

**At the
College of
Agricultural Sciences,**

**we are
growing**

**through
Entrepreneurship
& Innovation**



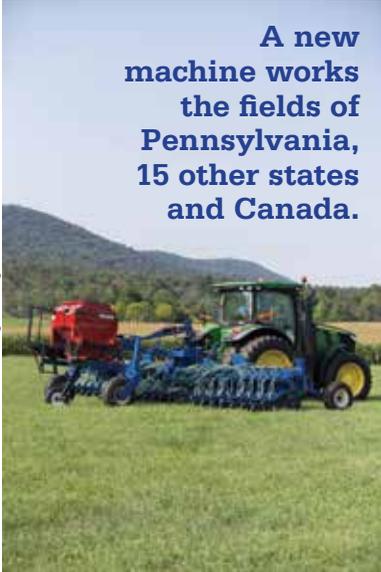
PennState
College of Agricultural Sciences



“Our students learn skills and share experiences to launch successful careers — and seek solutions to unprecedented global challenges in food, agriculture and bio-materials.”

— Dr. DAN AZZARA, *Director of the Entrepreneurship & Innovation Program at Penn State’s College of Agricultural Sciences*

A new machine works the fields of Pennsylvania, 15 other states and Canada.



With the patented InterSeeder, farmers can simultaneously fertilize a standing corn or soybean crop, spray herbicide and seed a cover crop.

As agronomy graduate students, Corey Dillon and Chris Houser invented the InterSeeder in 2010 with their advisors and professors Dr. Greg Roth and Dr. William Curran. The machine saves farmers time and money and helps keep nutrients on the land and out of the water where they become pollutants.

InterSeeder led Dillon and Houser to new careers as startup business owners. It's also a model for a new way of doing business at the College of Agricultural Sciences that encourages and helps students and faculty create new businesses to realize the full potential of their ideas and research findings.

InterSeeder is envisioned as the first win of many to come: Discoveries and new technologies that provide new jobs and economic growth, return money to the college and hold promise toward solving environmental problems.

Remarkably, just 18 months after its incorporation, InterSeeder Technologies is already doing all of that. The company licenses the technology from Penn State, owner of the initial patent, and returns royalties to the college.

InterSeeder quickly turned a profit and in its first 18 months sold 28 machines, earning \$850,000 in sales. Its contract manufacturer in Lancaster had to hire new people and build a new shop to keep up.

Dillon and Houser had some help as they built prototype machines and wrote their business plan. They won seed money — or “RAIN” — grant from the College of Agricultural Sciences’ Entrepreneurship & Innovation Program.

Caterpillars grow quickly, then transform within their protective chrysalises.



FACING PAGE: The patented InterSeeder, developed at the College of Agricultural Sciences, allows farmers to handle three tasks at once: fertilize, spray herbicide and seed a cover crop.



Lisa Duchene, Penn State College of Agricultural Sciences

Re-Energizing The College's Culture

So far, more than 70 faculty members have worked to commercialize their research, leading to 10 patents and 19 licensing agreements. E&I has helped undergraduate students start more than 30 of their own businesses and non-profit ventures.

The Entrepreneurship & Innovation Program—or “E&I”—represents the college’s renewed commitment to innovation. What began with one Penn Stater’s goal to better prepare students to create and run their own businesses evolved to re-energize the college’s entire culture to a more entrepreneurial mindset.

E&I has helped five new companies, including InterSeeder Technologies, to sprout from research at the college. So far, more than 70 faculty members have worked to commercialize their research, leading to 10 patents and 19 licensing agreements. Many faculty also partner with food and agricultural science companies on research projects.

E&I has helped undergraduate students start 30 of their own businesses and non-profit ventures. It hosts entrepreneurs on campus to tell their

stories, mentors students, offers new undergraduate classes for entrepreneurs in the agricultural sciences and a new minor degree program. E&I’s signature event, Ag Springboard, awards \$10,000 to the best student business pitches. (Think “Shark Tank” — but just for ag sciences students.)

Through the E&I Program’s initial results, the College of Agricultural Sciences is helping to lead a university-wide focus on entrepreneurship. Penn State President Eric Barron’s \$30 million Invent Penn State initiative urges the Penn State community across the commonwealth to drive job creation, economic development and student career success. E&I collaborates with Invent Penn State and shares its goals.

“This is the modern-day mission of a land-grant institution,” says Barron.

Better Preparing Students

Earl Harbaugh, a 1961 graduate, founded five businesses and has supported the college for more than a decade.

Not long ago, he realized there was no way for students to study and learn how to be or think like an entrepreneur. No way to major or minor in entrepreneurship. No way in which students could immerse themselves in the process — unless they did it on their own, as he had when he raised and sold broiler chickens in his hometown of Waynesboro, Pennsylvania, to help pay his way through college.

“The whole future of our economy rests on entrepreneurs and business development,” says Harbaugh, who started the first specialized dealership for Ditch Witch Midwest in Northern Illinois and created four more enterprises.

He and his wife, Kay, who grew up in Erie, settled in St. Charles, Illinois.

“Pennsylvania is still where our roots are,” says Harbaugh. “We thought ‘How are we going to give back to this college?’ Our answer was E&I — building a culture of entrepreneurship and innovation.”

Soon, they established the Harbaugh Endowment for Entrepreneurship to host successful entrepreneurs on campus. The Harbaughs’ donations formed the backbone of what became the E&I Program. Everyone — students to professors to administrators and alumni — can innovate, creating value, new enterprises and new

FACING PAGE: Bridge the GapSci, winner of Ag Springboard 2015, is a nonprofit venture to provide basic lab supplies to students in West African countries. It is the brainchild of (L to R) Kerry Belton, Jamaal James, Shawntawnee Collins (back row), Dr. Sarah Owusu and Dr. Josephine Garban (front row).

AT RIGHT: Colorful potato varieties inspired students Ben Nason and Deanna Spaniel to start a specialty potato chip company.

Naturally Colorful Potato Chips Headed For Market

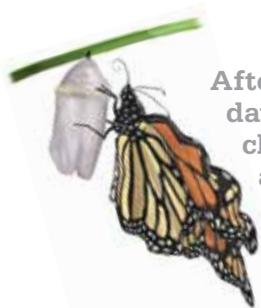
When students Deanna Spaniel, a senior agriculture business major who has run her own restaurant, and Ben Nason, a senior horticulture major, learned potatoes of nearly every color could be grown, they decided to partner on a startup potato chip company. They learned about the varieties with Dr. William Lamont, Jr., a professor of vegetable crops.

ROY BIV Potato Chips — winners of \$7,500 at Ag Springboard 2016 — will soon sell its blue and white chips.

Their company, named for rainbow colors, plans to market the naturally colorful potato chips to sports fans — starting with, of course, blue and white for Penn State fans!



Lisa Duchene, Penn State College of Agricultural Sciences



After 10-15 days in their chrysalises, adult butterflies emerge.



Lisa Duchene, Penn State College of Agricultural Sciences

ABOVE: Zach Wilson made 500 bottles of wine and graduated with a degree in agribusiness management in 2011. Wilson visited University Park in fall 2015 to share his story with students.

FACING PAGE: Zach Wilson periodically shares his progress with Dr. Mark Gagnon, who teaches entrepreneurship and agribusiness classes and is the Harbaugh Entrepreneurship Scholar & Entrepreneurship Coordinator.

jobs, says Harbaugh, and their work can help solve big, environmental problems.

“We’ve just begun to lift off,” says Harbaugh, describing E&I’s progress. “We’ve just begun to start because of the excitement of faculty, students, administration and stakeholders. We can be very pleased — but we’ve just begun.”

So far, more than 1,000 Penn State students have engaged with the E&I Program. Sometimes, it’s as simple as helping students realize their ideas matter and encouraging them to take a first step with an idea — good preparation for any future career.

Zach Wilson, who graduated in 2011 with a degree in agribusiness management, is turning his family’s farmland and dairy heritage in Nottingham, Pennsylvania into a thriving new family-run winery.

He grew up loving to build things. As a sophomore, he began building a vineyard and started talking to Dr. Mark Gagnon as a sounding board. Gagnon teaches classes in entrepreneurship and agribusiness and mentors undergraduate students with startup ideas. He is the Harbaugh Entrepreneurship Scholar & Entrepreneurship Coordinator, supported by one of the Harbaughs’ early gifts.

Wilson planted 90 vines in 2009 and another 3,000 the next year. By 2011, he made 500 bottles of wine. In fall 2016, he harvested 45 tons of grapes to make 35,000 bottles of wine.

Since 2014 students can also pursue an E&I Minor with a focus on Food and Bio-Innovation, thanks to \$200,000 in E&I scholarships funded through the generosity of donors.

Through the Ag Springboard student business pitch competition, E&I has mentored more than 50 student teams and awarded \$32,000 to new ventures. ROY BIV — renamed from Blue and White Chips — is launching its specialty potato chip business following its 2016 Ag Springboard win.



Lisa Duchene, Penn State College of Agricultural Sciences



**Wilson planted 90 vines
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Growing the Value of Discovery

Dr. Jeffrey Catchmark, associate professor of agricultural and biological engineering, discovered a promising, new medical foam to stop bleeding that can safely dissolve in the body. Catchmark is collaborating on the medical foam with Dr. Scott Armen, chief of trauma, acute care and critical care surgery at Penn State Hershey College of Medicine.

In 2015, Catchmark won a \$75,000 RAIN grant to help bring the medical foam to market. Since 2013, E&I has awarded a total of \$586,941 in RAIN grants to 14 projects showing commercial progress.

The RAIN grant program is the college's first of its kind. The "proof of concept" hurdle is a key step in commercializing any new technology or product.

"This is exactly what the RAIN grant program was designed to encourage. The

competitive pool highlights the potential to advance economic development through research in our college," says Dr. Gary A. Thompson, the college's associate dean for research and graduate education.

A proven entrepreneur and alumnus reviews each selected proposal, then becomes a mentor for the faculty researcher. The Penn State Research Foundation provides a one-to-two-match — \$25,000 for every \$50,000 from the college.

Past RAIN grant winners include entomologist Dr. Nina Jenkins, who founded ConidioTec to market a non-toxic, bed-bug-killing biopesticide developed by her team. RAIN funding helped Jenkins apply for Environmental Protection Agency approval by paying for a regulatory consultant and required testing.

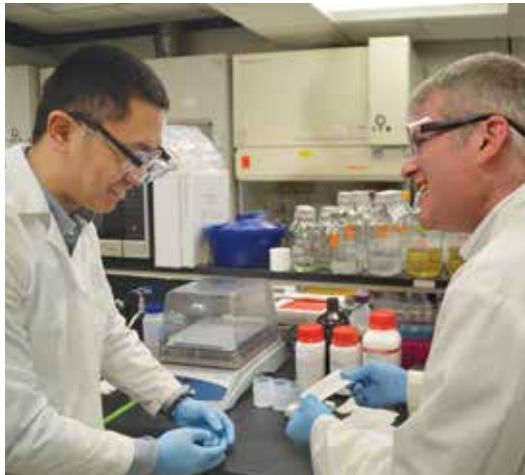
FROM LEFT TO RIGHT: Jingxuan Yang, a visiting scholar from Donghua University (left), and Dr. Jeffrey Catchmark (right) work on a new medical foam.

Food Science Professor Dr. Gregory R. Ziegler hopes to commercialize a brilliant orange made from avocado pits as a natural food coloring.

Dr. Wansheng Liu, an associate professor of animal genomics, developed a genetic test to quickly predict the fertility of male calves.

Dr. Troy Ott, professor of reproductive physiology, discovered a blood test to determine whether a dairy cow's insemination succeeded or failed.

BELOW: Avocado pits include a substance that can be extracted and purified to produce a brilliant orange.



Martha Schupp, Penn State College of Agricultural Sciences



Lisa Duchene, Penn State College of Agricultural Sciences

Since 2013, E&I has awarded a total of **\$586,941** in **RAIN grants** to **14 projects** that show commercial promise.



Entomologist Finds Biopesticide For Bedbugs

ConidioTec and InterSeeder Technologies have gone on to win a total of \$52,500 in first-place awards in Ben Franklin's TechCelerator Program competition.

"We're leveraging the potential of the entrepreneurial ecosystem," says Dr. Dan Azzara, Director of Entrepreneurship & Innovation. That group includes the Office of Technology Management, PSRF, The Small Business Development Center and Ben Franklin, notes Azzara.

To help faculty commercialize, E&I also hired consultant Scott Welsh as one-quarter of a new entrepreneur-in-residence position. Welsh's company, Fieldstone Innovations, specializes in commercialization strategy for new ventures and technologies in agriculture, biotech and energy.

Dr. Nina Jenkins, an entomologist and expert on safe pest-control methods, discovered that a formulation made from fungal spores effectively kills bedbugs.

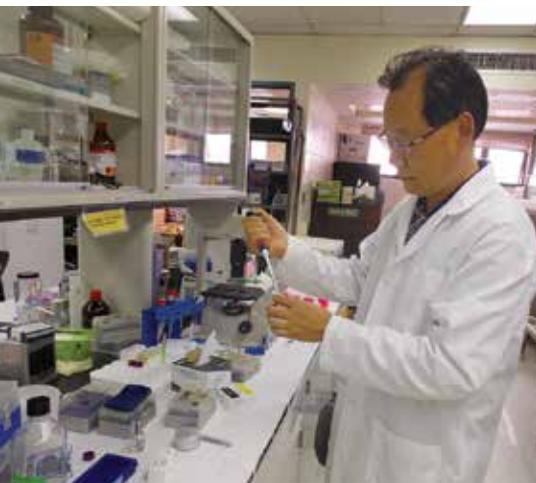
Now, Jenkins is CEO of ConidioTec — founded with Dr. Giovanni Bellicanta, her business partner and a post-doctoral scholar in microbiology. The product, Aprehend™, will soon be sold to licensed pesticide applicators, pending approval from the Environmental Protection Agency.

The spores stick to the bedbugs, allowing them to be carried back to hard-to-reach cracks, crevices and other hiding places to infect other bed bugs.

Jenkins and Bellicanta research and prepare for production and distribution while awaiting final word from the EPA.



Lisa Duchene, Penn State College of Agricultural Sciences



Lisa Duchene, Penn State College of Agricultural Sciences



Lisa Duchene, Penn State College of Agricultural Sciences



Martha Schupp, Penn State College of Agricultural Sciences



Advisors Prove to be Game-Changer

ABOVE LEFT TO RIGHT: The E&I Program Advisory Board with College of Agricultural Sciences leaders. **Left to right, front:** Earl Harbaugh, Dr. Mark Gagnon, Dr. Ann Tickamy, Skip Roskam, Dr. Barbara Christ, Mark Theiss, Dr. Joy Pate. **L to R, back:** Peter Tombros, Dr. Dan Azzara, Dr. Dennis Calvin, Peter Linder, Bill Donley, Dr. Vivek Kapur, Dr. Gary Thompson, Ray Evans.

FACING PAGE: **TOP LEFT:** E&I Director Dan Azzara (left) and Earl Harbaugh at a meeting of the E&I Advisory Board.

TOP RIGHT: Penn State Extension courses help farmers and food producers in 67 counties market their products.

All of the E&I Program's work is made possible by the generosity of donors. The Harbaughs certainly spearheaded the effort, recalls Mark Theiss, senior director of development. But they soon realized the E&I Program would need an advisory board of business people, working alongside academics, to realize the grand vision: fully prepare students for success, ensure discoveries and solutions reached the marketplace — where they can fully benefit society, drive economic development and generate new revenue.

When the advisory group met for the first time in late 2012, it included Harbaugh and William "Bill" Donley, former president and CEO of Tangent Rail Corp., a railroad supply company. Donley, a 1978 forest science graduate, had led a management buyout that created Tangent then led its turnaround. The company's 2010 sale represented a 98 percent gross internal rate of return, allowing Donley to retire in his early 50s.

Donley wanted to use what he'd learned in the business world to help students. Early on, he talked to people about what he saw as a "bit of a misalignment" between the E&I effort to encourage faculty to commercialize research and the university culture,

its processes and rewards system. A few months later, Interim Dean Barbara Christ invited Donley to chair the advisory board.

Donley agreed, and got to work meeting administrators and faculty, which he saw as necessary to accomplish the mission.

"This is a block and tackle effort," says Donley. "Day by day, professor by professor, graduate student by graduate student, undergrad by undergrad to get people engaged and supportive and get people acting that way."

"In a perfect world," says Donley, "we commercialize a few projects, hit a home run which enables us to get money back from the marketplace to give the college a never-ending supply of money so professors can do more research. Why not?"

The advisory board, says Theiss, was a "game-changer."

"Without that board direction and involvement on so many things, this program would not be where it is today," says Theiss. "It was the board regularly corralling everybody together and pushing that boulder up the hill that really got it done."



E&I Adds a Director

Azzara, the former senior vice president of research and development at the Hershey Company, knows what it takes to bring a great idea to market. Now, he's using his experience and scientific background to help professors.

Azzara earned a doctorate in food science at Penn State in 1986 and serves as the Alan R. Warehime Professor of Food and Agribusiness, teaching agribusiness classes in innovation management and strategic decision-making that are part of the E&I Minor.

Dean Richard Roush's appointment of Azzara added executive leadership to E&I's organizational structure.

"Action like the RAIN grants and the ENTI minor, communication and establishing an organizational structure are all shifting the culture," says Azzara. "If we do these well, we'll start to reenergize the culture and the thinking around E&I."

Innovation Part of College's DNA

These ideas aren't new, but rather rooted in the college's heritage, notes Harbaugh.

When a group of farmers joined to start the college, they were leading the nation.

"They were enterprising people who put capital investment forward to bring science to agriculture. Those are our roots," says Harbaugh.

In 1855, Centre County businessman James Irvin donated 200 acres to serve as the campus for the Farmers' High School. Six years later, it awarded the nation's first baccalaureate degrees in agriculture. Dairy research began 10 years later, and Berkey Creamery is now a world leader in dairy production and food science.

E&I in many ways has also stood on the shoulders of Penn State Cooperative Extension, which reaches into Pennsylvania's 67 counties to help farmers and food producers develop and market their products. The Food for Profit Workshop is a one-day overview of basic food science, business management, food policy and regulations. Many of its 1,000 graduates have started new food businesses or improved existing ones.

"The more we're able to support those entrepreneurs looking to start or grow their businesses the better," says Dr. Jeff Hyde, who oversees the programs of Penn State Extension and is a professor of agricultural economics. "That's a big part of our value to Pennsylvania and beyond."

Earl and Kay Harbaugh's gift to their alma mater created the core of what became the E&I Program.

Taking Flight

To fund its full, long-term vision, the E&I leadership team is hoping to grow its Entrepreneurship & Innovation Program Endowment from \$3 million to \$10 million by 2022. Azzara, Donley and several other board members have made initial donations.

“We want more of our students to experience the actual entrepreneurial process from concept to launch,” says Gagnon.

New funding and investment would allow more students to participate in start-up competitions, both at Penn State and around the country. “We want more of our students to experience the actual entrepreneurial process from concept to launch,” says Gagnon.

E&I would also boost the entrepreneur-in-residence to a full-time position, and encourage more faculty-generated licenses and start-ups, says Azzara.

Additional investments would also make RAIN and industry research partnerships sustainable for many years. Azzara adds: “We are taking steps to expand and enhance the E&I program and to provide a solid financial foundation for its long-term success.”



Adult monarchs are important pollinators and the only butterflies to make a two-way migration. Some fly as far as 3,000 miles.



Invent Penn State is a commonwealth-wide initiative to spur economic development, job creation and student career success. It blends entrepreneurship-focused academic programs, business startup training and incubation, funding for commercialization and university-community collaborations to facilitate the challenging process of turning research discoveries into valuable products and services that can benefit Pennsylvanians and humankind.

Entrepreneurship & Innovation Program
Penn State College of Agricultural Sciences

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