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Start-ups From Uw Research Fuel The State's Economy

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Ellen Williams-Masson

It takes Mother Nature millions of years, but an hour is all Eric Apfelbach needs. Apfelbach is president and CEO of Virent Energy Systems , a Madison-based start-up company founded in 2002 by UW-Madison scientists Randy Cortright and Jim Dumescic.

Building upon technology invented and patented at the university, Virent uses solid-state catalysts to trump Mother Nature in the conversion of plant sugars into "biogasoline" and other hydrocarbon biofuels.

In contrast to ethanol, which is generally used as a 10 percent blend in gasoline, Virent's advanced biofuels are compatible with existing engines and could be sold full strength at the pump.

"We're looking at taking nonfood-based biomass and converting it directly into gasoline that is identical to what you currently use from oil," Apfelbach said. "We have a significantly better efficiency in terms of thermal efficiency and CO2 footprint than other first-generation biofuels like ethanol, so we think we can be a true win-win sustainable biofuel going into the future."

Backed by Honda, Cargill and Royal Dutch Shell , Virent has attracted more than \$40 million in grants and investments and is gearing up for the commercial production of its hydrocarbon biofuels, targeted to hit the market within the next five years.

Technology transfer\ Companies like Virent that spin off research at the university are magnets for biocapitalism, pumping money into the Capital Region economy via property taxes, purchases and payroll.

"We are able to attract money from around the country and the world, and it gets put to work here in Wisconsin," Apfelbach said. "There is a tremendous amount of leverage on the economic activity for the state for every start-up that comes out of the university."

The University of Wisconsin System is an economic powerhouse, contributing nearly \$9.5 billion to the state's economy and more than 5 percent of Wisconsin's gross state product. According to studies by NorthStar Economics , UW-Madison impacts the state's economy as much as the other 25 campuses in the UW System combined.

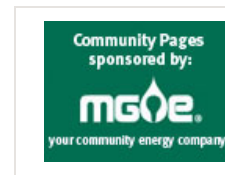
Transferring technology from publicly funded research labs to the private sector falls under the auspices of the Wisconsin Alumni Research Foundation , a non-profit organization on campus that patents and licenses the inventions of UW-Madison faculty and staff. The WiSys Technology Foundation performs analogous services for the remaining campuses of the UW System.

Patents protect technology and provide a 20-year window for the commercialization of scientific findings. Of the 400 or so inventions that WARF screens each year, about 60 percent progress to the patenting process. Of those receiving patents, 44 percent are licensed to companies for development.

Fees and royalties\ Although the university recognizes the intellectual property rights of its scientists, proprietary rights usually revert to WARF for federally funded research. Whether constrained by federal guidelines or not, most inventors take advantage of WARF's streamlined patenting process, which pays the inventor a \$1,500 fee and covers the costs and hassles of filing.

WARF gives preference to inventors when licensing technology and often takes equity in startup companies in lieu of licensing fees. Inventors are eligible for royalties as well as "sweat equity" in the form of founder stock.

"University technology is generally very early stage technology, so it takes a lot of investment," WARF managing director Carl Gulbrandsen said. "It's better to have that investment made locally than by an ongoing company somewhere outside the state of Wisconsin. Today, it's more difficult to license university technology to growing concerns because of the cost of development - companies don't like development costs to hit their bottom line."



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Once the royalties from licensed technology begin rolling in, WARF pays 20 percent of gross income to the inventor group – more than 300 UW faculty and staff received royalty payments last year – and 15 percent to their respective departments on campus. The remaining two-thirds of royalties are added to WARF's \$2 billion endowment fund and used to support research on campus.

Since its inception in 1925, WARF has returned more than \$1 billion to the university through graduate fellowships, professorships, and the direct funding of research projects. WARF has also played a role in the construction of nearly every research facility on campus.

Eureka! Start-up companies are a risky venture at best, but university spin offs have an impressive success rate; only 15 percent of start-ups go out of business. While some are "lifestyle companies" providing a living for only a handful of founders and employees, other start-ups have struck gold in the commercial market.

TomoTherapy , a publicly traded company with more than \$200 million in revenue, was the brainchild of UW professor Thomas "Rock" Mackie and his colleague Paul Reckwerdt in 1997.

The marriage of a CT scanner and a radiation therapy treatment device, TomoTherapy allows for the precise delivery of highly modulated beamlets of radiation to tumors that helps spare normal tissue.

TomoTherapy machines are now used in medical facilities in Wisconsin and throughout the world, but the company was founded as a financial necessity.

"My university research group was running out of funding, so we would have had to lay them off," Mackie said. "We really focused in the early days on getting the first prototype finished for the University of Wisconsin."

Mackie shifted staff from his research lab to the start-up company and reduced his faculty appointment to 75 percent.

The university research group recovered over time with a new focus on proton radiation therapy, and Mackie currently has a 50 percent appointment at the university and is chairman of the board at TomoTherapy.

Reckwerdt is president and a full-time employee at the company.

Keeping one foot in the research world helps Mackie stay on top of new developments in radiation therapy.

"I liken it to a farm and a food processing plant," he said. "A food processing plant needs a continual supply of food, and a high tech company needs a continuous supply of new ideas. TomoTherapy has many collaborators at universities."

Show me the money\ Launching TomoTherapy required collaboration between scientists, WARF and a venture capital firm called Venture Investors.

Mackie and Reckwerdt invested proceeds from the sale of their first company, Geometrics , and WARF took equity in TomoTherapy and gave the company exclusive licensing to develop the technology.

John Neis of Venture Investors helped round up more than \$42 million in private funding before the company went public in May 2007.

"We are an early-stage venture capital firm whose principal focus is trying to identify and back companies that are spinning out of major research universities in the Midwest," Neis said. "We will invest in those entities, try to help them build management teams, attract additional investors to the table and usually go onto the board of directors to help them advance their mission."

According to the National Venture Capital Association , venture capitalists invested \$1 billion in 154 Wisconsin companies between 1970 and 2006. Venture capital backed companies with headquarters in Wisconsin generated \$12.4 billion in revenue in 2006.

Family, friends and high-risk "angel" investors often provide initial infusions of cash for early-stage companies.

According to a NorthStar Economics study, angel investors contributed \$102.9 million in early-stage risk capital in 2006. Venture capitalists sweetened the pot with an additional \$61 million in investments.

Venture Investors has \$200 million under management, including \$117 million in the firm's latest fund. Invested capital enters a blind pool of money that is invested in about 20 companies over a three- to five-year span. Payback comes when the companies go public or are acquired.

"Our goal is to generate a rate of return overall in our fund of about 20 percent per annum," Neis said. "We assume we are going to hold investments an average of six years, which translates into trying to return about three times the capital over the life of the fund. It's a numbers game – we do 20 deals per fund, and we expect the top three or four to drive our overall rate of returns."

Incubating success\ Fledgling spin off companies can flex their wings at the University Research Park , an entrepreneurial operation that is free from subsidy by the state or UW-Madison.

One of the most successful university-affiliated research parks in the country, University Research Park provides lab space, infrastructure and a campus-like atmosphere to nurture nascent companies in its business incubator, the MGE Innovation Center . Maturing companies can move into stand-alone lab space or build facilities within the 255-acre research park.


"There's a fabulous impact on the local economy in that it helps create infrastructure for the easy transition for these companies from an academic idea to a full-blown, tax paying, job-supporting company," park director Mark Bugher said.

"We have documented significant value to the Wisconsin economy and to the local economy as a result of our presence, including impact in over 9,000 jobs and about three-quarters of a billion dollars' worth of economic value that we provide to

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the state of Wisconsin."

Not all scientists aspire to a chair in the boardroom. UW-Madison animal sciences professor Mark Cook holds a score of patents from his research on the effects of diet on inflammation, growth and feed efficiencies in animals, but he disentangles himself from his start-up companies once "the business people take over."

"The only reason I would start a company is if the technology is very useful and nobody is doing anything with it," Cook said. "Lately, I am more inclined to start one (myself) because I would love to keep them in the state of Wisconsin – if you license the technology (outside the state), there is no value to Wisconsin except for the royalty income."

Out of the ivory tower\ Hector DeLuca is the godfather of patenting at UW-Madison, filing approximately 300 U.S. and 1,200 foreign patents during a half-century of research exploring the intricacies of Vitamin D. His patents have earned millions of dollars in royalties and licensing fees for the university – WARF declines to cite specific numbers – and at least nine prescription drugs trace back to DeLuca findings.

Historically, a wall breached by few scientists has separated academic and industrial research, but start-up companies are becoming an accepted pipeline for shuttling technology into the marketplace.

DeLuca has founded four companies over the years, but climbing out of the ivory tower to take the reins as president and CEO of his newest company, Deltanoid Pharmaceuticals, while remaining on the university faculty was an experience he didn't envision in the earlier stages of his career.

"It took the turn of the century to make me feel that I would be comfortable doing that," DeLuca said. "I think universities began to see (they could) increase their value to the community by increasing the flow of information and starting up of companies to aid in the economy. This university has certainly embraced it."

As the last graduate student of legendary biochemistry professor Harry Steenbock, DeLuca's research has complemented his mentor's legacy of alleviating human suffering. Steenbock's patented discovery that Vitamin D is increased by the irradiation of foods formed the nexus for WARF and provided a cure for rickets in 1924. Vitamin D research still provides about 70 percent of WARF's funding.

From lab bench to barn\ Not all technology flows through the patent office before impacting the people of Wisconsin.

UW-Extension, the outreach arm of the university, fulfills the Wisconsin Idea, a century-old tradition of disseminating knowledge throughout the state.

Associate professor and Extension specialist Paul Fricke works directly with dairy producers, veterinarians and county agents to improve reproductive efficiency in the dairy industry. Fricke is currently working with two test herds to optimize synchronization strategies for impregnating cows.

For Dan Monson, a co-owner of Spring Grove Dairy, participating in Fricke's reproductive studies is a symbiotic relationship.

"There is no doubt we have had the inside track on new technology," Monson said. "We have a lot of producers that look to us for what's working, what's new and what's different – we take that as a fairly big responsibility."

The synergy between bench scientists and business strengthens the UW-Madison tradition of impacting the world through scientific innovation.

For Eric Apfelbach of Virent Energy Systems, an economical, carbon-neutral biofuel is the Holy Grail in his company's quest to lessen the world's dependence on fossil fuels.

"It's one thing to start a company, try to make money and then sell it or take it public," Apfelbach said. "It's another when you have a very urgent global energy and CO2 problem that needs to be addressed at the scale this needs to be addressed – we need to move fast."

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