Companies now incubating **13**

Companies incubated since 2006 **23**

Companies growing since leaving the incubator **10**

Money raised since 2006 **$90 million**

People employed by current incubator companies **70**

Companies failed **3**

Money raised by current companies **$45 million**

Companies acquired since 2006 **3**

BU student interns working at companies in the incubator since 2006 **80**

10 Interns hired as full-time employees by companies in the incubator

Jobs created since 2006 **150**

{ *Part* ONE *of a* TWO-PART *series* }

On the sixth floor of Photonics, a dozen young companies are learning to fly

BY ART JAHNKE

Start-up Ville

FOR FIVE YEARS, Raj Mohanty tinkered in a kind of parallel universe, an odd place where objects were so small they could be seen only with a scanning electron microscope and movements were so quick they were measured in billions of oscillations per second. For Mohanty, a College of Arts & Sciences associate professor of physics, nanoscale structures were intriguing stuff, and his investigations were driven by a fascination with the science and a kind of arm's-length hope that his efforts would someday be useful and profitable.

"You just keep working on something," he says. "And from time to time you have an idea that may be relevant in the marketplace."

Mohanty's market-relevant idea came in fall 2006, when he found a way to use silicon to make very small resonators — chiplike devices that oscillate at extremely high frequencies. He knew, as would most physicists, that the device he had created could be put to work as a clock, replacing the much larger quartz crystal timepieces used in radio transmitters for the last ninety years. He also knew that the market for such an innovation, which was well suited for cell phones and other wireless devices such as GPS receivers, was somewhere north of $1 billion and possibly as high as $5 billion.

"There is a tremendous need for components that can be miniaturized," says Mohanty. "What

MONEY TALKS
For investors, the incubator is a department store of opportunities, from nanotechnology to computer software.

In the last three years, the twenty companies in the incubator program have raised more than $90 million and created more than 150 jobs.

we came up with is a way to manufacture these microcomponents on a chip scale."

He took his idea to BU's Office of Technology Development, whose job is to match promising technology with first-rate business resources and produce competitive start-up companies. There he met, among other people, a business-savvy advisor named Matt Crowley, who helped him write an e-mail to venture capital firms that had invested in similar technology. Within days, Mohanty got his first response: a potential investor hoped to stop by his lab within the next week.

The speed of that response and a few more like it persuaded Crowley to leave his BU job and join Mohanty as a founding partner and the vice president of business development for the company, which they called Sand 9. They moved into an office on the sixth floor of the Photonics Center, where Mohanty found his embryonic venture in excellent company.

Clifford Robinson's workdays included scheduling visits from investors from around the world.

A few doors down the hall, the firm MTPV was honing a technology that turns industrial waste heat into electricity. Another neighbor, LumenZ, had found a way to get more light from less energy and was building what may be the next generation of LEDs. Yet another, Entra Pharmaceuticals, was fashioning an ultra-lightweight drug delivery system that uses battery technology to precisely time the flow of drugs into the body. And Ninth Sense, founded by a CAS physics professor, Shyamsunder Erramilli, was creating patient-specific protein biomarker–based therapies for diagnosing and monitoring breast cancer. Good Start Genetics was hammering out a prepregnancy test that screens for sixty genetic disorders, and PatientFlow Technology, founded by Eugene Litvak, a School of Management research professor and director of the Management of Variability Program at BU's Health Policy Institute, has written software to help health-care facilities greatly reduce waiting times, cut operating costs, and improve care.

And so it goes, behind the often deliberately closed doors of the thirteen young companies occupying office and lab space provided by the Charles River Campus Business Incubation Program. They have come to take the best advantage of a range of provisions and services that could mean the difference between an early death and a long and lucrative life, particularly in the unsettled business environment of 2009.

Clifford Robinson, who was director of BU's incubator program for four years until his retirement in September, says the critical mass of the place attracts cutting-edge researchers like Mohanty and investors who will swallow some risk for a potentially monster-size payoff. Since 2006, the twenty-three companies that have entered the incubator program have raised over $90 million and created more than 150 jobs within the incubator. Counting the sixteen companies that have left the incubator in recent years, the number of new jobs jumps to more than 1,500, and the dollars raised leaps into the hundreds of millions. A123 Systems, a lithium-ion battery maker that left the incubator in 2002 to set up shop in Watertown, Massachusetts, was recently awarded $249 million in federal stimulus funds.

Robinson, whose workdays included scheduling visits from investors from around the world, is necessarily closemouthed about the start-ups' business deals. He will not say, for instance, which company or companies were visited last spring by Anatoly Chubais, a market-oriented Russian

PHOTOGRAPHS BY VERNON DOUCETTE

economist who served for ten years as the head of Russia's state-owned electricity provider, United Energy System, and is now director of the Russian Nanotechnology Corporation. But Robinson will say that in addition to frequent visits from venture capitalists, the incubator's guest list includes the chief minister of Penang, Malaysia, the minister of economy, industry, and employment of France, the president of the National Research Council Canada, the consuls general of Canada, France, China, and the United Kingdom, and economic development officers from Spain, Switzerland, Singapore, Norway, Ireland, and Scotland.

From Robinson's perspective, the Photonics Center incubator is a boon to everyone involved. For investors, he says, it's a veritable department store of opportunities, from nanotechnology to computer software, many of them spun from concepts that were first imagined in research institutions such as BU, the Dana-Farber Cancer Institute, MIT, Massachusetts General Hospital, Draper Laboratory, Harvard, Cornell, and Dartmouth. For resident companies, it offers shared lab space, conference rooms, and in many cases, interns. Since 2006, Robinson says, more than eighty BU students have worked as interns for incubator companies, and ten have been hired as full-time employees. And for the University, it offers money (more than $2 million in fees annually), a training ground for students, and a good-sized serving of prestige in the world of venture capital.

WEB EXTRA Watch a video of Entra Pharmaceuticals CEO Frank Bobe talking about the benefits of an incubator for small businesses at www.bu.edu/bostonia.

He also sees another, greater beneficiary: the economy. "In this current economic climate, universities are being called on more than ever to contribute economic value to the community," he says.

Robinson is fond of quoting Carl Schramm, an admirer of the Photonics incubator and the president of the Kauffman Foundation, one of the world's largest foundations devoted to entrepreneurship, who calculates that one-third of the U.S. gross domestic product is produced by companies that did not exist before 1980.

Mohanty, whose company has attracted more than $10 million in venture capital, says he opted for space in the incubator because it was convenient, because he liked the idea of keeping BU in the loop, and because he wanted to focus on his technology and not worry about office management. The effort to avoid distraction has paid off, he says. Sand 9 hopes to have its first micro-oscillator on the market next year.

Bob DiMatteo's engineers have found a way to turn waste heat into electrical energy, producing power and sparing the atmosphere at the same time.

FROM WASTE HEAT TO ELECTRICITY

In 1884, the Englishman Sir Charles Parsons connected his new device, called a steam turbine, to an electrical generator, producing 7.5 kilowatts of power. Today, the same basic technology — steam turbines connected to generators — produces 80 percent of the world's electricity. In a small office at the far end of a Photonics Center sixth floor corridor, a handful of engineers think they have a better idea.

"Energy isn't easy," says Bob DiMatteo, CEO of MTPV. "If it were, we wouldn't be driving cars that work basically the same way they worked 100 years ago."

DiMatteo's crew is using solar panel–like technology to generate electricity from "waste heat," such as the heat that emanates from a car's exhaust system or from an industrial furnace. From an environmental standpoint, the new technology is a twofer: it produces more electricity from the same amount of fuel, and it traps and exploits heat that would otherwise enter the atmosphere.

Most solar cells can't compete with the efficiency of steam turbines when it comes to converting thermal energy to electricity. But

"Energy isn't easy. If it were, we wouldn't be driving cars that work basically the same way they worked 100 years ago."

WHO THEY ARE AND WHAT THEY DO

- **Block MEMS** *Optical sensors to detect chemical threats*
- **Cyber Materials** *Control systems for manufacturing optical coatings*
- **Entra Pharmaceuticals** *Improved drug delivery systems*
- **First Founders, Inc.** *Business advice to new companies*
- **Good Start Genetics** *Prepregnancy test for genetic disorders*
- **LumenZ** *Next generation blue and ultraviolet LEDs*
- **MassDevice.com** *News Web site covering the medical device industry*
- **MTPV** *Technology that converts thermal energy to electricity*
- **Nano Surfaces** *Anti-fouling surfaces for marine environments*
- **Ninth Sense** *Biomarker-based therapies for breast cancer*
- **PatientFlow Technology** *Software that reduces patient waiting time and operating costs in health-care facilities*
- **Sand 9** *Technology for faster, better wireless devices*
- **Zoiray Technologies, Inc.** *Cheap, portable medical tests for use in the field*

MTPV has found a way to crank up the efficiency of its cells. DiMatteo says the company's technology increases by tenfold the number of photons that flow from a heated surface to the solar cell and jacks up the maximum theoretical efficiency from 41 percent (for existing technology) to 85 percent. "Theoretical," he says, is the operative word. As far as practical efficiency goes, he is shooting for an efficiency of 50 percent, but he admits that their prototypes are not yet at that number.

MTPV's secret sauce includes, among other things, the radical reduction of the space between the heated surface and the cell. When that distance is collapsed to something less than the unimaginably small wavelength of the emitted light, photons no longer bounce from one surface to the other. Rather, they move freely from surface to surface, taking their energy with them. Simply put, says DiMatteo, the technique pulls much more energy from much lower temperatures and makes feasible an energy source that had been stuck for decades in the realm of the theoretical.

Today, with more than $10 million invested by several successful technology entrepreneurs, the company is building its first real product — a square-foot panel designed to produce one kilowatt of power — which will hit the market sometime next year. If things go well, MTPV will construct arrays of 100 panels — commercial-scale installations that could be placed in the exhaust port of an industrial furnace. DiMatteo says the company is now testing its components in commercial environments.

BUSINESS JAM SESSIONS

DiMatteo, a graduate of Harvard and MIT and a Sloan Fellow at MIT, started commercializing his photovoltaic innovations three years ago in space rented from Draper Lab. He brought his small group of ten to the Photonics Center in June 2007, enticed by the combination of office space, a dedicated test and assembly lab, a clean room, a shared semiconductor fabrication shop, and a shared metrology lab equipped with scanning electron microscopes that measure flatness to nanometer precision.

Only after setting up shop, DiMatteo says, did he discover another benefit to working in the entrepreneurial village of the incubator: once a month, the leaders of the early-stage companies gather for a CEO Roundtable in one of the two large conference rooms. Over brown bag lunches, they share advice about how to make the best impression on venture capitalists, about how to build an effective sales force, and about other business challenges whose solutions can evade even the most brilliant engineers. Sessions are often led by experienced execs who have guided their own firms along the trails the start-ups hope to follow.

"I'm always impressed with the level of information that comes out in those meetings," says DiMatteo. "Someone will have a question about anything from human resources to IT to marketing, and someone else will have an answer."

Peter Russo, an SMG executive-in-residence, who moderates the sessions, says they cover just about everything a young company needs to know. "People talk about intellectual property, the best ways to involve investors, hiring practices, where to find good people, or what is a reasonable compensation package," says Russo, who many years ago sold his company, Data Instruments, to Honeywell.

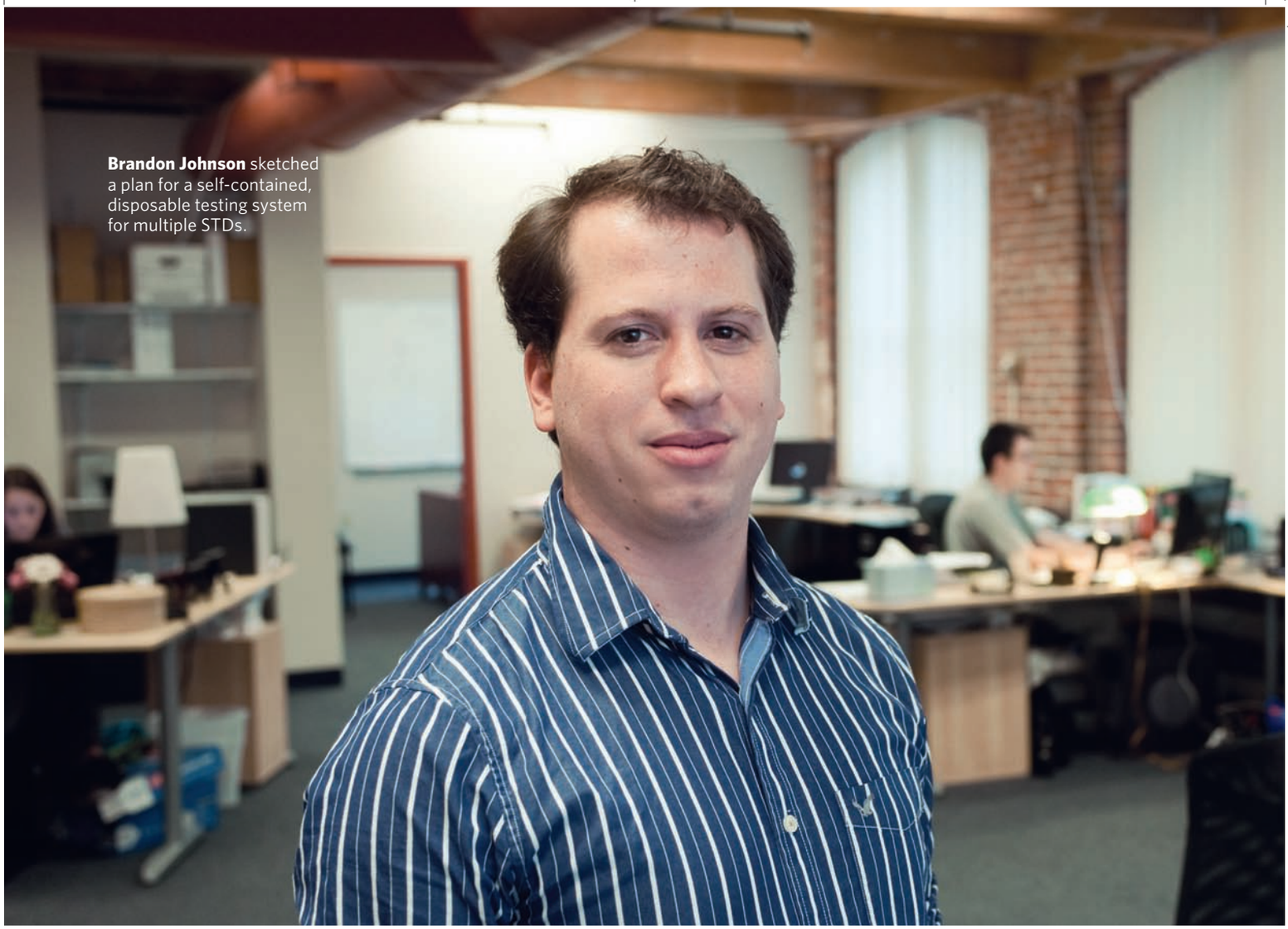
Russo says he sees the advice offered by outside experts to incubator CEOs as one side of a doubly rewarding equation. He also encourages the CEOs of the start-ups to visit SMG classes and talk about their challenges and solutions.

"I feel very strongly that having those companies on campus significantly enhances the educational opportunities for our students," says Russo. "And the CEOs of those companies are very generous with their time."

In fact, some incubator CEOs have found the roundtables so helpful that they continue to show up after their companies have flown the coop.

Another Incubator, More Breakthroughs

The Photonics Center Incubator, a launching pad for technology-based start-ups, is one of two business incubators at Boston University. A second, whose fifteen newly hatched companies focus on biomedical products and life sciences, is in the BioSquare Discovery and Innovation Center on the Medical Campus. For more on that incubator, read part two of "Start-up Ville" in the next issue of *Bostonia*.



Brandon Johnson sketched a plan for a self-contained, disposable testing system for multiple STDs.

Brandon Johnson (ENG'04), the president and CEO of Boston MicroFluidics, a medical assay company that left the incubator in June 2008, remains a regular at the business jam sessions.

"They're still very valuable," says Johnson. "It's great to have a place like that to get advice and sort out problems."

Johnson's path to and from the incubator is a tidy case study of what the place does best. Five years ago, when the biomedical engineering student was in need of a suitable class presentation, he wondered if some of the ideas tossed around in a class discussion of microfluidics could be used to build a one-time use handheld device to test for sexually transmitted diseases (STDs).

"Some of the people in my group thought it was crazy," he recalls. "But my professor thought it was a good idea."

Johnson sketched out a plan for a self-contained, disposable testing system that, infused with a drop of blood, could deliver near-immediate results in testing for multiple STDs. When he graduated, he had two choices: he could work for someone else, or try to go it alone. Johnson took his idea to Jonathan Rosen, now the executive director of SMG's Institute for Technology Entrepreneurship and Commercialization, who introduced him to Robinson. The incubator director recognized that meeting Johnson's space needs would not be a problem: the entire company consisted of Brandon Johnson.

"When we were raising money, it was great to have an office at BU," Johnson says. "It might seem like it's not a big deal, but it makes a difference just to be able to bring investors into a conference room."

In Johnson's case, the conference room and other resources made a difference of $2 million, enough to get his ideas off the ground and set up his young company across the river in East Cambridge. This fall, he is planning the release of his first product, a finger-prick blood test that in just a few minutes can let someone know if they have herpes simplex 2, chlamydia, or syphilis and has the potential to help stem the inadvertent spread of these STDs.

Johnson spent only a year in the incubator, and while he learned a lot, he's the first to admit that he still has a lot to learn. That's one reason he keeps coming back. ■

"It might seem like it's not a big deal, but it makes a difference just to be able to bring investors into a conference room."