

SUMMARY

The annual Harris & Harris Group portfolio company showcase held recently made it clear that the impact of nanotechnology is broadening out and becoming more deeply ingrained in major industries. The result is more opportunity, faster commercialization and bigger increases in value for investors. Our notes and observations from the March 13th event are summarized below, sorted roughly by level of investor interest:

- **Solazyme** – Engineering algae to produce specialty fuels, biochemicals and organic materials at scale is opening three large market opportunities for Solazyme. Technology advantages, management execution and key partnerships with industry players (Bunge, Unilever, Roquette & Sephora) sets them apart.
- **Kovio** – An advanced approach to item-level intelligence delivers the function and performance required at dramatically low costs by using a nano-based printed silicon technology. Commercialization is coming at the perfect time given current trends in mobile advertising and commerce.
- **Metabolon** – Proprietary software and data analysis enables a proprietary platform for improved cellular identification and a whole new approach to the massive diagnostics business.
- **Bridgelux** – Investors looking for a more profitable way to exploit the transition away from old burning wire lightbulbs should take some time to understand the Bridgelux story. When lights are intelligent nodes on the network, the way we think about light, energy and applications changes completely.
- **D-Wave** – Quantum computers are controversial but it's hard to argue with results. D-Wave has been putting theory into practice, delivering technology adept at “computing” solutions to many classes of complex problems best handled directly by using their systems.
- **HzO** – If you've ever dropped your cherished smartphone in the water or worried that you might, this is a company to know. Their “WaterBlock” technology may be delivered through other companies, including their major investor, ZAGG, but this technology is something you will want to have.
- **Neophotonics** – The race to add bandwidth is on, and speed, cost and flexibility are all offered by optical networking on top of standard IC technology. NeoPhotonics is public and growing to become one of the key vendors in the space.
- **Laser Light Engines** – Movies are growing richer; more dimensional and with higher frame rates. But the best digital projectors are still hampered by inadequate light sources. Not for much longer. Laser Light Engines is working with the major projector makers to take the cinema experience to the next level.
- **Champions Oncology** – Drug development is astronomically expensive, yet very few make it out of the pipeline and into the market. And, when they do, they often don't work as expected due to individual differences, timing of treatment and interrelationships with other drugs. Champions is working on a way to make all drugs work better.
- **Contour Energy** – Batteries, especially in portable devices, never seem to have enough power. Contour has better technology already in the market and is working on even more advanced Fluoride-based technology that doesn't require the typical rare earth elements found in alternatives.

Solazyme – Tyler Painter, CFO

Solazyme is already a public company (SZYM - \$15.66) that we have published on. (Please see our report for more details: Solazyme – [Synthetic Nanobiology Comes of Age, May 2011](#).)¹ Investors were left with a strong impression, appreciating the combination of:

1. expanding opportunities in energy, food and other biochemical applications;
2. strong partnerships with very large players like Bunge, Unilever, and Roquette; and
3. management focus on execution and milestones on the way to building a major company.

We learned more about an algae-based product that can substitute for eggs and butter in foods to lower calories and cholesterol while providing similar taste and the all-important “mouth feel” of the real thing. Although the near and medium term volume expansion for Solazyme will continue to be energy-based, their non-energy businesses are ramping up and, in most cases, offer even higher margins.

The shares have been appreciating nicely in the market post their IPO and still below our \$20 IV. We expect that IV to be revised upward in the next six months if the company continues to execute well. Solazyme is a great example of the type of long-term investment that suits the Harris & Harris portfolio in both the early and later stages of development.

Kovio – Amir Mashkooi, CEO

Kovio is using printing technology to overcome the cost and integration challenges that prevented the widespread adoption of RFID for item level intelligence. Kovio’s technology started out in the MIT Media Lab back in 2001; after \$100M invested the company is ramping operations in Silicon Valley as it prepares for serious adoption on the coattails of widespread near-field communication (NFC) capabilities in mobile phones.

Talking about “smart devices” and discrete item intelligence obscures the fact that we are on the verge of solving a large portion of what we call the binding problem, which fundamentally limits the power of computing. Thus far, efforts to link physical and virtual elements have been primitive. The QR code, audio-jack-based readers, and displayable barcodes require extra equipment and multiple steps to use. In other words - not ready for prime time. Until recently the costs to manufacture and attach an RF device was too high and required a special reader. The advent of NFC being built into smart and feature phones means that now the reader and application technology is widely deployed.

If most objects can have their own IC and antenna, and the readers (phones) are all internet-attached the possibilities and applications grow exponentially, for it means that any object may be accessed and become interactive with any digital infrastructure or application software. Those of you with a programming or computer science background should have halogen light bulbs going off in your head right now.

Because unit volumes are large, the costs and process required has to employ the printing economics that Kovio is using. This can’t be an engineering exercise. So far the only notable phone maker absent in the NFC movement is Apple; the iPhone 4S doesn’t have NFC. However, discussions held at the recent Macworld event suggests that Apple has NFC in the works and has at least one major partner to bring out NFC with built-in payments on the next iPhone. To what level the Apple iOS will allow other developers to use NFC in applications is still unknown.

Longer term, Kovio plans to extend core technology to imbue items with even more capabilities, including low-level sensors, displays and possibly even solar energy.

Metabolon – Todd Lynch, CFO

¹ <http://blog.research2zero.com/wp-content/uploads/2012/01/Solazyme-Report-May-19-2011.pdf>

Metabolon presented their biochemical-marker-based technology, which we have described more fully in prior research on the company: [Metabolon Private Company Profile](#).² This presentation illustrated more about the software assets and data analysis technology that helps to separate the valuable chemical “signals from the noise.” The company already has 160 patents filed with 20 issued so far.

Metabolon has built a service business with high gross margins and repeat revenue from large customers. This has lowered the capital required to fund the business and created a recurring business that can “expand in place” within their existing customer base. For example, Merck might have 2 discovery centers using Metabolon but there are 40 more in the company that might adopt the technology.

Metabolon is also pursuing a much bigger opportunity in the diagnostics market, which has proven very attractive in the past few years. Quantose, their first commercial diagnostic test, is targeted at diabetes. Most approaches measure blood glucose levels but by the time they are elevated, it’s too late. The damage is irreversible. Quantose measures insulin resistance for a real target risk group of people - those with a BMI of 26 to 32, or about 1/3 of the population. Health Diagnostics Laboratory will be running the tests. The plan offers built-in scale-up for Metabolon with 300,000 tests in year 1, 500,000 in year 2 and 750,000 in year 3 at \$25/test.

There are dozens of important diagnostic areas to go after so this can scale up to be a very large business. Prostate cancer was mentioned due to the invasive nature of the procedure and the high rate (75%) of biopsies that turn out to be cancer-free. Collectively, this is a \$1B+ annual opportunity and Metabolon has a pipeline of products for several segments.

Bridgelux – William Watkins, CEO

To his credit, the CEO dealt with the “yes we are a lighting company but not the way you think about it” point up front. Investors have been disappointed by LED companies that got caught with high fixed costs and rapidly declining unit prices. Bridgelux is doing something different than can generate sustainable profitability.

The key to understanding the story is to stop thinking about light bulb replacement and instead realize that if all lighting becomes solid state and silicon-based, the unit costs will come down dramatically while at the same time the intelligence and capability of the lighting system will increase. The “light” is now a functional smart node on a digital network – capable of monitoring and programmable control.

In order to get costs and production volumes in line with the demands of the market, Bridgelux is putting their Gallium Nitride (GaN) process into standard silicon. This gives them the ability to use standard 8-inch wafers, which offer much better costs per unit.

In terms of opportunity, lighting is a giant market and the energy use there dwarfs other popular application areas like datacenters. Bridgelux is using a broad combination of technology, products, partners and business models to connect with revenue. Some of the major partners they are using include Molex, Flextronics and Chevron. Chevron is an example of how Bridgelux is finding leverage and innovative models to penetrate the market profitably. In this case, Chevron gives municipalities an opportunity to upgrade their streetlights with new technology and have it financed completely out of energy savings. Chevron handles the sales, marketing and relationship management; Bridgelux provides the technology and design, which is manufactured by Flextronics. The result is above-average gross margin with vastly lower capital invested.

Bridgelux has spent lots of money to get here and build their IP. In 2011 alone the company spent \$44M on R&D. They have over 650 patents filed for or issued and are working on a cross license covering a portfolio of 4,000 more. At the same time, they have built a complete management team to scale the business from the \$60M in revenues for 2011 into what should ultimately be a \$1B/year revenue business.

² <http://blog.research2zero.com/wp-content/uploads/2012/01/Metabolon-Private-Company-Profile-May-27-2011.pdf>

Investors may be resistant to looking at new ideas that pertain to lighting, but if Bridgelux can continue to scale and - most importantly - demonstrate a business model that offers increasing returns to scale, then this will evolve into a superior investment story in the public markets one day.

D-Wave – Vern Brownell, CEO

We spent weeks delving into the D-Wave quantum computing technology, and it's one that will have important applications and a profound impact on broad classes of computing problems. It takes a full research report to do it justice so we'd encourage anyone interested to grab a fresh cup of coffee, find a quiet place and give it a thoughtful read: [D-Wave on a Path to Commercialize Quantum Computing, November 2011](#).³

The short story is that D-Wave has seized upon the theoretical promise of quantum computing and actually built systems that have reached commercial scale. It's similar in some ways to the scanning tunneling microscope that was dismissed as not being buildable; but then IBM managed to build one in their Zurich lab and then many more. D-Wave has had to tackle a broad range of challenges to make their computer a reality. One of our favorite new terms used in this presentation is the need for "a magnetic vacuum" to be part of the operating environment.

D-Wave is in the process of scaling their technology to 512 "qubits," which will make it competitive with super computers and excel at solving some fairly general problem types. The company has invested \$105M to get to this point and is seeking more capital to scale further. The good news is that the cost of the D-Wave systems should remain nearly constant, and the systems already have high gross margins.

D-Wave is the most controversial company in the mix but they also offer a high reward if they can continue to execute, scale their technology and deliver on a cloud-based access and revenue strategy.

HzO – Paul Clayson, CEO

If there were a "demo of the event" award it would have gone to HzO for their dunking of coveted electronic devices into tanks of water with them all continuing to work. The wow factor was amplified by the subsequent draining of the submerged devices to show that the water wasn't blocked from coming inside, it was allowed in but was unable to penetrate or disrupt any of the electrical circuitry. This "protection from the inside out" was a real crowd pleaser.

On the business side, it's known that the vast majority of consumers worry about water damage to their smartphone and most (63%) would pay an extra \$99 for this kind of technology (according to an HzO survey), and we expect to see more surveys indicating similar market conditions.

Consumer awareness of HzO exploded after CES in January of 2012 based on their success there. The company went from relative obscurity to millions of media views and Google references in two weeks. Consumer demand is helping to get OEM clients to pay attention, and ZAGG is an early investor and will likely play a role in the commercialization of the technology. We have taken a closer look at HzO and ZAGG in a prior report: [ZAGG: Case Maker Gets Closer to the Metal](#).⁴

NeoPhotonics – Tim Jenks, CEO

NeoPhotonics is a public company (NPTN \$14.46) in the optical communications space. They are a pioneer in the practice of creating "photonic integrated circuits," or PICs, to provide improved price/performance and better integration and packaging options. Bandwidth demand is insatiable but costs are a major issue. Solving for higher bandwidth with vastly reduced costs requires using an innovative approach like PICs.

³ <http://blog.research2zero.com/wp-content/uploads/2012/01/D-Wave-R2-Company-Profile-November-2-2011.pdf>

⁴ http://blog.research2zero.com/wp-content/uploads/2012/01/R2ZAGG_01132012.pdf

The applications are high-speed communication in the so-called “40G” and “100G” segments. This is the current focus of most market players now. NeoPhotonics also supplies products for optical switching and access. The story gets much more complicated between this basic premise, the end markets and margins. The company factors their core technology into a very broad range of offerings designed into products from the biggest telecommunications equipment conglomerates. Making the situation even blurrier is the “co-opetition” that characterizes the market.

The company gave several examples of their products designed for speed, switching and access at customers like Alcatel-Lucent, Ciena and Huawei. Their recent acquisition of Santur bolstered their 100G product profile and added to their current portfolio of design wins.

NeoPhotonics is an integrated provider with 250 people in the US and 2500 people in China. This results in high fixed costs in what is a fairly competitive and low margin business. However, design wins have been good (13 via acquisition in 2011) and management has a long-term gross margin target of 35% with 10% operating margins. Break-even revenues are said to be \$65-70M per quarter (as compared to the current \$50-55M.)

The NeoPhotonics story is hard to parse. The technology is impressive but there appear to be a multitude of methods to addressing the industry needs for speed, switching and access with dozens of companies all vying for a slice of the pie. Forecasting revenue and profit growth is difficult because of the industry structure, and vertical integration entails high fixed costs. Although the long-term financial targets are acceptable, the evidence to support reaching them remains scant. Recently, gross margins have been declining with an increase in revenue creating larger operating losses – exactly the opposite of what investors are looking for.

NeoPhotonics may be a good investment, but they compete in a sea of high speed networking component and equipment providers and will need to continue to hone their positioning in their end markets and find more compelling ways to communicate their story.

Laser Light Engines – John O'Hara, CEO

Our work in digital cinema highlighted the potential for Laser Light Engines (LLE) two years ago, and we've already researched and written on the company: [Laser Light Engines – Private Company Report, June 2011](#).⁵ This presentation was given by the new CEO of the company, who reviewed the overall opportunity and story and also described some details around the “special sauce” that enables LLE Magic to transform photons from one wavelength to another.

The company is now working with all four major projector companies. They have shipped units to two of them thus far and will have units in all four by the end of 2012. Their plan calls for \$15M in revenues this year, which will scale as the market expands and theaters retrofit existing systems with laser-based light sources.

They've focused on making sure their IP is solid, with patents on the first, second and third-best ways to despecckle green light. Their position makes it very difficult for anyone to make a device that does the job without infringing on their patents. It helps LLE to encourage everyone to use their technology or at least license their patents.

Champions Oncology – Joel Ackerman, CEO

Champions is going after a big problem in a big industry. The vast majority of drugs never make it through the arduous and expensive approval process; even worse, the ones that are available often don't work. Given the size of the industry, it's a stunning reality.

There are many reasons for this, but one of the most common is that it's very hard to know which drug to give to which patient and at what time. Patients respond differently to any given drug, and even those receiving the same

⁵ <http://blog.research2zero.com/wp-content/uploads/2012/01/PCP-Laser-Light-Engines-June-2011.pdf>

drug may respond very differently depending on *when* they receive it. It's also true that many drugs work differently when in combination with others. The timing and combination challenges take this area beyond other approaches to "personalized medicine."

Champions is pioneering an approach for cancer treatments that uses specific tumor tissue to test multiple treatment options simultaneously in mice. This "living laboratory" captures data for different treatments, doses and combinations, and measures results. This information gives the oncologist a much better path to treatments more likely to work for a given patient. Getting the right treatment for cancer is certainly worthwhile, but this therapy is too new to be covered by insurance. In time, it may prove to be a cost- as well as a life-saver.

There is a knowledge base/data library aspect to the investment case that plays into a longer-term story of monetizing the approach. Meanwhile, the company needs resources and partners to scale up and, ultimately, insurance companies will have to appreciate the benefits of better drug therapies.

Contour Energy Systems – Maurice Gunderson, Chairman and CEO (interim)

Contour makes better batteries. They see Fluoride ion batteries as the next generation. Their high capacity carbon fluoride lithium batteries are in markets today and are available in some standard consumer formats like buttons. They are working on a version of their battery technology that will offer high performance at lower costs and without the use of rare earth elements.

The management team is studded with expertise and experience, but the company is actively engaged in a CEO search that will undoubtedly plot the slope of the trajectory going forward.

CONCLUSION

One inescapable conclusion is that the impact of nanotechnology is broadening out and becoming more deeply ingrained in major segments of healthcare, energy, and electronic devices. For any individual reading this report, at least five or six of these companies are delivering products and services that will touch their lives.

Harris & Harris has worked for a long time to build a sustainable advantage in making investments in these kinds of companies, and now that a rapidly expanding number are reaching the point of having commercial potential and scale we should begin to witness an expansion of influence, investments, exits and asset values.

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CONTACT INFORMATION

Address: Research 2.0, 1313 Washington St., 326, Boston MA 02118

Phone: 800-979-0280, FAX 88-415-8919

Website: <http://www.research2zero.com>

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