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# Forbes/Wolfe Emerging Tech

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**REPORT**

## Technology Trends to Watch in 2008

**T**hings we know about 2008: It will be a leap year, the U.S. will elect a new president and Beijing will be hosting the Olympic games. Beyond that, making predictions for the next 12 months can be risky business.

One other prediction, however, is that my team will be watching developments in some very specific emerging technology markets next year. We explore a select few in this issue, including converging developments in molecular biology, **Honda's** [HMC] fuel cell gambit, and the approaching battle for GPS chipsets targeting 3G cellular networks.

Some of the technologies we explore in this issue will probably see significant breakthroughs over the next twelve months. But space limitations prevent me from exploring all of the sectors worth tracking in 2008. Among the notable absences below—like emerging display technologies, biopolymers and nano-enhanced medical imaging—may appear as feature topics in future issues.

### Molecular medicine

Independent advances in molecular biology, nanotechnology and genetics over the past decade began to converge this year, signaling some notable breakthroughs in medical diagnostics and treatment.

Most notable among the successes was the recent IPO of molecular diagnostics company, **Nanosphere** [NSPH] (see "A Tale of Two Nanotech IPOs", November 2007). The company's Verigene system leverages nanotechnology to move genetic and protein testing to the point of care, thereby overcoming the time—and cost-intensive limitations of conventional polymerase chain reaction (PCR) tests.

Nanosphere's current menu of diagnostic tests is limited. I am optimistic long-term. Piper Jaffray initiated coverage earlier this month with a BUY rating and \$17 price target. Meanwhile, analysts for both Credit Suisse (target price: \$22) and Leerink Swann (price range of \$16-\$18) gave Nanosphere outperform status.

The company is a pure-play in the global molecular diagnostics market that, in 2006, measured \$2.3 billion according to Boston Biomedical Consultants. The market is projected to grow more than 15% over the next five years.

And the momentum is pushing even more proactive solutions based on sequencing individual genomes. The 0.1% difference between our DNA is what determines why some of us develop certain diseases and others do not. Electrophoresis can sequence individual strands of DNA today. But it would take the technology decades to sequence enough

genomes necessary to begin isolating the genetic root of many diseases.

Companies like **Helicos Biosciences** [HLCS] and **Illumina** [ILMN] are among the companies vying to develop new technologies to accelerate and simplify the sequencing of single DNA strands.

### Reverse genetics

Interest in personalized medicine hasn't been lost on incumbent biotech giants, like Roche, **Abbott Laboratories** [ABT] and **Siemens AG** [SI]. Many of them are launching initiatives that combine in vitro diagnostics with therapeutic solutions in one procedure, according to Cheryl Barton, founder of U.K. consultant firm PharmaVision.

Many of those solutions are likely to include targeted drug delivery—another trend worth watching in 2008.

While many current drugs provide effective therapies, more precise delivery to target sites can increase net potency and reduce toxicity. One approach incorporates ligands into drug formulations to enhance their selective uptake in target tissues. Another approach effectively steers magnetic nanoparticles toward disease sites where they dump their therapeutic load or else destroy cancerous tissue with heat (see *MagForce Technologies, Companies to Watch, November 2007*).

## Some of the technologies we explore in this issue will probably see significant breakthroughs over the next twelve months.

Targeted carrier systems represented about half of the \$6.5 billion market for advanced drug delivery in 2006, reported Barton. By 2015, the sector could see nearly thirty new commercial therapies focusing on treatment for cancer, cardiovascular and infectious disease.

The convergence of diagnostics and therapy is natural, even organic. Intersecting advances in cloning, genetics, instrumentation, and molecular and structural biology have allowed researchers to see beyond the exterior morphology of cells and tap their component molecules for solutions.

That spells breakthrough developments in another medical sector: the development and production of new vaccines.

Traditionally, vaccines were manufactured from the complete organ

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# Companies to Watch

## Treadstone Technologies

Private

[www.treadstone-technologies.com](http://www.treadstone-technologies.com)

609-734-2368

Princeton, NJ

**Chief Executive:** Gerald DeCuollo

**What it does:** Developing a corrosion-resistant metal plate technology designed to cut the weight, volume and cost of fuel cells.

The comparatively low weight of polymer electrolyte membrane (PEM) fuel cells has generated interest among automakers developing hybrid vehicles. But in addition to being large and heavy, current fuel cell designs are prone to corrosion.

Treadstone is hoping to change that by developing anti-corrosive technology that would greatly expand the viability of fuel cells for automotive and other applications.

A typical PEM cell design forms a stack from several individual cells to produce a usable voltage. Within the stack, the largest components are the separator plates, which provide electrical connections between cells and physically separate the oxidant flow of one cell from the fuel flow of another.

These plates are generally made from a graphite composite. But metal plates enable stacks with lower volume, weight and cost, and they provide better heat and water management, which improves long-term reliability. The problem is that metal plates tend to corrode long before they meet the automotive industry's targeted lifetime of 5,000 hours.

Treadstone's surface treatment coats off-the-shelf metal separator plates with a non-corrosive inorganic layer. In addition to potentially reducing fuel cell stack weight by 40 percent less, this enables metal plates to meet the automotive industry's reliability standards.

"So we've achieved the first hurdle," said CEO Gerry DeCuollo. "Now everyone's asking, 'What's the cost?'"

Other metal plate technologies have surpassed the 5,000-hour mark. But the expensive alloys and coatings on which these technologies rely raise the cost of fuel cells to between \$15 and \$20 per kW—well above the U.S. Department of Energy's target of \$6/kW.

Through the use of off-the-shelf metals like titanium and stainless steel, Treadstone can enable cells that run between \$4 and \$7 per kW. The use of steel drops those estimates further to \$2 or \$3 per kW."

Treadstone provides only the metal separator plates. They don't manufacture fuel cells. But their technology is applicable to direct methanol fuel cells as well as PEMs, so the company is positioned to tap cell makers in the three biggest markets: automotive/transportation, stationary and portable.

The next step, said DeCuollo, is to establish relationships with fuel cell OEMs in all three markets. The company currently has samples under evaluation at an undisclosed automaker, and it's finalizing projects with two other customers, including an OEM that targets stationary applications.

Last January, the company received \$400,000 in seed funding from Virginia-based Commerce International, and another \$50,000 in July from the New Jersey Commission on Science and Technology. Next year, the company may start looking for additional financing from a strategic partner, like a client or a VC firm, said DeCuollo. **N**

# Companies to Watch

## BG Medicine

Private

[www.bg-medicine.com](http://www.bg-medicine.com)

781-890-1199

Waltham, MA

**Chief Executive:** Uwe Maschek

**What it does:** Focusing on the discovery, development and commercialization of molecular diagnostic tests based on biomarkers

As health care moves toward personalized medicine, biomarkers have increasingly become important molecular signposts signaling the progression of a disease in a patient, the effectiveness of a therapeutic treatment, and/or a patient's ability to metabolize certain drugs.

BG Medicine has developed a proprietary technology platform designed to maximize the efficiency of biomarker discovery, and generate a steady flow of molecular diagnostic tests. The company's scalable, automated approach enables integrated and precise analysis of thousands of potential biomarkers, such as proteins, metabolites and nucleic acids. Currently, the company has the capacity to field 16 to 20 new discovery projects per year.

Founded in 2000 as Beyond Genomics, the company changed to its current name three years ago. Since its inception, it has raised \$52.1 million in financing from investors, such as Flagship Ventures and Gilde Investment Management.

In August, it filed plans with the SEC to list stock on Euronext Amsterdam under the symbol BGMDX. At the time, the company sought to raise up to \$80 million, based on a share price between \$14 and \$16. Cowen & Co. was named as the IPO's lead underwriter, supported by Leerink Swann.

Then, earlier this month, it amended its filing, shifting its IPO to the Nasdaq under the ticker BGMD, and slashing its targeted proceeds. The company now plans to issue 4.5 million common shares, priced from \$8 to \$10 per share. That puts its market capitalization between \$152.4 million and \$190.5 million, and its expected gains at just over \$35 million, after fees and expenses, assuming its stock reaps \$9 per share.

The company plans to use its equity to develop new diagnostic products, enhance its R&D infrastructure, build a marketing and distribution force, repay debt and pay for administrative costs.

Like any early stage company, BG Medicine's IPO poses risks, among them a history of quarterly net losses—with more expected. It currently lacks a commercial product. But it has generated steady revenues from collaborative partnerships, including one with Philips to discover biomarkers for use in conjunction with Philips' medical technologies for disease diagnosis and patient monitoring.

The company also claims to have a broad pipeline of product candidates focusing on cardiovascular disease, cancer and central nervous system, or CNS, disorders. Most notable among them is a molecular diagnostic biomarker for testing the severity and prognosis of patients with congestive heart failure. The test could be commercially available as early as 2009. **N**

are enabling researchers to isolate subcellular components of viruses to develop vaccines through cloning, said Adel Mahmoud, a senior molecular biologist at Princeton University. The approach, called reverse genetics, is similar to reverse engineering.

The acceleration of vaccine development through cloning has broken down the sector's traditionally high barriers to entry, which has attracted the attention of pharmaceutical companies. It has also opened the possibility of single dose vaccines with a long term immunity response.

One concrete development to watch for in 2008 is how the TroVax vaccine, made by **Oxford Biomedica** [OXB.L], performs in its Phase 3 clinical trials. Designed to treat kidney cancer, TroVax works by encouraging the immune system to attack a protein found in solid cancers.

### Fuel cells roll out

Next year won't be the end of the gas-powered vehicle. But Honda Motor Company's release of 500 hydrogen fuel-cell powered FCX Clarity's in California in 2008 could be the beginning of the end.

What makes Honda's gambit significant is the corresponding release of its Home Energy Station Unit. Set the unit up in the yard, and it will use natural gas to produce enough Hydrogen to power your FCX Clarity and your home at around 50% of the normal cost and with a 30% reduction in emissions.

Its approach addresses the Catch-22 confronting every alternative-powered vehicle that's come down the pike: Without the fueling infrastructure, there's no incentive to buy a hydrogen-powered vehicle, and until hydrogen-powered vehicles become available there's no incentive to build the infrastructure.

By offering both, Honda could jump start demand for the Clarity, which is based on Honda's own V Flow fuel cell. The cell stack combines hydrogen with atmospheric to form chemical energy, which is then converted into electric power. The road to mass commercialization still stretches ahead, and hydrogen fuel cell vehicles are not the only alternative vying for attention.

Even so, getting the technology rolling on California highways will build important momentum for the fuel cell industry. And Califor-

nia is a strategic proving ground. In addition to \$4/gallon gas prices, the state is willing to subsidize fuel cell energy stations to keep pressure off its electrical grid. That may give the Clarity an edge over plug-in hybrids.

### GPS chipsets

Personal navigation devices (PNDs) are a hot gift to give this holiday season. Unit sales of GPS systems rose 488% over last year, according to the latest point-of-sale information from market research firm NPD Group.

GPS chipset provider, **SIRF Technology Holdings** [SIRF] is the company to beat in the personal navigation device space, with over 50% market share. The company is one of several gearing to battle it out for a piece of the next-generation cellular handset market.

Mobile phones are only starting to emerge as a high-growth market for GPS chipsets, which include the basic radio-frequency (RF) and GPS base-band chips. True, most handsets already incorporate the technology, but it goes largely unused because most network operators have been slow to roll out location-based services with broad consumer appeal.

The other reason GPS chipset suppliers have ignored the current generation of mobile handsets is **Qualcomm** [QCOM], which has been packaging GPS capability into its mobile phone chips for the last seven years.

The industry, however, is shifting from today's GSM and CDMA network standards toward 3G, or W-CDMA standards, and next-generation-compatible handsets are forecast to see a CAGR of 22% over the next five years.

Although Qualcomm is still a strong contender for that market, its dominance is not sealed in stone, said Gemma Tedesco, an analyst for In-Stat. The key may be integrating base-band and RF chips into a single module. These single-chip solutions will be critical to getting onboard cellular handsets, since they offer reduced power, size and components.

Not surprisingly, single-chip structures are being fielded by all the players vying for the W-CDMA handset market, including **SiRF**, **Qualcomm**, **Texas Instruments** [TXN], **Broadcom** [BRCM] and a host of smaller and international players. **N**

## The Insider

What a year 2007 has been! And what a year we think 2008 will be. This issue, we look at the top trends going into 2008. These key trends will evolve in future issues just as quickly as the technologies themselves do. In Best Buy the other day, I asked the customer service department what the most returned item was. The answer? GPS units. Surprised that would be so, I dug deeper. It turns out the vast majority of people were gifted low-end models of GPS units and were returning them for higher-end more expensive models. It's only a single data point from a single store—but it merits watching closely as the chipsets, touch screens, batteries and hardware coatings all incorporate nanotech and other emerging technologies to drive demand for GPS enabled devices.

In due time, the media and investors will shift priorities. The zeitgeist of global warming pales in comparison to vaccines. You have a choice: worry about a 100 year problem that can be solved in 50 years, or a 20 year problem that needs to be solved in 10 years. Vaccines are an underappreciated segment of life science sector and new innovations in this arena and the massive market sizes have gotten me very excited. Be sure to read our story Next Generation Vaccines, page 3, on this area and the key emerging players. And be sure to read our exclusive interview with Janine Benyus on biomimicry—technology inspired by Mother Nature. As always, here's to thinking big about thinking small...and to the emerging inventors and investors who seek to profit from the unexpected and the unseen...

