

# 2008-2009 University Research Professors

## Craig Rush: Paying Close Attention to ADHD

Inattentiveness, inability to work, procrastination, and feeling distant from others. These are the symptoms of attention-deficit hyperactivity disorder (ADHD), a condition that affects an estimated eight million adults in the United States. ADHD usually persists throughout a person's lifetime, impacting his job, and family and social relationships.

Fortunately, a drug is available that works and works well to counter the effects of ADHD—Ritalin. It's a mild stimulant that increases alertness, but, as with any medication, it has side effects. Craig Rush is testing an alternative drug that shows some promise of fewer side effects.

Rush, who speaks in a steady baritone, is leading a clinical trial of a new drug, Strattera, a non-stimulant that may work equally well as Ritalin but won't increase the craving to smoke. Since Strattera has been on the market for a relatively short time, not a lot is known about it. Strattera appears to provide 24-hour coverage that might carry over into the next day, and the drug's antidepressant properties may provide effective treatment for those with depressive and anxious symptoms in addition to ADHD.

Rush's ground-breaking study includes two groups of smokers, those who have ADHD and those who don't. Here's how it works. A volunteer comes to Rush's "lab"—actually a suite of rooms off campus—and is given Strattera in pill form. After an hour, the time it generally takes for the drug to take effect, the subject, unaware of the study's hypotheses, is taken to a small ventilated room and given no instructions. "The room has a recliner, a TV with a DVD player and a stack of DVDs, and a wide variety of magazines," Rush explains.

A pack of the subject's preferred brand of cigarettes is also there, as well as a basket of snacks. "We're not only monitoring smoking, but also their eating behavior, because Strattera might also be an appetite suppressor. We're curious about the differences, if any, between calorie intake of the two groups."

So far in this study, the 12 subjects in the control group have been filmed, and their smoking and eating habits assessed. Several of the ADHD volunteers have also completed the study.

"What we know so far," Rush says, "is that Strattera didn't increase smoking among the control group. Its effect was negligible. Of course, we hope this drug will have a similar non-effect on the ADHD group."

Rush was "happily surprised" to win a Research Professorship this year and says that some of the money has already gone to hire a graduate student, Megan Poole, to work on this project. "This study will funnel into her master's thesis, and I'm glad we are able to give Megan this support," he says. ■ JW



"One of the problems with Ritalin is that because it's a stimulant, it increases a person's urge to smoke," says Rush, a UK professor of behavioral science who has been studying the pharmacology of drug abuse for 17 years. "Young adults who are dealt the ADHD card are already at increased risk to smoke—over twice as many people affected with ADHD smoke compared to adults without the condition—so this Ritalin side effect may be one that patients down the road can't afford to risk."

## John Anthony: Going Green with Carbon Electronics

You know the chorus from that old Irving Berlin song: “Anything you can do I can do better. I can do anything better than you.” It pretty much sums up UK chemist John Anthony’s challenge to silicon-based technology. His goal is to take anything you can make with silicon (think ceramics) and make it cheaper and greener with carbon (plastics).

Liquid-crystal displays (LCDs are the hot HDTV sets) and radio-frequency identification (RFIDs are tiny white tags that already appear on some products and will one day replace barcodes) are made from pricey and brittle silicon. But Anthony is tweaking carbon-based molecules to do these things and more.

Anthony, an effusive teacher who says his goal is to get his students to understand how the minutia fits into the big-picture solution, is constantly looking for the next big thing. For several years Anthony has been working on flexible solar cells (tiny semiconductors that convert solar light into electricity) to replace expensive silicon solar panels. (See *Odyssey*, Winter 2007, “Green Energy.”) In a new project, scientists at Cornell University are making solar cells using his tailor-made molecules and buckyballs.

Buckyballs (a.k.a. fullerenes) are soccer-ball shaped molecules composed entirely of carbon atoms. “The intrinsic electrical properties of these things make them great for solar cells,” Anthony says, citing good electrical conductivity and heat resistance. A lot of companies are working on buckyball-based products, but buckyballs aren’t green, and Anthony explains that’s due to the fact it takes a lot of electricity to produce them. “You have to shoot enough juice through graphite to turn it into a gas. And then only a fraction of what you get is buckyballs.

“That’s why we’re jumping in, with our friends at Cornell, to replace buckyballs with cheaper materials and get the work commercialized. A year or two down the road—when you’ll need to drop the price of the technology to really get consumers to buy in—we’ll be ready with a greener and cheaper replacement.” Anthony’s green solution is to chemically transform petroleum byproducts and coal waste into molecules suitable for solar cells. “We can convert 5 percent of the sun’s energy into electricity with our best buckyball mix, and we’re working on matching that with these green molecules.” He adds that his Research Professorship funds are supporting a grad student who has

just submitted her first publication on new materials for low-cost plastic solar cells.

Anthony’s tackling another hot technology—flat-panel displays. Think a beautiful flat-screen TV, but one that rolls up and fits in your briefcase. “The display market is the one area where consumers are still spending money. If we can make something ultra-thin, flexible and low-cost, people will want that technology.” In 2005, Anthony founded Outrider Technologies, a company that makes semiconducting materials for a range of applications, especially displays.

He shows a picture of a black and white, 10.5-inch display made by Sony. Incredibly, this flexible, see-through display—no thicker than a dozen sheets of paper—is made by inkjet printing. Anthony’s molecules are dissolved in a solution and the inkjet printer sprays them onto a flexible material. “My molecules form the control elements, the on-off switch, and this



display is 76 dpi—that’s a better resolution than my laptop monitor,” Anthony says.

But Anthony’s not stopping there. His next green display idea—replace the inkjet printer (the solutions required give off volatile organic compounds, chemical gases that contribute to indoor air pollution) with simple crayons. “Yeah, people laugh at my pie-in-the-sky semiconducting crayon. You’d just take the molecule itself and scribble. No waste, no solvent, totally green.” ■ AG

## Jim Griffioen: Inventing the Next Internet

It's a good thing the future of the Internet doesn't depend on Jim Griffioen's gaming skills. Griffioen, director of the UK Laboratory for Advanced Networking, laughs as he admits, "I'm one of the worst game players you've ever met. Challenge me to any computer game, and I will lose." But the next generation of the Internet—and all the things we use it for, from interactive gaming to scientific computing—will certainly be shaped by Griffioen's back-to-basics research funded by the National Science Foundation.

His "Postmodern Internetwork Architecture" project asks the question, "If we took a clean-slate approach to the Internet, what would we do differently?" Griffioen's work with fellow UK computer scientist Ken Calvert and cohorts at the universities of Maryland and Kansas seeks to answer that question.

Griffioen, whose career began on an Apple computer in math class his senior year of high school, says, "In looking at how the Internet has evolved over the past two decades—what it was designed to do and what we're making it do now—we've learned a lot of lessons."

When the Internet was first conceived, the goal was

simply to get computers on different networks to share information. The backbone of the Internet is made up of routers. Acting as baggage handlers, routers process chunks of information, called packets, and forward them to their destination.

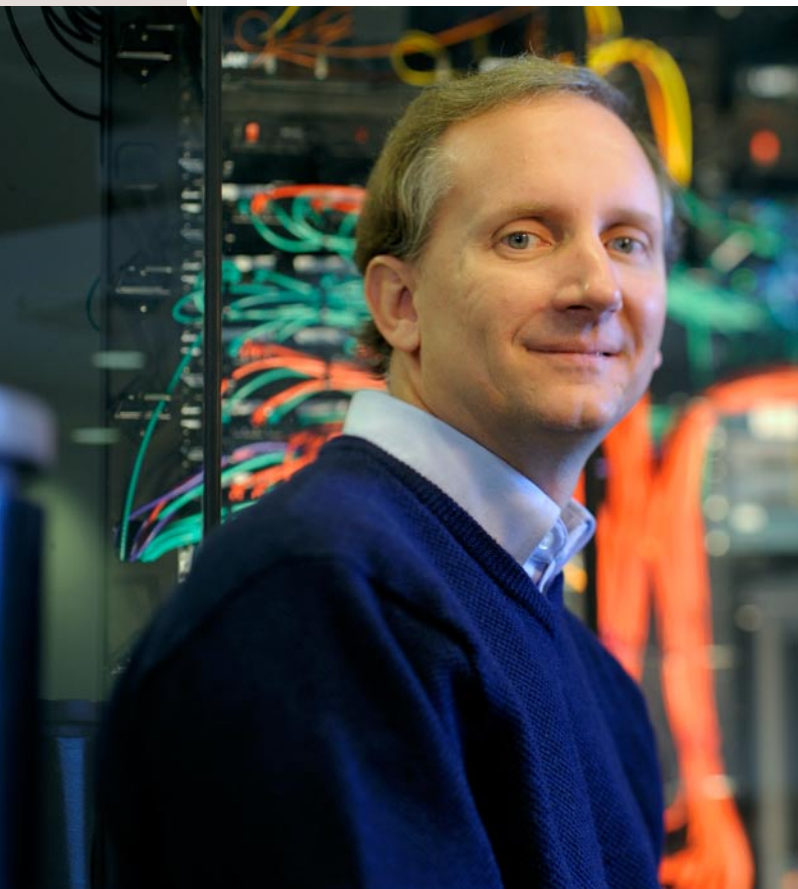
Griffioen explains that routers weren't designed to handle issues like security, privacy and authentication ("How do I verify that I'm talking to who I think I'm talking to?"). These issues have been addressed by stopgap mechanisms and "overlay" networks, which "are not particularly well-designed and won't be necessary if we rework the fundamental architecture of the Internet," he says.

Part of his plan is to provide each packet with "motivation." He gives an analogy: "It's like the packet has cash. So when it gets to the router, it says, 'Here, I've got money. I'll pay for my ticket across to the next stop.'" The packet would get this "cash" along with a "stamp of approval" before entering the network.

The biggest change Griffioen proposes is taking the "rules" away from the routers. Right now routers have a built-in set of rules, or policies, that they apply to every packet they encounter. If a hacker sends an email with a malicious attachment, the router forwards that packet like all the others. Internet service providers (companies that sell access to the Internet) have created mechanisms like filtering and firewalls to try to combat these nasty interlopers. But "as anyone with email has experienced," Griffioen says, with a knowing look in his ice blue eyes, "sometimes these filters make mistakes." Legitimate emails can end up in your spam folder or good attachments can be blocked.

"We want to build an infrastructure that decides the policies outside the network and then tells the routers which packets to forward, so the problem where routers forward a packet just because it got into the network largely goes away," he says.

By separating the policies from the network, Griffioen adds, senders will have more control over where their packets go. "Right now each router acts independently to choose the shortest path between point A and point B. If a mechanism outside the network could identify multiple paths between A and B, and send packets over three or four paths at once, the Internet could much more quickly and efficiently deliver high-definition video. Right now we only get a single path, and I want to change that." ■ AG



The UK Board of Trustees first awarded University Research Professorships in 1977. The goal of these \$35,000, one-year professorships is to enhance scholarly research and awareness of UK's research mission by recognizing outstanding faculty.

## Jonathan Glixon: The Music of the Sisters

Practice, practice, practice. Any of us who have played an instrument have had this exhortation drilled into us. UK musicologist Jonathan Glixon says that in his early teens he decided he wanted to play the violin professionally, but encountered a major stumbling block: he hated to practice. “Then in high school I met a musicologist and realized I could do music but never have to practice again! That was a major turning point in my life,” says Glixon, a professor in the UK School of Music whose office in the small Wesels House on Rose Street is a storehouse of books on sacred music, Venetian opera, and Renaissance and Baroque music.

Glixon's interest in the history of music took him to Brandeis University, Princeton University—where he earned a Ph.D. in musicology in 1979—then to UK four years later. In his quarter century here, he has received fellowships from the National Endowment for the Humanities, and grants from the American Council of Learned Societies and the American Philosophical Society. His articles have appeared in many American, Italian and British publications.

*Honoring God and the City: Music at the Venetian Confraternities, 1260-1807*, Glixon's first book, was published by Oxford University Press in 2003. “Confraternities are religious and charitable organizations of laymen, who also used music in their ceremonies and other observances,” Glixon explains. His history chronicles the music practices of confraternities over a 500-year period.

Glixon's second book happened, he says, by accident. “In a dusty old Venetian archive—most of what I do involves reading old books—I discovered documents having to do with 17<sup>th</sup>-century opera that were in the collection of one of these confraternities.” Glixon couldn't wait to tell his wife, Beth, who also teaches in the UK School of Music and usually goes with him on his research trips to Italy. “Beth's field is Venetian opera, and she was thrilled by what I'd come across.” This serendipitous discovery led them to do further research in this area and co-author *Inventing the Business of Opera: The Impresario and His World in Mid-Seventeenth-Century Venice*, published by Oxford University Press in 2005.

Glixon is currently working on a book on the role of music in the lives of Venetian nuns in the 16<sup>th</sup> to 18<sup>th</sup> centuries. “I'm interested in the music they performed in their religious services and also the music that was performed for them. Books they owned. Organs they built.”

This is the “formal” music that helped shape the nuns' lives, but Glixon is also studying other music that floated their way. “Sometimes the nuns heard music they weren't supposed to hear,” he explains, “from outside the walls of the nunnery. Love songs, perhaps, or maybe,” he adds, with a slight smile, “some guys floating down the canal singing dirty songs.”

Glixon's work on this book will be accelerated by the Research Professorship, he says, because now he can “buy time” from teaching and work on the book full-time.



“One of the aspects of this work that I've always found interesting is how women lived when equality with men wasn't possible, when they weren't granted a voice in how society was run. Even though these nuns were the most suppressed group of women, locked away from public activity, they found ways of expressing themselves either directly or indirectly, of making a life for themselves.” ■ JW