheimer, who led America's atomic bomb development during World War II, was "suspected" of being a communist and an enemy of America during the McCarthy era in the 1950s. He wasn't. Richard Jewell, the hero who saved a lot of people's lives during the pipe bombing of the 1996 Olympics in Atlanta had been "suspected" of being the bomber and the FBI had dragged his name through the mud for months until finally being forced to admit he was innocent. You can be "suspicious" of anyone you want about anything. The news media will always be there to trump up your "suspicion" into a full-blown public indictment; that's what they do best. I don't like secret courts. Liberty and justice wither in the shadows and only tyranny flowers in the darkness of secrecy. Article Four of the Bill of Rights reads: *The right of the people to be secure in their persons, houses, papers, and effects against unreasonable searches and seizures shall not be violated, and no warrants shall issue but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched and the person or things to be seized.* Congress does not have the power to set these rights aside; neither do Presidents. No matter what. But that was what the illegal powers granted to Bush were designed to do.

One month later, on February 15th, Bush announced that the Afghanistan war was going to erupt once again in the spring, and he called upon NATO to provide an army to combat the resurging Taliban and Al Qaeda forces there. Three days later, intelligence and antiterrorism officials announced that Al Qaeda was reconstituted and had recovered after being scattered during the invasion of Afghanistan. Bush was now asking Europe to take over the real war against America's enemy. Nothing could have made it more clear that the Armed Forces of America had been overextended and tied down in Iraq and we no longer had the military reach to deal with those who had attacked our country. Nothing could have made it more clear that Bush's private war is costing us the real one. As commander in chief, he is an absolute failure.

One week later, on February 22nd, the Bush administration stated there was no need to increase government oversight of the hedge fund industry to protect our country's financial system. By the end of the year the mortgage crisis would be in full bloom, the country would be sliding headlong into recession, and the stock market would be descending into its next major bear market, the second one of the Bush administration. A dozen years of Republican rule had loosened or removed key safeguards put in place years before to protect the American public – safeguards designed to meet the constitutional obligation of our government to promote the general welfare – and the consequences are now starting to come home to roost.

By the end of February the committee Aicha had formed to come up with the college strategic plan had largely wrapped up this assignment and pretty much all that was left was to draft the final draft and present it to the dean. Much as I had expected, the committee had tended all along to want to produce a tactical rather than a strategic plan. My main contribution on the committee had been to keep pointing out the difference between things that were tactical and things that were 'strategic.' In the end we produced a kind of compromise plan. The first sections of it dealt with 'strategy' while a kind of appendix outlined some near term tactical initiatives and set up an administrative structure to oversee the administration of these tactical initiatives. The final document ran to about thirty pages. The strategic plan itself ran to about five pages. I was glad when the committee finally declared victory and disbanded.

On March 6th Lewis Libby, Cheney's ex-chief of staff, was convicted of perjury during the investigation of who had leaked the identity of CIA operative Valerie Wilson. He would be sentenced to thirty months in prison on June 5th and his sentence would be commuted by Bush on July 2nd. I was outraged. I thought to myself, *Even Nixon hadn't been this bald-faced in covering up the Watergate scandal.* A scapegoat found, a ceremonial sacrifice having been made, the Valerie Wilson crime was allowed to fade from public view. Congress did nothing about it.

On Friday, March 9th, the Director of the FBI publicly admitted the Bureau had "improperly used" the Patriot Act to spy on Americans. Congress affected outrage at this revelation. *'Well, Congressman,'* I thought, *'welcome to my world.'* It had been almost three years since the FBI had started spying on my students. I guess Congressional outrage only lasts about four months because on July 20th the White House announced that permission had been given to the CIA to resume torturing terror suspects in secret overseas prisons, and on August 4th the House caved in to Bush's demands and gave him the changes he wanted in a terrorist surveillance program, granting the executive branch broad new powers to violate the Bill of Rights. By then I was beginning to wonder, *whose side are these guys on?* Not my side; that's for sure. So much for the oath every Congressman takes to preserve, protect, and defend the Constitution.

On April 16th a mentally disturbed student at Virginia Tech went on a shooting rampage – two, actually – and murdered thirty-two people, wounding fifteen more. Sixty Minutes conducted an interview with a liberal psychologist – or maybe he was a psychiatrist; I don't remember which – who took the view that it would be a bad thing to forbid mentally ill people to purchase firearms.

Well, that's just nuts. I wondered what color the sky was on this guy's home planet.

That sort of thinking is book smart and life dumb. It is living in an abstract world full of abstract people with no thought to the social contract that alone makes civilized society possible. We had two

murder cases that year here in Moscow, and both involved mentally ill assailants. In the first case, the killer drove up from California and gunned down a student he'd gone to school with here at the UI. The victim had been in the History of Philosophy class I was again helping to team teach that semester. The killer also stopped off in Boise and murdered another student down there. In the second case, a mentally ill man murdered his wife in their home and then went downtown that night and opened fire on the police dispatch office where his wife had worked, and on the courthouse as well. One of our local police officers was killed in the shooting, and a student who lived nearby off campus and had heard the shots being fired was wounded after he grabbed his pistol and came charging in like Wyatt Earp to take on the gunman. After killing the officer and wounding the student, the killer broke into a nearby church and murdered the elderly custodian who lived there before shooting himself. I heard about it early Sunday morning when Sherri called to make sure *I* wasn't the guy who decided to play Wyatt Earp. I guess she thought that was just the kind of thing her brother might be reckless enough to do.

Mental illness isn't rare. It is often possible to control the effects of mental illness through medication, and people receiving proper treatment for their disease are able to function in society. I've had students over the years who were able to do precisely that. It is just part of my job that from time to time I have students who are being treated for schizophrenia or mood disorders. But it is also true that some mentally ill people stop taking their medication for one reason or another, and when they do the psychosis returns. Allow mentally ill people to own guns just for the sake of an abstract and very questionable principle? Hey, there, Sigmund Fraud, if you want to gamble bet your own life, not mine.

Guns are forbidden on the UI campus, with the single exception of the ROTC folks. In the aftermath of the Virginia Tech shooting, predictably, the would-be Wyatt Earps among us have started to call for a law forbidding universities to forbid guns on campus. One of our brainy Idaho Republican legislators is trying to get such a bill passed this year. Now there's a brilliant idea. Let's set things up so that thousands of students undergo the sometimes high-stress pressures of their studies or their social lives, mix in the availability of alcohol and the habit of binge drinking, and arm the students and faculty to the teeth. What could go wrong with that? Some people don't have the common sense God gave a goose. □

Aicha did come through with new faculty positions for the ECE department that let us rebuild at least some of the specialty areas that had been decimated during the budget crisis. Throughout the spring semester we had prospective new colleagues visiting the department to interview. As a faculty we had carefully discussed what sort of professional specialties to seek in rebuilding our ranks. There was unanimous consent that our two priority areas were in electronics and in computer engineering. I would also have liked to have been able to bring at least one new systems person in as well, but we only had so many positions available and I did agree the other two specialties were higher priorities.

The easiest hire was Dr. Greg Donohoe. Greg was very well known by us. He had come to Moscow from New Mexico several years earlier when the UI had established a research center to help serve the growing population in the Coeur d'Alene-Spokane region. This had been done by the simple expedient of recruiting an existing center at the University of New Mexico to leave there and come here. The director of this center was Dr. Gary Maki, who was a former UI professor of electrical engineering and who had, in fact, been the founder of the Microelectronics Research Center, the forerunner of the MRC Institute. While most of the members of Maki's center lived and worked in the little town of Post Falls, ID, midway between Coeur d'Alene and Spokane, Greg had chosen to live in Moscow and had been working side by side with us ever since. He held the position of Research Associate Professor, an untenured job, and his position was funded on what is known as 'soft money.' What this meant was that it was up to him to bring in enough research dollars each year to pay for his own position.

Positions like this are fairly high risk, in terms of job security, for people who hold them because they are vulnerable to low tides in the flow of research contract dollars. Like a small businessman, a professor in a position like Greg's can be put 'out of business' in any year where the availability of external funding dries up for any reason – usually Congress. Because his position was entirely self-funded with no safety

net in the form of 'hard money' dollars in the university budget, a funding drought would leave him without an income. When Greg first came to us another Research Associate Professor named Dave Cox, also with Maki's center, likewise came along and chose to live in Moscow. Dave was an older guy, now in his sixties, and, like me, a former HP engineer. During 2004 he had hit a funding drought and had to leave the university. Fortunately for Dave, he landed a job as VP of engineering with a small New Mexico electronics company. Greg had survived the drought that time – he's one of our most productive guys in terms of annual research funding brought in – but, as you can appreciate, it's a precarious way to make a living. Greg is married and he was looking to better his financial security. When the new position for a 'hard money' tenure track faculty member was approved, he applied for it. By then we knew him very well and knew him to be a capable teacher as well as a first-rate researcher. Hiring him turned out to be a no-brainer for us. Although Greg's main area of research is in a new class of computer chip, known as a 'reconfigurable computer,' he is also able to teach systems courses and, like me, is a good 'utility infielder' for the department.

Our second hire was a younger, relatively new Ph.D. named Suat Ay. Suat immigrated to the U.S. from Turkey and his specialty is electronics. He's a quiet, easy-going family man and was clearly the best of the candidates we interviewed for our second job opening. He joined us as a tenure track Assistant Professor.

We also ended up getting a third new professor, and in this case the circumstances were quite unusual. Joe Hass was also an untenured Research Associate Professor working in the Post Falls center. During the 2006-07 school year he had become a whistle-blower when accounting irregularities began taking place up in that center. That resulted in a university audit of the Post Falls center and, eventually, the removal of Maki as the director of that center. But before that took place, Maki, so it is said, tried to shift the blame over on Joe, an action that ultimately resulted in Joe and his wife filing a lawsuit against the university. I have to say that our upper administration did not perform splendidly in dealing with the situation, particularly our VP of Research who, as it happened, planned to retire that year anyway. I don't know too many of the details of what all went on, but the UI eventually agreed to make Joe an untenured Research Associate Professor in Moscow. So when all the dust settled, we had another faculty member specializing in VLSI. All three guys officially joined us in the fall semester of 2007.

Funding for the AUV project ran out at the end of spring '07, the victim of the congressional pogrom against 'federal earmarks' that began in January of '07. Earmarks, known as 'pork barrel' in an earlier time, have long been the target of a lot of criticism by the news media as well as by particular members of Congress. Former Senator Mike Mansfield used to annually come out with his "golden fleece" awards – a list of specific earmark projects he regarded as the most egregious cases of pork barrel for that congressional year. Usually this list contained a few university research projects whose names made them easy prey for ridicule. The scientific purposes of those projects were usually conveniently omitted in the public show the golden fleece awards could be counted on to produce in the media. The current anti-earmark champion is one of the Republican congressmen from New Mexico.

There are at least three species of congressional earmark projects: the silly ones, those involving at least the suspicion of bribery, and those that are good, useful, and important. The first two get all the publicity and the third tends to be painted with the same brush as the other two so that the public is left with the impression that all earmarks are cases of greedy feeding at the public trough of taxpayer money. I'm all for clamping down on the first two types, but I also think it isn't good to throw the baby out with the bathwater. Many earmarks produce valuable results in high risk areas of research that would likely be perceived as too risky for the federal funding agencies to chance. I also think it isn't too likely that federal earmarks are going to go away. After the current dust settles, I think they'll be called something else and congressmen will continue to win friends and votes back home by getting them passed through Congress.

In the case of the AUV, I thought it was unfortunate this particular baby was disappearing with the bath water. It leaves the promise of a lot of good and important military applications unfulfilled. But the

effect of all this on me personally was very slight. Ron had finished up his thesis work on the acoustical communication system, went on to graduate at spring commencement, and took a job in the private sector. Likewise, Kaylani Merrill, who developed the artificial intelligence system for the AUV language, finished her work, graduated, and is currently intending to pursue her doctoral studies. Two other graduate students whose committees I served on also graduated that spring. One became an electrical engineering professor at another university, the other, Roger Lew, continued to work on his doctorate in neuroscience with the UI neuroscience program. Shingis and nine other undergraduates I knew fairly well also graduated at that commencement. Some went on to graduate school, most took jobs in the private sector. And so the 2006-07 academic year quietly came to an end. □

REU ’07 ice cream social with REU students in the Washington State University REU program in material science. The guy standing behind and to the left of me in this picture is the WSU REU director.

One of the learning experiences I think an REU program should provide its participants is exposure to other research fields outside the students’ home disciplines. The interdisciplinary nature of the neuroscience REU makes this pretty automatic for our participants, but the close proximity of Washington State University, just eight miles down the road from Moscow, provides an extra opportunity for this. WSU has a strong REU program in material science, and the director of that program and I take advantage of being next door neighbors by giving each others’ REU students daylong tours of each others’ programs. The UI participants usually find the material science research their young peers are doing wildly exotic, and the WSU kids likewise find the research in the many facets of neuroscience we carry out to be, in a manner of speaking, mind boggling. I get a huge kick out of the kids’ reactions, and students from both programs ask extremely good and penetrating questions of each other. But, after all, that’s to be expected. These kids are among the finest young minds in the country. The tours are topped off by a social event, usually either a barbecue or an ice cream social, where the kids can get to know each other better and make new friends.

The summer 2007 REU participants. And me. The pictures on the wall behind us are all the past presidents of the University of Idaho. This picture was taken at our annual banquet at summer’s end. The students usually dress much more casually.

We had ten more excellent young participants in the REU program for the summer of 2007, which was the first session under our renewed funding. The kids ranged in age from just completing the freshman year to one who was a senior with just one more semester to go. They came from all over the country, from Bowdoin College in Maine, to the University of Portland in Oregon, to Seattle Pacific in Washington.

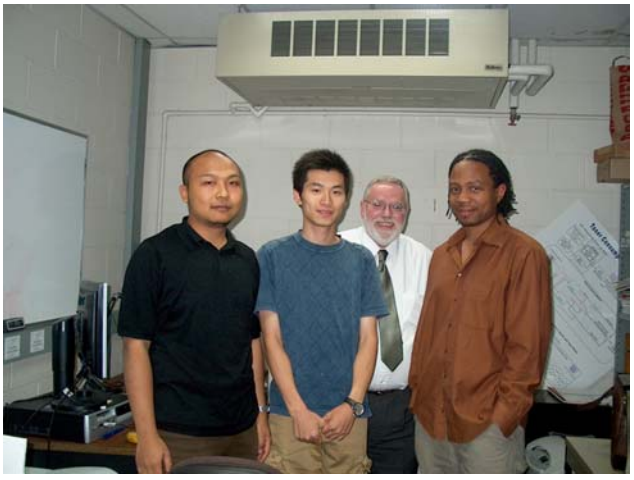
Shayna Williams, now having finished her junior year at Claremont-McKenna, returned to participant again in the ’07 session. It’s not too common for a student to take part in our program twice, but Shayna has everything it takes to be a brilliant scientist. One key objective at NSF for the REU program is to encourage young people to make a career in science and research, and when we find an extra-extraordinary young person like Shayna, we do everything we can to

nurture the intellectual gift and develop the talent for science.

In ’07 we had seven different research projects carried out by our team. Four of these ended up going to the 2007 Sigma Xi national competition in Orlando, FL. There were well over two hundred research projects entered in the competition that year. For some reason, the organizers of the Orlando conference chose that year to have only a single category of award, a medal corresponding to the blue ribbon of years past, rather than the usual three-ribbon tiered method for judging the contest. I didn’t approve of that change; after all, one big purpose for this competition is to help inspire talented young people to go on to a career in research and I don’t see how a one-winner system of judging the competition serves that. But hubris and elitism aren’t rare in the academic world, unfortunately, and a lot of things go on in Florida that I think are pretty oddball and sometimes outright dumb.

That year they awarded twenty-five medals for the most outstanding research projects, and we won two of those. Shayna repeated her blue ribbon performance for the second year in a row, continuing to build on her work of discovering the genetic correlates of boldness in zebrafish. The team of Alan Flavel, a senior double majoring in math and electrical engineering (back row, second from the left in the picture above), and Meredith Drennan, a junior majoring in electrical engineering (front row, second from the right in the picture above) took the other medal for their project on the design of an artificial neural network capable of ‘learning’ through human-like psychological conditioning. Albert Bush, a junior majoring in math (back row, third from left) and Linda Mummy, a sophomore majoring in math (back row, fourth from left), presented their team project which involved neural network modeling of the development of early sensorimotor learning in human infants. Kimberly Russo, a junior majoring in biology (front row, third from the left), presented her work on factors that control normal and abnormal development of the retina in zebrafish eyes. Personally, I think if the Orlando competition had been using the traditional three-ribbon system, both these projects would have probably won gold ribbons. They were that good. □

XI. Epilogue



Three of our computational neuroscience graduate students and me in my lab (2007). They are, from left to right, Lungsi Sharma, Junwei Zhang, and Richard Hill.

Well, that brings me up to the present and what will follow in my life only God knows. I’m not so old yet according to the calendar, but every year always seems anymore to go by faster than the one before. My guess is I probably have a dozen useful and productive professional years ahead of me yet before I come to retirement. My guess is also that these will seem to go by in no time at all. Maybe by then I’ll have done all I can and be able to say I have kept the Promise I made so many years ago.

A few things aren’t too tough to predict. My term as neuroscience director runs until the end of spring semester of 2009, so I know I’ll be doing administrative things until then. After that it’ll be another colleague’s turn for awhile. I didn’t come to the university to be an administrator. The current funding for the neuroscience REU runs through the end of 2009, so I’ll continue to guide this wonderful and successful program and I’ll be putting in the necessary proposal to NSF to keep it going after 2009. I think for the next proposal I’ll probably be bringing in a younger colleague as co-principal investigator and training him or her to take my place some day as director and principal investigator. There’s no reason the REU program shouldn’t long outlast me with the right people at the helm and the 2009-10 session feels like a good time to start breaking in my replacement. After all, I haven’t been immortal for a

long time now.

Touraj tells me he'll be retiring in just a few more years. I tell him he's not allowed to retire until I do. He's a terrific leader of the Institute and it'll be hard to find a new Director as good as he is after he retires. I know the new Director won't be me. I don't want the job and I know I couldn't do it as well as Touraj. His shoes will be hard to fill and they're too big for me.

Discussing the modeling of brain systems with graduate student Richard Hill (Mar. 2007)

Most important of all are the students. At the rock bottom of things, the students are why I'm here and they are the reason I do what I do. The majority of my students will continue to be undergraduate students in engineering and most of the rest will be engineering graduate students. But hopefully the neuroscience program will continue to grow and more of my students over time will come to be computational neuroscience graduate students. I do believe neuroscience is the science of the twenty-first century. Computational neuroscience is a fresh young science and it's exciting to be part of its youth and perhaps have a little influence on how it develops in the years to come. I do have a few ideas of my own in regard to a possible program of research I think might one day prove to be useful in unraveling the mystifying complexities of how the brain is organized and how its biological and psychological dimensions might be integrated with the theory of mind presented in my 2006 E-book. Time will tell whether my approach will be a large success, a modest one, or not a success at all. I have reason to feel optimistic, but it is the nature of research to uncover unanticipated surprises. As I tell my graduate students, somewhat tongue in cheek, "If we *really* knew what we were doing, we wouldn't be doing research." That really is the big difference between inventing and doing research.

Teaching is at the center of what I do and it's going to stay at the center. Yes, it's fun to do research. It's fun to keep learning new things every year. There's a tremendous amount of personal satisfaction in the scholarly work I do, and I do still have electronic brains to bring into existence. But teaching is the core. Teaching and developing the young people who will own the future of America is the best and most important thing I do to keep the Promise I made forty-five years ago.

There is a kind of magic in being a teacher. Would you like to hear something sublimely marvelous? From time to time – usually when I've spent too many hours at a stretch doing paper or committee work – I get in a cranky and irritable mood. But I have found that no matter how bad a mood I might be in, all I have to do is see my students and my bad mood evaporates like the morning dew on a summer day. That's the magic. My students bring me inner joy every single day. Some of them of fearfully serious, some of them are a little goofy and rambunctious, most of them are inexperienced and often more than a little naive. But all of them hold this magic for me. I tell my colleagues I really don't mind spending all day long in meetings provided the people I'm meeting with aren't old enough to legally drink. In mind and body they are youthful adults in the bloom of the high summer of life, but their hearts are still unsullied by the world and still beat with the idealism and innocence of the springtime of childhood. They are now in the best and freshest passage of life, and somehow their youth renews me. I think Charles Kingsley captured the spirit I'm trying to describe:

> When all the world is young, lad,
> And all the trees are green;
> And every goose a swan, lad,
> And every lass a queen;
> Then hey for boot and horse, lad,
> And round the world away;
> Young blood must have its course, lad,

And every dog his day.

If there ever comes a time when I no longer feel this special magic, I'll know the time has come for me to go. It will mean I'll have given everything I have in me to give and the time has come to make way for a younger person to take my place. It will be time to pass on the torch.

Across the street from the Institute there is an elementary school. When I take my breaks during the day I usually go out to the balcony that runs around the outside of the building and watch the little tykes at play during recess on the school playground. All of them are belt-buckle high at their tallest, and I get a big kick out of watching them. They never walk when they can run. They never talk when they can shout. They chase each other around, swing like little monkeys on the monkey bars, tumble all over each other, and just generally go about the business of being little kids. When school lets out in the afternoon, they come trooping out to get on the bus or into mom's car wearing backpacks that are almost bigger than they are. They're comic and alive and energetic and innocently wonderful. I saw one little boy one day – he couldn't have been older than about fourth grade – riding his bicycle down the street. Every second push of the bike pedal, he rose up on the pedals and let out a shout, *Woo! Woo! Woo!* as he went on his way, completely oblivious to the idea anyone could see or hear him. He was in his own magic world. The little tykes remind me of my own childhood back in Maquoketa so many, many years ago, and they make me feel so much more appreciative now than I was then at how very, very lucky I was to have been born where I was born and when I was born.

Then there are the young assistant professors. There is always a new generation coming up behind in an unbroken succession. The young professors are mostly still in the summer of life, fresh and eager to begin their careers and make their marks on the world. With each passing year I'm finding it harder and harder to tell at a glance on the first meeting who is a young colleague and who is a graduate student. The march of life is seamless and one generation blends into the next. I am now what was once called an elder and with this comes a responsibility to coach, to mentor, to help those who will one day be what I am now, to help prepare them to take my place. I take this as an *obligation* to my country and to society. My affection for them is barely less than the affection I feel for my students, and I took this duty upon myself years before they were even born on that sad night in my special place when I made my Promise.

No person knows the span of the years of his or her life but I am aware that I'm coming to the end of the autumn of mine and that ahead lies the wintertime and my final season. This is no cause for melancholy and, for me at least, brings no dread. Whatever is to come and whenever it comes, my faith tells me one unshakeable thing: God never makes a mistake. Not ever. For every grief, for every pain, for everything I have experienced in my life, something good and fine came out of it eventually. My life has taught me to trust God unconditionally. The one thing I ask God for in my prayers is that however my own life comes to an end, I will be able to find the strength of character within me to meet that end with quiet dignity and the ability to keep my self respect. This is what I ask for myself. The rest is up to God and I'm okay with that.

I don't know if there is anything waiting beyond the grave, but I think there is. There are many things in my faith that don't really make much sense if there isn't. But I don't know for sure and I'm okay with not knowing. What I do hold to be true first and foremost is God never makes a mistake and that's enough for me. In the end that is what the word *faith* comes down to meaning: simple, categorical trust in God. I think that of all the manifold human virtues, it must be true that God values faith above all else. Faith is holding to be true that which you know you can't know for certain. Preachers who preach that the Bible is the revealed word of God, whether they mean to or not, are really trying to substitute doctrine for faith. That is a poor and fragile and empty substitute without any moral worth at all. Faith trumps certainty.

I think life is like a school and its purpose is discovered in self-formation. St. Anselm had a motto, *Faith seeking to understand,* and I think Anselm got this right as a dictum for how to lead one's life. Of all the things each of us is faced with understanding in life, I think the most important is, *What kind of person will I make of myself?* Kant believed every person is born with an innate Moral Law built right in,

but here Kant was wrong. What my study of mental physics has taught me is that we are each born not with an in-built moral law but instead with the in-built ability to *build* a Moral Law within our own hearts. The process in which one does exactly this is called *life*. That is why coming to know and decide what kind of person you will make of yourself is so important. The person you choose to make yourself reflects the quality of the Moral Law you build in yourself. Love, friendship, joy, conflict, triumph, grief, service, duty: these are the experiences in life from whence come the raw material for the Moral Law each of us erects in our individual hearts. We all learn from experience, make mistakes, and are blessed with the capacity to learn from those mistakes and, through new understanding, to make ourselves into the kind of person we choose to be. No one can choose this for another person. It is the one thing each of us must choose for ourselves. I think *coming to understand this choice* is the real task of a lifetime. I think that is why each of us is here: to teach ourselves to recognize and learn to act from *a good will*, and to be a catalyst for others in learning and in-forming their own choices.

Dogma only confounds and confuses and works against this purpose, erecting a wall of willful ignorance between a person and God. You do not learn to know God from a book. I think in life none of us serve God. Does a little child serve its parents? Does God need to be served? No. I think life is a preparation for something. What that something might be I do not know, but I think the virtues we choose to nurture in the person we choose to become probably do much to determine it, much like what the child chooses to learn and master and love greatly determines the adult he or she will be.

So what has my life taught me?

I think maybe the biggest lesson has been that the good life is not about things. For me it has always been – even before I realized it – about the people I have lived it with. There are some who look upon me as a 'self-made man' and there is a germ of truth to this. But my life has not been an island and I never at any time 'pulled myself up by my own bootstraps' (as the saying goes). At every step along the way there have always been others who lent me a helping hand when I needed one, who made my life richer by being a part of it, from whom I've learned and grown from this learning, who have presented me with challenges to learn how to overcome, or from whom I've received and given love and affection. No, the good life is not about things; it is about the people in your life. The very best part of my life has been and always will be my family and my extended family of those who became my brothers.

Everything that has ever happened to me worked out for the betterment of my life. There is a corner in my heart where I wish the long years when I estranged myself from my father had not happened, but even here there was a good that grew. I learned in that time to respect myself, and through learning self respect I learned in time to respect others. I learned to be self reliant and I learned the limits of self reliance and the need to trust and rely on other people, and I learned the virtue of becoming someone who others in their turn could rely upon. In the fullness of time the estrangement I felt towards Dad faded and the son did give himself back to the father, so even that was only a passage. Do you want to know something marvelous? I think my dad never knew for a single second there even was any estrangement. I've thought about this very carefully, sifting through my memories, and I can find not one hint or clue that he ever knew of it. I took myself away from him for many long years, yet *he* never lost *me*. The older I get, the more this seems miraculous to me. My life has taught me to think life contains myriad miracles, all small and subtle and so evanescent that God is never caught in the act and so the need for faith is never damaged or displaced. In my work as a scientist I can not and do not give countenance to miracles because science cannot make any practical use of miracles and still be science. That is why so-called 'creation science' is a fraud and a lie, a hoax trying to masquerade as science and as without substance as astrology or ghosts or witchcraft.

But in living my life, I have learned to count on them. Not the big miracles claimed in the Bible. I don't believe in them at all. But small gossamer miracles, yes. I think there are a lot of these. Call them 'coincidences' if you wish because that's what they look like. I don't believe in coincidences.

I learned to live and govern my life by a creed long before I ever knew any words to express that

creed. But I recognized the first time I saw them these beautiful words that gave my creed a voice: *To believe in the Life of Love; To walk in the Way of Honor; To serve in the Light of Truth.* These are not just words for me; they are the soul of my pure Reason.

I learned why to love my country and how to love her. I love America because of the shining Ideal that is the soul of the Idea of America: *liberty with justice for all.* I *felt* the *righteousness* of this Ideal in my core as an instinct when I was a little boy long before I began to understand the Ideal itself. Like all Ideals, liberty with justice for all is not a state of being but a perfection to continuously strive to achieve.

The striving to achieve it is called *citizenship* and citizenship is how to love America. Citizenship is not a right and it is not a privilege. It is a *Duty*. Citizenship is not a state of being but acting to uphold and cherish and strengthen and protect and teach the social contract that binds individual people into one People. History teaches us no society and no country endures unless its people take it onto themselves to accept the social contract as an obligation. The Roman historian Livy shows us in his writings how Rome grew in prosperity and majesty while the people of Rome *lived* their social contract and the government of Rome was a *res publica,* a public affair. This is where the word 'republic' comes from and the Roman Republic was the first republic in history. The American historian Will Durant shows us how the Roman Republic fell and the Roman Empire was born when its citizens ceased to live their social contract. I think the fatal weakness of the Roman Republic can be found in its class system, the patricians and the plebeians, and the fall of the Republic went hand in hand with the economic subjugation of its plebian class. By the time of Caesar Romans had become divided into the great majority living in grinding poverty and the tiny few into whose hands the wealth of their society had fallen. The crucial strength of the American Republic was founded on an Ideal of classlessness. The long shameful history of slavery in our country does not alter this fact. The existence of grinding poverty in our country does not alter this fact. Liberty with justice for all *is* our American Ideal, it *is* something for all citizens to strive for. Everything else stands or falls on this. There can be neither liberty nor justice for all in a country where economic slavery is tolerated and dismissed as 'the natural state' even if that slavery involves neither bondage nor whips and chains.

The leaders of our founding fathers were men well educated in the lessons of history and the political theories of Locke, Rousseau, and other great Western thinkers. In *The Social Contract* Rousseau wrote,

> Man is born free; and everywhere he is in chains. One thinks himself the master of others, and still remains a greater slave than they. How did this change come about? I do not know. What can make it legitimate? That question I think I can answer.
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> If I took into account only force, and the effect derived from it, I should say: "As long as a people is compelled to obey, and obeys, it does well; as soon as it can shake off the yoke, and shakes it off, it does still better; for, in regaining its liberty by the same right as took it away, either it is justified in resuming it, or there was no justification for those who took it away." But the social order is a sacred right which is the basis of all other rights. Nevertheless, this right does not come from nature, and must therefore be founded on convention. . .
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> I suppose men to have reached the point at which the obstacles in the way of their preservation in the state of nature show their power of resistance to be greater than the resources at the disposal of each individual for his maintenance in that state. That primitive condition can then subsist no longer; and the human race would perish unless it changed its manner of existence.
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> But, as men cannot engender new forces, but only unite and direct existing ones, they have no other means of preserving themselves than the formation, by aggregation, of a sum of forces great enough to overcome the resistance. These they have to bring into play by means of a single motive power, and cause to act in concert.
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> This sum of forces can arise only where several persons come together; but, as the force and liberty of each man are the chief instruments of his self-preservation, how can he pledge them without harming his own interests and neglecting the care he owes to himself? This difficulty,

in its bearing on my present subject, may be stated in the following terms:

> *"The problem is to find a form of association which will defend and protect with the whole common force the person and goods of each associate, and in which each, while uniting himself with all, may still obey himself alone, and remain as free as before."* This is the fundamental problem of which the *Social Contract* provides the solution.
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> The clauses of this contract are so determined by the nature of the act that the slightest modification would make them vain and ineffective . . . These clauses, properly understood, may be reduced to one – the total alienation of each associate, together with all his rights, to the whole community; for, in the first place, as each gives himself absolutely, the conditions are the same for all . . . Moreover, the alienation being without reserve, the union is as perfect as it can be . . . Finally, each man, in giving himself to all, gives himself to nobody; and as there is no associate over whom he does not acquire the same right as he yields others over himself, he gains an equivalent for everything he loses, and an increase of force for the preservation of what he has.
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> If, then, we discard from the social compact what is not of its essence, we shall find that it reduces itself to the following terms:
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> *"Each of us puts his person and all his power in common under the supreme direction of the general will, and, in our corporate capacity, we receive each member as an indivisible part of the whole."*
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> At once, in place of the individual personality of each contracting party, this act of association creates a moral and collective body, composed of as many members as the assembly contains votes, and receiving from this act its unity, its common identity, its life and its will. This public person, so formed by the union of all other persons formerly took the name of *city,* and now takes that of *Republic* or *body politic.*

Those who today call themselves conservatives and advocate for the abolition of all regulation and all restraints of government over the individual's unalienated right to do howsoever he pleases do not advocate for republicanism. They advocate for a return to a state of nature whose logical and inevitable consequence is anarchy, brutality, and lawlessness. These advocates have no right to hide behind the name Republican. They are the antithesis of republicanism. Those today who call themselves liberals and advocate for special laws, passed in stealthy manners so that the public gaze does not fall upon these acts of legislation, advocate for an unequal distribution of rights and powers and so, like the conservatives, advocate the betrayal and destruction of the social contract. Both ways can exist and sustain themselves only through *rulers,* and the ultimate perfection of ruler-ship is tyranny. Citizenship must oppose both.

Our leaders who drafted the Constitution knew this, and they knew achieving a true republican form of government was an art requiring great care to construct and perfect. In *The Federalist* (number 39), Madison wrote:

> The first question that offers itself is, whether the general form and aspect of the government be strictly republican. It is evident that no other form would be reconcilable with the genius of the people of America; with the fundamental principles of the Revolution; or with that honorable determination which animates every votary of freedom, to rest all our experiments on the capacity of mankind for self-government. . .
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> If we resort for a criterion to the different principles on which different forms of government are established, we may define a republic to be . . . a government that derives all its powers directly or indirectly from the great body of the people, and is administered by persons holding their office during pleasure, for a limited period, or during good behavior. It is *essential* to such a government that it be derived from the great body of the society, not from an inconsiderable proportion or a favored class of it; otherwise a handful of tyrannical nobles, exercising their oppressions by a delegation of their powers, might aspire to the rank of republicans and claim for their government the honorable title of republic.

To prevent tyranny and to make republican government practicable, the framers set up a government on principles of checks and balances. The balances were to come from the division of government into different parts: legislative, executive, and judicial. Each was to have checks against usurpation of power by the others. But the most important check depended on the people – you and me – themselves. In *The Federalist* (number 51), it is written:

> In order to lay a due foundation for that separate and distinct exercise of the different powers of government, which to a certain extent is admitted on all hands to be essential for the preservation of liberty, it is evident that each department should have a will of its own; and consequently should be so constituted that the members of each should have as little agency as possible in the appointment of the members of the others. . .
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> But the great security against a gradual concentration of the several powers in the same department consists in giving to those who administer each department the necessary constitutional means and personal motives to resist encroachments of the others. The provision for defense must in this, as in all other cases, be made commensurate to the danger of attack. Ambition must be made to counteract ambition. The interests of the man must be connected with the constitutional rights of the place. It may be a reflection on human nature that such devices should be necessary to control the abuses of government. But what is government itself but the greatest of all reflections on human nature? If men were angels, no government would be necessary. . . In framing a government which is to be administered by men over men, the great difficulty lies in this: you must first enable the government to control the governed; and in the next place oblige it to control itself. A dependence on the people is, no doubt, the primary control on the government . . .
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> It is of great importance in a republic not only to guard the society against the oppression of its rulers, but to guard one part of that society against the injustice of the other part. Different interests necessarily exist in different classes of citizens. If a majority be united by a common interest, the rights of the minority will be insecure. . . In a free government the security for civil rights must be the same as that for religious rights. It consists in the one case in the multiplicity of interests and in the other in the multiplicity of sects. . . Justice is the end of government. It is the end of civil society. It ever has been and ever will be pursued until it is obtained or until liberty be lost in the pursuit.

In my lifetime I have watched the slow and steady decay of this principle as divisions of government give way to the divisions of political parties, to the extent where today unholy alliances exist between the Congress and the Executive along party lines, and in which the duties vested in Congress are neglected and subordinated to the desires of the parties. The very existence of but two strong political parties is antagonistic to the framers' intention that there exist a multiplicity of interests, and the sly clauses in the War Powers Act, the so-called Patriot Act, and other politically-induced abandonments by Congress of its Constitutional interests and obligations is, I think, the direct consequence of this. But in all the years of my life, the most rapid disintegration of checks and balances has taken place in the Bush years. I am afraid the consequence is too terrible to be credible at first glance: we are no longer a republic.

I think it is no coincidence that the march away from the principles of our republic has gone forward hand in hand with the disappearance in public and higher education of the golden principles contained in the Great Books, particularly in the sphere of civics, political science, and the study of western civilization. Two years ago I asked some of my young students what was being taught in the civics courses in junior high and high school. I was astounded to find these students did not even know what the word 'civics' *meant.* It does not surprise me when even highly educated people have never heard of Rousseau or Locke or Mill. I only learned these men ever lived because the spirit of the principles they authored were part of the moral leadership training I received as a teenager in the Civil Air Patrol; and because the spirit of these principles is so compelling, I made myself track down the great works and I studied them for myself.

Citizenship calls upon each one of us, as a *duty,* to be part of the political process – not as Democrat or

Republican but as *American.* When the great moderate majority of our country pays no attention to the issues of government, only the extremists on both sides of the spectrum know what they want, and both ends of this spectrum want to rule us rather than lead us. Control of our government by our people can be preserved by nothing less than an interested, informed and *educated* electorate.

I have noticed with no little alarm in the past decade how party partisans – particularly Republicans – have dismissed higher education as nothing more than a private good and no longer a public good. Of all the attacks upon America from within, this is the most insidious. But we educators are left vulnerable to this attack because of the ill-founded ideas of the radicals of the sixties that led to the death of liberal education across the breadth of our country. Small wonder this has seeped down like a mold into the public schools as well. People today clamor over more emphasis in math and science in the public schools; this is not our most urgent need. Our most urgent need is *citizenship* education, and this means providing our youngsters with exposure to the Great Ideas of Western thought the American republic was founded upon. That is what 'liberal education' *means.* Liberal education is nothing else than education about preserving, protecting, and perfecting liberty with justice for all.

This year, barring evil catastrophe, will be the last of the Bush years, and good riddance to them. There has been a beacon of bright hope that has appeared already in the round of primary elections. There seems to be enormously more turnout for the primaries and caucuses than I have seen in many years now. Perhaps it is a sign of a reawakening of the body politic of America. I hope so. Watching the election and caucus outcomes, I am heartened to see evidence that we are again seeking for the best men and women to fill our public offices, and to see evidence that perhaps the hold on power of the two parties is weakening. I'm not sure about the latter yet. I am particularly distrustful of the so-called 'super delegates' being used by the Democrats this year. And I do know that the response to the crises our country faces cannot be settled in only one day by the mere casting of ballots. The Congress is broken and it is supremely important for us *as citizens* to see to its repair. But I have a greater level of hope than I have had in many years now that our country will right itself and re-establish the true nature and vitality of our republic. As for me, I have decided on who I am supporting. In Senator Obama I see the reflection of President Kennedy. I don't *know* I won't be disappointed once again, as I was ultimately disappointed by President Reagan. I don't even yet know if Senator Obama will be the Democratic candidate. But to turn Congress back to the path of its long-neglected duty will take a leader who is not in the mold of those who now control both parties, and I think Senator Obama is that leader. I hope so.

Whether he proves to be so or not, I will still work to keep my Promise so simply but sublimely set out in the words of President Kennedy nearly a half century ago: Ask not what your country can do for you; ask what you can do for your country. That was the Promise I made; it is the Promise I will keep for all the days of my life. It isn't a hard thing to do. I don't have to be President or a congressman or even a city councilman to keep this promise. All I have to be is an American citizen.

Some day my time will come to an end. Although I may be the only one who might think so, I think on the whole I've led an interesting life and one that has been worth the living. I hope when my time is up there will be some who think me worthy to be carried in their hearts as I carry all those people I have loved over the years who have passed on before me. I do know what I would like my own epitaph to be. The words were penned more than a century ago by the poet Matthew Arnold:

> Is it so small a thing
> To have enjoyed the sun,
> To have lived light in the spring,
> To have loved, to have thought, to have done;
> To have advanced true friends,
> And beat down baffling foes?

All these things this Maquoketa boy has done. □ □ □