

# NC STATE

OFFICE OF RESEARCH COMMERCIALIZATION | **IMPACT REPORT** | 2022

## CHANCELLOR'S INNOVATION FUND

CELEBRATES 10 YEARS OF IMPACT

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Wolfpack Investor Network Strikes Partnership with Cary-based Harbright Ventures

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NC State Awarded One of Inaugural NSF I-Corps Hubs

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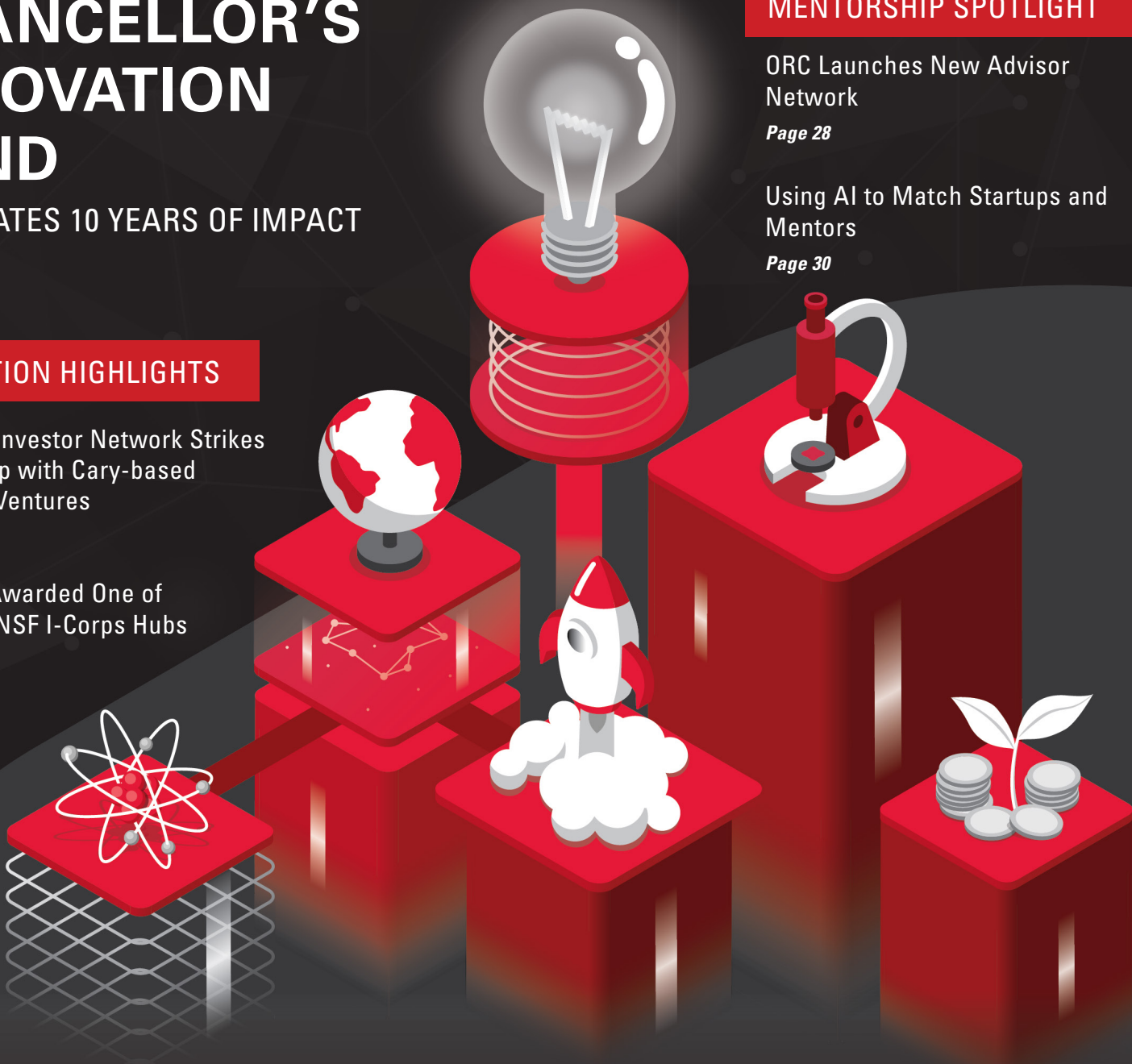
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ORC Launches New Advisor Network

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**NC STATE**  
UNIVERSITY

**Office of Research  
Commercialization**



## OFFICE OF RESEARCH COMMERCIALIZATION

IMPACT REPORT 2022

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# FROM THE ASSISTANT VICE CHANCELLOR

## Dear Innovators, Partners, and Friends,

NC State is a truly amazing place where cutting-edge research discoveries are creating real-world impact. It is an honor to lead such a talented and dynamic team of professionals dedicated to this mission and be surrounded by such brilliant innovators. I am very proud of the progress our team has made over the last decade.

It has been quite a journey and in this report we are starting off 2023 by looking back at the multitude of accomplishments by NC State innovators, startups, partners, and the Office of Research Commercialization (ORC) team through the publication of our first ever digital impact report.

NC State continues to solidify its status as a leader in innovation and research commercialization. In 2022, the nonprofit Heartland Forward ranked NC State second in research commercialization among all US public universities, and NC State continually ranks in the top five nationally for startups launched among universities without a medical school. The ORC team has also grown and increased its capacity as we work to advance research innovations to the marketplace and solve complex problems.

NC State has established itself as a leader in the National Science Foundation (NSF) innovation ecosystem, serving as a partner institution in the NSF Mid-Atlantic I-Corps Hub as we work to create and sustain a diverse and inclusive innovation ecosystem in the region along with the region's leading research institutions.

ORC's programs and initiatives also continued to flourish in 2022. We launched "ORCA" our new advisor network, and a virtual mentor matching platform, "Ask the Pack."

We were very pleasantly surprised and extremely grateful after receiving new funding support from local entrepreneur Bill Spruill, whose \$1 million philanthropic gift to NC State matches the current funding available from the Chancellor's Innovation Fund (CIF) Program, which targets deep technology innovation and commercialization. His Family Foundation 2ndF has a vision to return the Research Triangle to a position of dominance when it comes to commercializing deep tech and this gift adds fuel to the engine that we have built over the years and will drive increased growth of early-stage NC State research teams and startup companies.

2022 also saw the continued growth of the Wolfpack Investor Network (WIN), which surpassed \$20 million in capital deployed to 34 portfolio early-stage, high-growth startups with connections to NC State. ORC expanded its leadership role in WIN in 2022, and played a key part in establishing a new partnership with Harbright Ventures to enhance WIN member engagement, provide pre- and post-deal investment leadership and increase support for the broader NC State entrepreneurial community.

Thank you to all the team members, innovators, startups, investors, and ecosystem partners who make our continued growth and success possible.

Let's grow the next generation of companies that will solve the world's grandest challenges. I'm blessed and honored to be asked to serve. Let's get to work!

## Go Pack!



**Wade Fulghum**  
Assistant Vice Chancellor  
Office of Research Commercialization





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NC STATE UNIVERSITY

Office of Research Commercialization



NC STATE UNIVERSITY McKimmon Conference & Training Center

# ABOUT US



## History and Mission

NC State’s Office of Research Commercialization (ORC) acts as the steward of all intellectual property generated and owned by the university. Since its formation in the 1980s, it has worked to promote economic growth by facilitating the commercialization of research discoveries, leading to the launch of over 190 new startup companies and 600 commercialized products. ORC’s mandate includes protecting and promoting university-owned research discoveries and innovations, engaging with industry partners, and supporting the launch and growth of startup companies commercializing university intellectual property.



## Licensing

ORC’s Licensing team is tasked with strategically managing invention disclosures submitted by faculty, staff, and students from all colleges, departments, and units on NC State’s campus. Their responsibilities include the evaluation of new inventions, managing patent protection for novel innovations, identifying potential technology licensing partners, and working to negotiate license agreements that enable technology commercialization.



## New Ventures

ORC’s New Ventures team works to support university faculty and student innovators and entrepreneurs seeking to launch a new company to commercialize university-owned research. Their work includes strategic planning and business model support, assistance with new company incorporation, entrepreneurial training, development of logos and websites for new startups, and connections to startup funding and mentorship resources.



## Finance and Operations

ORC’s Finance and Operations team plays a critical role in assisting innovators and industrial partners with license payment, billing, and royalty collection and distribution, as well as maintaining compliance with federal sponsors. The team also manages the patent application process and correspondence, oversees reporting and tracking of products that arise from NC State intellectual property, and records and reports NC State commercialization data to internal and external stakeholders.



## OUR IMPACT

# BY THE NUMBERS

NC State is creating real-world impact through innovative ideas and action. Our faculty, students and staff are at the forefront of progress, and the Office of Research Commercialization helps accelerate those ideas to the market. See how we are making a difference locally, nationally and globally.

# 190+

## STARTUPS LAUNCHED



# 1.7B+

### FINANCING RAISED BY NC STATE STARTUPS



# 8.5K+

### TOTAL JOBS CREATED



# 600+

### PRODUCTS TO MARKET



# 5K+

### INVENTION DISCLOSURES



# 800+

### COMMERCIALIZATION AGREEMENTS



# 1.5K+

### PATENTS ISSUED

# OUR RANKINGS

AUTM FY20 | UNIVERSITIES WITHOUT MED SCHOOL

# #4

### STARTUPS LAUNCHED

# #1

### ACTIVE LICENSES AND OPTIONS

# #6

### TOTAL LICENSES

# #6

### TOTAL DISCLOSURES

# #1

### TOTAL OPTIONS

# #5

### RESEARCH EXPENDITURES





“The goal is to provide the critical funding needed to translate technologies to a point where a startup can be formed for commercialization or a license can be executed with an existing company.”

**Wade Fulghum**

*Assistant Vice Chancellor of the Office of Research Commercialization*



# CHANCELLOR'S INNOVATION FUND **TEN YEAR IMPACT**

The Chancellor's Innovation Fund (CIF) Program, established in 2010, awards up to \$50,000 to support short-term, commercially focused research projects. Each year, a select few promising proposals are chosen based on their likelihood of market success — as well as their potential societal benefits.

The CIF seeks to help this research bridge the gap between public and private funding. For every dollar the CIF awards, it generates close to \$20 in additional funding or investment.

To date, the CIF has granted nearly \$3.9 million to 63 projects — which have attracted nearly \$75 million in follow-on funding. These projects have led to 32 startup companies, 61 commercialization agreements and \$2.5 million in licensing revenue.

“CIF continues to serve as one of the most effective ways we can help our world-class faculty commercialize their cutting-edge research,” says Wade Fulghum, Assistant Vice Chancellor of the Office of Research Commercialization. “The goal is to provide the critical funding needed to translate technologies to a point where a startup can be formed for commercialization or a license can be executed with an existing company.”

CIF has supported a variety of successes since its inception, including funding research that ultimately supported the formation of rising startup Locus Biosciences and supporting a mobile security platform project that was licensed to Samsung and is now part of its Knox Security System. In addition to these high-profile impacts, several diverse, CIF-funded projects are now beginning to gain commercial traction.



# Chancellor's Innovation Fund TEN YEARS OF DATA

## FUNDED PROJECTS

### OVERVIEW

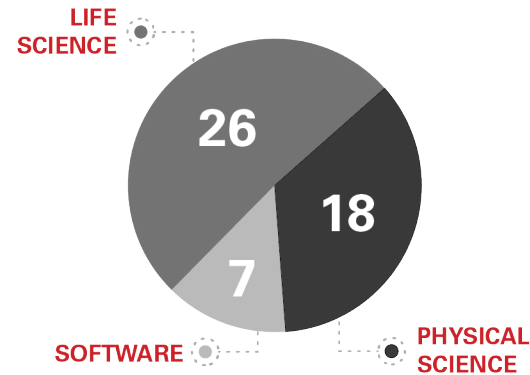
TOTAL PROJECTS FUNDED

**63**

PROJECTS STILL ACTIVE (78%)

**52**

#### PROJECTS FUNDED BY TYPE



PROJECT TECHNOLOGIES LICENSED

**39**

STARTUP COMPANIES FORMED

**32**

### FINANCIAL SUCCESS

IN FOLLOW-ON FUNDING RECEIVED

**\$60M**

FOLLOW-ON FUNDING BY TYPE:

**\$50.4M** LIFE SCIENCE  
**\$9.6M** PHYSICAL SCIENCE  
**\$23K** SOFTWARE

IN LICENSING REVENUE

**\$1.5M**

LICENSING REVENUE BY TYPE:

**\$557K** LIFE SCIENCE  
**\$90K** PHYSICAL SCIENCE  
**\$816K** SOFTWARE

### PROJECT SUCCESS

SUCCESSFUL PROJECTS

**34**

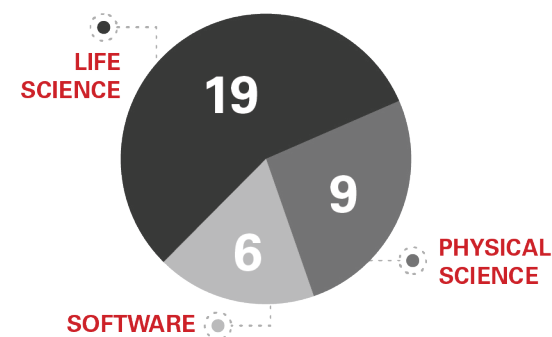
TOO EARLY TOTELL

**12**

UNSUCCESSFUL PROJECTS

**5**

#### SUCCESS BY PROJECT TYPE:



\*Success: the technology has been licensed to an existing company or a newly formed NC State startup company

# Chancellor's Innovation Fund WAYS TO ENGAGE

The Chancellor's Innovation Fund accepts applications annually as part of its funding cycle. Pre-proposals are typically due in October of each year and highlight the commercial application and market need for university-owned innovations. Semi-finalists are invited to submit a full proposal and a select number of finalists are invited to pitch their project to the CIF Selection Committee, a group consisting of regional investors and entrepreneurial support organization leaders, in May of each year.

All NC State innovators eligible to serve as a Principal Investigator can apply to the CIF and an invention disclosure for the technology must be on file with the Office of Research Commercialization (ORC) to be considered for funding.

Learn more about the Chancellor's Innovation Fund and how to apply by visiting: [go.ncsu.edu/cif-funding](http://go.ncsu.edu/cif-funding)







## CIF Awardee: Sinnovatek NC State Spinout Company Seeks to Spark Innovation, Fight Food Waste

Author: Matt Simpson

When food science professor Josip Simunovic applied to the Chancellor's Innovation Fund, he wanted to build a machine. A machine that would allow other inventors like himself to get new products to market faster — and at a fraction of the cost.

SinnovaTek, a company he co-founded, has now helped bring more than 100 new FDA-approved products to market.

"Usually, it takes about a couple of years to get on the market, and we can do it in six months to a year. That's never been done before," says quality manager Elaine Howell, who earned her bachelor's in food science at NC State University and is one of several State grads SinnovaTek now employs.

Simunovic, a research professor in NC State's College of Agricultural and Life Sciences, launched SinnovaTek in 2015 with his former student Amanda Vargochik, who serves as the company's chief innovation officer, as well as Michael Druga, who serves as CEO.

"Back when this whole thing started, we really didn't anticipate the way it would develop," says Simunovic, who earned his Ph.D. from NC State in 1998 and now holds dozens of patents.

He says in the beginning, the goal was "to maximize nutrient retention" — and quality — especially in products like baby foods, which were relatively overlooked. One of the first foods they tested was puréed sweet potato.

"The technology used before retained less than 30% beta carotene," Simunovic says. "When we did our trials, it was 97-98%."

Along the way, they realized that the technology had the potential to help curb food waste, too.

According to USDA estimates, close to one-third of food goes uneaten in the U.S. each year at the retail and consumer level. While food that gets tossed to the trash in homes and restaurants accounts for much of this waste, plenty more loss occurs throughout the supply chain — particularly in the produce industry.

In North Carolina, Druga says as much as 40% of sweet potatoes grown by farmers used to go to waste.

Perfectly edible fruits and veggies can get left behind for various reasons. Oftentimes, it's simply due to supply and demand. If the market price is too low to justify the cost of harvesting and transporting the crops, or if there aren't enough workers to harvest them, they often get left in the fields. But sometimes it's because the crops aren't quite the right size or just don't look good enough to sell in stores.

That's where companies like SinnovaTek can step in to help.

A Certified B Corporation and member of the UpCycled Food Association, each year SinnovaTek helps turn millions of pounds of food once destined to rot into products such as protein gummies and purées or soups, smoothies and sauces.

One new client alone, which is "coming online" this year, now brings them close to 10 million pounds of carrots that would otherwise go to waste.

"Eight million pounds a year that we can turn into a beautiful purée," Druga says.

Processed food gets a bad rap. The truth is, though, plenty of processed foods can now be made to taste as if they were

freshly prepared and can also pack just as much nutrition — while remaining shelf-stable throughout shipping and months of storage.

That's largely thanks to the advent of microwave processing and many subsequent innovations, several of which were pioneered by NC State food scientists like Simunovic.

Microwave processing — known in technical terms as "continuous flow microwave pasteurization and sterilization" — is a type of aseptic processing, a system for quickly heating and packaging food products in a sterile environment.

Using the same kind of energy as the microwave in your home, Simunovic and SinnovaTek's patented technology can evenly cook thick, viscous foods with indirect heat — resulting in products that retain more nutrition and flavor.

In 2014, Simunovic received support from the Chancellor's Innovation Fund, a competitive internal seed funding program NC State created to guide ideas from the research lab into the business world. The CIF aims to bridge the gap between public and private funding; it's designed

to help develop a technology to the point that it can be licensed or a startup can be formed. Simunovic, Vargochik and Druga launched SinnovaTek roughly a year later.

Through its subsidiary FirstWave Innovations, SinnovaTek now helps other inventors and small companies get their novel products to market — guiding them through the commercialization process.

"The CIF is similar to what we're doing here now," Simunovic says. "That category didn't really exist for aseptic processing until this was put in place."

The modular machines SinnovaTek builds and sells can put out "anywhere from two to five liters per minute" — which are called "precision-scale processors" and make up most of the equipment at FirstWave — to as much as the "20-30 gallons per minute" that its largest systems can generate, Simunovic says.

This allows companies of all sizes to test, launch and eventually scale up products much faster than average — and for far less money upfront.





“Usually, it takes about a couple of years to get on the market, and we can do it in six months to a year. That’s never been done before,”

**Elaine Howell**  
*SinnovaTek Quality Manager*



“In the aseptic food space, you need to be at millions of units to even test-market a product. It’s just a lot of risk,” says Vargochik, who earned her master’s in food science from NC State. “So we’ve provided a model where companies can lower their risk.”

FirstWave has no minimum-order requirement.

Why? To help “better products” get to market. “It’s definitely our focus to bring young brands into the market because we find there’s a lot of innovation there,” Vargochik says.

Druga says that while most of SinnovaTek’s competitors go after products like applesauce — which are popular and therefore safer, but at the same time, “aren’t differentiators” — SinnovaTek focuses more “on small-scale entrepreneurs looking to launch new, innovative products.”

“Something that’s better for you and unique, not just a combination of artificial flavors and sugars,” Druga says. “We really try to get more into natural products and leverage the technology to do that.”

SinnovaTek also works with big players in the industry, too, though. Druga says they

recently helped a Fortune 500 company get from “idea to store shelf within three months.”

“And now we’re going to launch a commercial product for them in less than a year, with virtually no capital out of pocket for them,” Druga says, as opposed to the two to three years and few million dollars it normally takes. “So that’s really what the model enables: Rapid prototyping for food innovation.”

The smaller, mobile microwave processors SinnovaTek makes are good for more than just pilot-testing new products, though. They’re also ideal for those who need the ability to process leftover produce immediately and on-site.

“One of the biggest issues with waste streams right now is trying to preserve them long enough to be able to use them,” Druga says.

For example, Druga says the wet skins and peels that are byproducts of a typical juice production system go bad within hours.

The SinnovaTek team knows there’s still lots of nutrients left in these types of byproducts, too. They’ve shown that when combined with protein, the skins of blueberries and muscadine grapes can be transformed into nutrient-rich gummies.

In 2019, SinnoVita, another subsidiary of SinnovaTek, partnered with Ripe Revival — founded by NC State Poole College of Management alumnus Will Kornegay — to launch a line of fruit gummies, which are not only made from food waste but also high in protein and allergy-friendly.

The technology behind the gummies evolved from research that began in the labs of Simunovic and Mary Ann Lila, director of NC State’s Plants for Human Health Institute in Kannapolis.

But it was Nathalie Plundrich, now SinnovaTek’s technology development manager, who first thought to apply the technology to create gummies. Plundrich, who earned her master’s and Ph.D. in food science from NC State, studied the technology when she was a student

in Lila’s lab. When Plundrich joined SinnovaTek in 2018, she brought that knowledge with her.

Things have come a long way since Simunovic received support from the Chancellor’s Innovation Fund (CIF) in 2014. He credits the SinnovaTek team for much of the progress that’s been made over the years.

But it was the CIF’s early-stage support that allowed him to build the initial prototype of the precision-scale microwave processors now housed in FirstWave’s facility off Atlantic Avenue.

And Simunovic says that prototype equipment is still in use today, too, by students in his lab.

Additionally, beyond the financial support Simunovic received, Druga and Vargochik say NC State’s Office of Research Commercialization has remained an ally since SinnovaTek’s inception. For example, the Office of Research Commercialization invited the trio to be a part of NC State’s first-ever National Science Foundation I-Corps cohort, in 2017.

SinnovaTek continues to work closely with the Office of Research Commercialization — licensing almost 20 existing patents and regularly seeking to file new ones.

“We work very closely with Kultaran [Chohan] and the group there to make sure we have the right licenses, to make sure that we’re able to support the IP,” Druga says. “We’ve also continued growing the IP portfolio. We’ve actually created several new patents that are shared with NC State, because of the shared ownership with Josip. So it’s always been a collaborative effort.”

What’s more, SinnovaTek got backed by the Wolfpack Investor Network in August. Leveraging the NC State community’s powerful opportunities for networking and guidance from industry experts and successful business leaders, the Wolfpack Investor Network — made up of NC State alumni and others in our entrepreneurial community — matches investors who have relevant expertise with companies in

**“I don’t want to just develop the next chip flavor or something, I want to be part of something bigger.”**

**Nathalie Plundrich**  
*SinnovaTek Technology Development Director*

its portfolio.

SinnovaTek is still growing, almost as fast as their microwave processors can churn out food. Druga says one of their co-packing partners sells its baby food in Whole Foods across the country — and is “growing like crazy.” So to keep pace with demand, SinnovaTek needs more space.

The company plans to open a brand-new, 62,500-square-foot production plant by the end of the year.

Druga says they’ll start out with “a line similar to the one” in FirstWave’s current, 9,000-square-foot facility, which will remain in operation. The machines at the new plant will run “about five times faster,” though, Druga says. Down the road, Druga says they’ll add “more production lines and new package formats.”

But in one key way the equipment will be exactly the same — all-electric.

“We believe very strongly in electric heating because it can run from sustainable energy sources,” Druga says.

Simunovic says they’ve been getting “calls from all over the world” about their technology and how it plays into global efforts of “decarbonization through electrification.”

Sustainability is paramount to SinnovaTek’s mission, and the company also wants to continue expanding its

reach internationally. It’s already made a difference in Africa, where one of its microwave processors is being used to make shelf-stable sweet potato purée.

With help from Tawanda Muzhingi, an adjunct professor in the Department of Food, Bioprocessing and Nutrition Sciences, SinnovaTek shipped one of its “Nomatic” processors to Kenya in 2020.

The company was recognized for this work with a Tibbetts Award from the U.S. Small Business Administration. It’s work like this that inspired Plundrich to join SinnovaTek after finishing her Ph.D. at NC State.

“I don’t want to just develop the next chip flavor or something,” Plundrich says. “I want to be part of something bigger.”

However, while they want to make impacts worldwide, when picking a location for their new plant, Druga says it was also important to stay close to campus. The new production plant will be located in Middlesex, North Carolina, roughly a half-hour drive from Raleigh.

Druga says they plan to hire as many as 50 new employees within the first two years of opening the new plant, which would more than double their staff. It’s almost certain that more than a few of these new-hires will be products of NC State.



# CIF Awardee: Fathom Science

## Fathom Science's Metocean Forecasting Technology Wades Into Uncharted Territory

Author: Matt Simpson

When a storm's coming, you want to know as soon as possible — especially at sea. Whether it's a hurricane or an ocean "tornado" headed your way, extra time to prepare can make a world of difference.

Ruoying ("Roy") He has devoted the better part of his last two decades to physical oceanography research that could, among other things, make it possible to accurately predict as far as three months out when ocean eddies — which He colloquially calls "ocean tornadoes" — will form.

"This has never been routinely done before," says He, a Goodnight Innovation Distinguished Professor in NC State University's Department of Marine, Earth and Atmospheric Sciences. "We are hoping our technology will enable that."

He's startup company, Fathom Science, has been asked by a leader in the oil-and-gas industry to predict the patterns of ocean eddies, circular currents of water which can wreak havoc on offshore drilling operations.

He says that it is possible to predict ocean conditions much further out than the average weather forecast. Still, though, He says a "decent" ocean forecast typically can predict conditions up to three weeks or, at most, a month ahead of time.

But due to the safety hazards ocean eddies create for offshore oil rigs —

and, in turn, delays in the supply chain — He and his company have been asked to more than triple the window of time their client has to prepare for an incoming eddy.

Fathom Science, founded in 2018, is a metocean — short for "meteorology" plus "oceanography" — forecasting company that uses its proprietary software to develop customized analytics, which can be packaged as a dataset, report, web portal or combination thereof depending on its clients' needs.

Fathom has worked with NOAA, NASA, the National Science Foundation and the Office of Naval Research, in addition to businesses both large and small. Its work to lessen the impacts of ocean eddies on offshore oil rigs is just one of many different challenges that He and his team have been asked to solve.

Fathom's been contracted to crunch the numbers on variables such as predicted wind and current patterns to a variety of ends, from sailboat racing routes to shipwreck recovery searches, says Joe Zambon, Fathom's vice president of research and development.

Fathom Science was co-founded by He, who serves as company president; Zambon, who's also a research assistant professor at NC State; and Jennifer Warrillow, who serves as vice president of operations and is also a lab manager with He's Ocean Observing and Modeling Group

at the university. The three of them launched their startup less than a year after receiving support from the Chancellor's Innovation Fund (CIF).

Without the help of the Office of Research Commercialization (ORC) and the CIF, the work of He's Ocean Observing and Modeling Group might've never left the lab — beyond what research gets published in peer-reviewed journals, which He has come to realize have a relatively small audience.

He says once he realized how many more people there are living along the coastlines of just the U.S. alone than there are marine science researchers around the globe, it was "a wake-up call" that he needed "to do something more impactful."

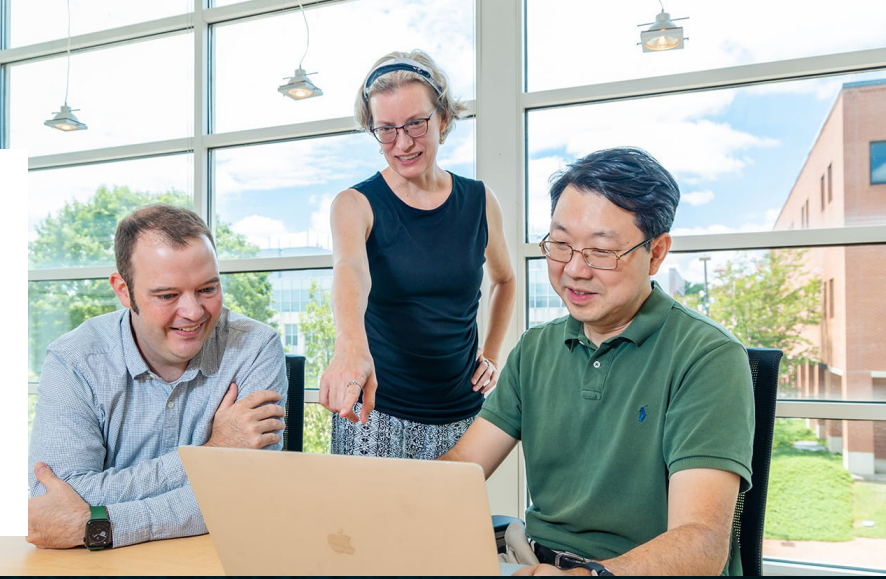
"The Chancellor's Innovation Fund really made us realize that what we do — oceanography — is applied science," He says.

He decided to apply to the CIF — taking an existing concept, the "Coupled Northwest Atlantic Prediction System" (CNAPS), and rebranding it for the purposes of the pitch as a "Virtual Marine Ecosystem" (VME) system, likened to a combination of Google Maps and AccuWeather for the ocean. The VME system was essentially a prototype that incorporated aspects of what now makes up Fathom's suite of products.



"The Chancellor's Innovation Fund really made us realize that what we do — oceanography — is applied science,"

**Ruoying ("Roy") He**



The funding they received ultimately allowed them to develop the first of those products: FishCast. FishCast™ is now used by commercial and competitive fishers alike — including in the annual Big Rock Blue Marlin Tournament, hosted off the coast of Morehead City, North Carolina. But when FishCast first launched, Fathom needed customers.

Thankfully, the support of the CIF is far more than financial. For example, He says they were paired with a team of four business mentors who met with them twice a month over the course of a year.

"We had ideas, but we didn't know how to execute [them]," He says. "They gave us lots of good advice — but also a reality check."

Initially, he and his team had 10 different sectors they wanted to pursue; the mentors helped Fathom figure out the fishing industry was the best first target.

More importantly, the mentors helped Fathom realize that pivoting to a business-to-business ("B2B") approach was more viable than selling FishCast to individual consumers. As a small startup, Fathom's employees had nowhere near enough time to field emails and calls from customers during the peak of the fishing season. Partnering with ROFFSTM, a company with decades in the industry and an existing client base to show from it, allowed Fathom to further establish a proof-of-concept — and secure a "beachhead market."

In addition to matching them with mentors, ORC encouraged the Fathom team to participate in the National Science Foundation's I-Corps program, which He says taught them the importance of listening first in meetings with prospective partners or customers; whereas before, coming from an academic perspective, they had a tendency to over explain things — sometimes "boring" their audience in the process.

"Every time we go to a new end-user or business partner, we want to understand what they're looking for," He says. "We know to listen first, then provide a solution that can help to solve their specific problem."

Warrillow also credits the CIF with inspiring her to earn a graduate certificate from the Poole College of Management's Technology Entrepreneurship and Commercialization (TEC) program.

Last fall, Fathom was selected as a finalist for one of those showcases — NASA iTech Cycle II — which was one of its first opportunities to market its ocean intelligence technology on a national stage. While the NASA iTech event was Fathom's first chance to network on a national scale, back in November 2021, it received recognition for "innovation, excellence and growth" at the state level here in North Carolina — being named as a finalist for the NC Tech Awards, in the "CleanTech" category.

Moving forward, He hopes to shift

Fathom's focus even more toward sustainability and ways it can help mitigate climate change. The Fathom team is among a project group who recently submitted a multimillion-dollar proposal to answer key scientific questions on ocean-based carbon dioxide removal approaches. "Ocean alkalinity enhancement" is one of eight ambitious ocean-based carbon dioxide removal (CDR) initiatives, He says, which could potentially help capture significant amounts of carbon dioxide from the Earth's atmosphere.

"The ocean plays a major role in modulating the carbon concentration in the atmosphere," He says. Warrillow says that NASA and NOAA are becoming increasingly interested in using the concept of a "digital twin" to research complex scenarios without having to worry about any impact on the natural environment. Fathom is "ideally suited" to work on the digital twin concept "for a lot of different scenarios," Warrillow says.

He says what sets Fathom apart from its competition is that it does much more research in-house, as opposed to simply using data from sources like NOAA.

"Many companies are just using open-domain datasets," He says. "We are building our own data, our own models, which allows us to stay cutting-edge."





## CIF Awardee: TreeCo Seed Funding Speeds Growth for TreeCo — an NC State Startup

Author: Matt Simpson

The world's largest and most advanced collection of gene-edited wood presumably lives on Centennial Campus at North Carolina State University.

Stacked on shelves in a corner closet of the Forest Biotech Group's lab, these bundles of sticks sit mere feet from the incubation freezers that contain the tree stem cells they started out as. Directly across the hall, you'll find Rodolphe Barrangou's CRISPR Lab — where some of today's most cutting-edge

CRISPR research with food and nutrition applications is being done.

TreeCo — a startup founded by Jack Wang, director of the Forest Biotech Group, and Barrangou, the Todd R. Klaenhammer Distinguished Professor of Food, Bioprocessing and Nutrition Sciences — performs much of their research in those two labs and a few greenhouses just outside the building.

"We focus on combining tree-genetic insights with the power of genome

editing to breed healthier forests and a more sustainable future," says Wang, who's also an assistant professor in the Department of Forestry and Environmental Resources.

It only makes sense that a research startup like TreeCo would have roots at NC State — home to one of the first schools of forestry in the nation.

"The idea of translating decades of basic foundational research into something that could be impactful in the real world is just

tremendously exciting," Wang says. Thanks in large part to support from the Chancellor's Innovation Fund (CIF), TreeCo has grown quickly — almost as quickly as the Poplars, Loblolly pines and Eucalyptus trees they've been experimenting with.

By using CRISPR to edit select genes, TreeCo is able to create cultivars that can cut the growing cycle from years or decades to as little as 12 months — and achieve a number of other desired enhancements, such as better drought or frost tolerance, for example. More importantly, using DNA-free CRISPR technology means that the trees produced are natural; that is, they are not considered genetically modified organisms (GMOs).

"We're not using DNA to edit DNA inside the trees," Wang says. "That's a very exciting technology that has a whole host of benefits down the road."

TreeCo's technology opens the door for

a number of tactics to mitigate climate change. Not only could it help grow trees faster — or that are more resilient to less predictable weather patterns — but it could also help meet the rising demand for biofuels, plastic alternatives, and sustainably manufactured textiles and paper.

"When we change and optimize the biochemical composition of those trees, we make that operation more efficient," says Barrangou, who's considered a pioneer in the CRISPR field. "It would take fewer resources and less energy to run the same manufacturing plant."

Barrangou says they're working to produce the world's first genome-edited pulp and paper — the production mills for which are well-known sources of pollution and "energetic inefficiencies."

Wang says they also focus on the emerging markets of sustainable bioenergy and bioproducts — by testing traits that could lead to the more efficient production of green chemicals and fuels, or feedstocks that are better-suited for lignin-based fiber materials and other

nano-cellulosic plastic alternatives.

Through innovations like these along with the potential to breed forests faster and healthier, TreeCo hopes to offer many opportunities to contribute to the overall reduction of our carbon footprint.

"Sustainability is paramount in today's world," Barrangou says. "And breeding healthier trees for a more sustainable forestry enterprise is one of the greatest goals that we can aspire to — but at the same time, a very daunting challenge lies ahead of us."

Barrangou says that, realistically, some of the things they're working on today "won't actually fully come into fruition until 2046."

"It will take years — in some cases a couple of decades — to fully illustrate the benefits that can be reaped," Barrangou says.

However, they have made plenty of progress in just a few years. Namely, Wang and Barrangou say they've proven they can successfully perform "multiplex





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**Rodolphe Barrangou**

*Todd R. Klaenhammer Distinguished Professor of Food, Bioprocessing and Nutrition Sciences*



genome editing” — that is, target multiple genes simultaneously — in multiple tree species.

The work TreeCo does each day ranges from refining the methods and tools used for making desirable genetic changes to verifying that those changes occurred — and just as importantly, that the trees grew up healthy, with no unintended side effects.

“Everything from the computer code used in the design of genetic surgery all the way to delivering those molecular scaffolds into cells we surgically edit, then grow and develop into bona fide trees,” Barrangou says.

After first determining which genes to target in order to change phenotypes of interest, molecular machines are

used to select and surgically modify the DNA. Then, once the stem cells have regenerated into plantlets, the baby trees are nurtured in an incubation room for a few weeks. When they’re mature enough, the trees get sent out to the greenhouse to continue growing. About six months later, last but not least, it’s time to characterize their features — testing the trees’ attributes and chemical composition to see how healthy they are and how many of them turned out as expected.

Wang and Barrangou are currently nearing the end of the first year of Phase I funding through the National Science Foundation’s Small Business Technology Transfer (STTR) program. Their STTR project, in partnership with NC State, concentrates on Loblolly pines — one of the primary economic tree species in the U.S. Loblolly pines make up close to 80% of

the roughly 3.2 million acres of managed timberland in North Carolina.

The forest sector contributed an estimated total of nearly \$35 billion to North Carolina’s economy in 2019 alone, supporting almost 150,000 jobs. Every one of our state’s 100 counties is supported by forestry in one way or another.

It took only three months from the time they received CIF support for Wang and Barrangou to incorporate TreeCo as a company. While this is an outlier — it normally takes considerably longer — Wang and Barrangou say that it wouldn’t have been possible without the CIF and the Office of Research Commercialization (ORC).

The CIF dollars themselves primarily went toward proof-of-concept testing in Poplar trees, Wang says.

“The CIF project really allowed us to establish a proof of concept, and validate our technology of DNA-free modality to

genome editing in tree protoplasts,” Wang says. “We confirmed the editing of target genes with little to no off-target effects — in fact, we didn’t detect any off-target effects in the samples that we edited.”

Barrangou says that at the advice of ORC, they have applied for patents across the globe — and that these kinds of comprehensive protections give them “the freedom to operate and deploy [their] knowledge, technology and know-how.”

“Seeing how in just three years we’ve gone from an idea to a successful company, I think speaks volumes,” Barrangou says. “It’s not just advancing the science or advancing the business — we’ve really been able to move the needle, pun intended.”



# Wolfpack Investor Network Strikes Partnership with Cary-based Harbright Ventures

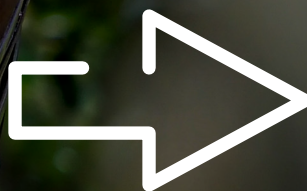
Author: Deborah Strange



WOLFPACK  
INVESTOR  
NETWORK



HARBRIGHT  
VENTURES



The Wolfpack Investor Network (WIN), NC State University's alumni-driven, early-stage investor group, is partnering with Harbright Ventures to enhance WIN member engagement, provide pre- and post-deal investment leadership and increase support for the broader NC State entrepreneurial community. This collaboration will strengthen opportunities and professional support for WIN members, NC State students and WIN portfolio companies.

**"With WIN investments surpassing \$20 million across 34 portfolio companies, alongside a leadership transition, this was a prime opportunity to restructure and take WIN to the next level by bringing in new expertise and support,"** said Wade Fulghum, assistant vice chancellor for research commercialization and the chair of WIN's steering committee.

NC State is already a leader in innovation research commercialization. This year, the nonprofit Heartland Forward ranked NC State second among all U.S. public universities in research technology transfer and commercialization. NC State also ranked second among universities — public and private — without medical schools and seventh among all U.S. universities. Working with Harbright Ventures will increase the university's ability to serve researchers and investors alike.

"This partnership embodies NC State's Think and Do spirit by fostering collaboration and leveraging expertise throughout the community for the benefit of our students. The innovative

work of the Wolfpack Investor Network (WIN) aligns closely with key elements of the university's strategic plan, Wolfpack 2030: Powering the Extraordinary, including empowering students for a lifetime of success and impact, elevating the national and global reputation and visibility of NC State, and leading in developing innovative partnerships, entrepreneurial thinking and applied problem-solving," said Chancellor Randy Woodson.

Harbright Ventures, a venture capital firm based in Cary, North Carolina, provides financing to early stage, high-growth companies based primarily in the Southeast. The group benefits stakeholders by embracing diverse sectors, providing thorough due diligence, following a robust investment philosophy, and providing significant post-investment support to portfolio companies.

**"Harbright knows that NC State provides great value to the state of North Carolina through its research, innovation and product development,"** said Robert Ross, a founding partner of Harbright Ventures. "Our investment strategies are well aligned, and together, we can ensure that investment opportunities are managed to the benefit of WIN members and NC State-affiliated companies."

As Harbright joins WIN, the investor network's potential portfolio bandwidth will significantly increase. The new team approach will increase the ability to evaluate potential companies, grow membership within the network, and expand investment offerings nationally.

The Wolfpack Investor Network (WIN) was launched in December 2016 as a university-affiliated nonprofit LLC. It showcases the university's entrepreneurial ecosystem by curating university-affiliated investment opportunities for its investor members. WIN provides members with a professionally managed investment platform as well as an opportunity to collaborate and network with other like-minded alumni, parents and friends of the university who are interested in early-stage investing. Since its inception, WIN has collectively invested more than \$20 million into 34 portfolio companies spanning industries such as food science, medical devices, advanced materials and novel therapeutics. WIN has received support from the Chancellor's Office, Kenan Institute for Engineering Technology and Science, Office of Research Commercialization, Academic Outreach and Entrepreneurship, the Economic Development Administration, NC IDEA, and the Poole College of Management. To find out more about the Wolfpack Investor Network, please visit <https://research.ncsu.edu/win/>.

Harbright Ventures is an early stage investment and advisory group that fuels the growth of extraordinary ideas and provides capital, connections, and strategic guidance to portfolio companies. Founded in 2014, Harbright is sector agnostic, but primarily invests in the life sciences, B2B SAAS, and industrial technology verticals. Harbright offers fund, SPV, and specialty debt structures to its investors. For more information please visit [harbrightventures.com](http://harbrightventures.com).



# WIN Portfolio Companies

## Diveplane

Raleigh, NC (Artificial Intelligence): Groundbreaking technology start-up dedicated to keeping the best of humanity in artificial intelligence. CEO, Mike Capps.

## Reveal Mobile

Raleigh, NC: (Ad Tech): Creates accurate and precise mobile audience segments to help companies advertise effectively by using patented beacon detection and latitude/longitude data. CEO, Brian Handly.

## Spiffy

Raleigh, NC (Consumer Services) Provides full-service mobile car washes and detailing as well as on-board diagnostics. CEO, Scot Wingo.

## Advanced Animal Diagnostics

Morrisville, NC (Animal Health): provides livestock producers with on-site diagnostics that improve profitability and empower more precise care of animals so they live healthier, more productive lives. CEO, Joy Parr Drach.

## Natrx

Raleigh, NC (Advanced Materials): Delivers innovative infrastructure solutions that protect shorelines and the surrounding environment. Its patented technology allows the team to produce naturalistic structures that are customized to the project site conditions. CEO, Leonard Nelson.

## SonoVascular

Chapel Hill, NC (Medical Device): Developing a multi-mechanism thrombectomy system for the endovascular treatment of arterial and venous disease, including deep vein thrombosis, pulmonary embolism, peripheral artery occlusion and acute ischemic stroke. CEO, Dan Estay.



## WIN Student Engagement



The portfolio companies are not the only ones that reap the benefit of mentorship and learning. Each company selected to present to WIN is screened by a due diligence team made up of current NC State MBA and STEM graduate students. Led by Lisa Chang, Diligence Director these teams of 3-5 students then prepare due diligence reports for WIN members to review before making investment decisions. "Working with WIN provides a holistic view of all lessons and courses from the Jenkins MBA. This hands-on-experience, which can incorporate everything from viewing financial reports, researching technical features, and interviewing executives, has proven invaluable in my graduate studies and career as a whole," shared due diligence analyst and MBA candidate, John Swann.

"This educational process has proven to be a valuable experience for graduate students to communicate with company management teams, review and organize complex information, and network with successful alumni members," Phillips stated. "WIN member-investors are enthusiastic that the network provides hands-on educational opportunities for students and future alumni," Phillips added.

Reflecting back on the experience gained as part of the due diligence team, Swann added "The exposure to WIN has challenged how I think, improved my writing and communication skills, and provided the opportunity to meet new and interesting people. WIN has been the perfect complement to the entrepreneurial focus I have chosen for the Jenkins MBA."

**Companies interested in securing funding or investors interested in becoming WIN members can learn more at [research.ncsu.edu/win/entrepreneurs/](https://research.ncsu.edu/win/entrepreneurs/).**

**Our interdisciplinary teams of graduate students have taken the university's motto of Think and Do to heart, and relish the opportunity to work with WIN to produce quality due diligence reports on portfolio companies for review by our members. Their access to the thought process of both portfolio company leadership and WIN investors is an experience afforded to few in the real world, much less to those still in school. The opportunity to tap into their collective technical and business expertise to support the growth and success of NC State-related companies is widely recognized by these students as one of the most fulfilling and impactful experiences in their time at the university.**

**Lisa Chang**  
WIN Diligence Director

Portfolio companies must meet the following criteria:



### Wolfpack Connection

Have a founder, executive, or board member who is a NC State alumnus, faculty, staff, student, or parent, or have licensed NC State University intellectual property.



### Funding

Raising seed or Series A equity capital of \$250,000 to \$5 million or syndicating later-stage equity financings with an existing or new lead investor.



### Location

To help build economic development and support the land grant mission of the university and the company must be location in the United States.

Most of the companies WIN has invested in are headquartered in the Triangle area and 23 of 25 are headquartered in NC. **"These companies drive innovation, job creation, and positive environmental impact in North Carolina and beyond, all while strengthening the reputation of NC State University as an institution that is investing in innovation,"** Phillips stated.





# NC State Awarded One of Inaugural NSF I-Corps Hubs

Author: Deborah Strange



**Overall program impact includes:**

**20 Startups**  
have been launched, nine in FY21 alone

**\$3.7 Million**  
in follow-on funding generated by I-Corps teams

**\$1.3 Million**  
of which was received in FY21

**17 SBIR/STTR**  
proposals have been submitted by I-Corps teams, seven of which have been awarded

NC State University, in partnership with nine other leading research universities, has been selected by the National Science Foundation to be one of the five inaugural national I-Corps Hubs, a program that seeks to change the culture of research universities to explore commercialization as an avenue for research to make an impact on society. NSF's I-Corps program has been adopted by most federal agencies to help researchers bring their discoveries and technologies to the marketplace.

The Hubs' goal is to create and sustain a diverse, inclusive innovation ecosystem in the United States by establishing tools and training activities, funding research, providing

opportunities to diverse communities and sharing effective innovation practices across the country. The Hubs will build upon the National Science Foundation's I-Corps, or Innovation Corps. NC State has been home to an I-Corps Site since 2017, with 102 teams having participated in the program throughout 12 cohorts.

"This is an exciting opportunity for NC State to build upon research and commercialization with our peer universities," said Mladen Vouk, the university's vice chancellor for research and innovation. "Research commercialization truly embodies our mission at NC State: uniting science and technology to tackle challenges and bolster social and economic development across the world."

"We were honored when asked to serve as a partner institution in the leadership of the envisioned I-Corps Mid-Atlantic Hub. This is very exciting given the collective research power of the prestigious universities and federal labs in the Mid-Atlantic region, and under the leadership of such an established team growing from the Washington, D.C., node. This will continue fostering collaboration among researchers, industry leaders and government agencies," said Wade Fulghum, NC State's assistant vice chancellor for research commercialization and principal investigator. "I am optimistic about the I-Corps strategy NSF has created, and I feel that many of the scientific breakthroughs that will solve society's greatest challenges

will emerge from this region.

NC State's Office of Research and Commercialization has ushered in nearly 2,000 patents worldwide based on university research. Our researchers' technologies include filtration material to protect against viruses and bacteria, including SARS-CoV-2; clotting nanoparticles to help heal wounds; and environmentally-friendly aerogels that can be used in cleanups of oil spills.

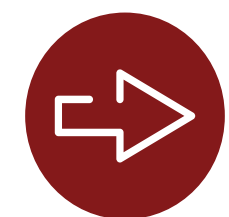
Stemming from NC State research are more than 190 startups, based in a wide variety of new technology. Using CRISPR technology, Locus Biosciences, Inc., creates therapeutics for critical disease areas ranging from resistant bacterial

infections to the microbiome. Combining machine learning and agricultural technology, SoilMetrix creates soil fertility zone maps and predicts soil nutrient levels to drive crop and nutrient selection. Thanks to materials sciences research, Teveri uses liquid metal technology to seamlessly integrate electronics in athletic apparel.

As part of the Mid-Atlantic region I-Corps Hub, NC State joins fellow prominent research institutions, including the University of Maryland, the University of North Carolina at Chapel Hill, Carnegie Mellon University, George Washington University, Howard University, Johns Hopkins University, Penn State University, the University of

Pennsylvania and Virginia Tech. The \$15 million I-Corps Hubs will be funded over five years.

**To learn more about I-Corps @ NC State, visit**



[go.ncsu.edu/i-corps](https://go.ncsu.edu/i-corps)





# REIMAGINING MENTORSHIP

## ORC Launches New Advisor Network

Author: Amy Parker

For many early-stage, research-based startup companies that spin out of universities to bring university discoveries from the lab to the marketplace, the road to success can appear long and daunting for first-time faculty and student founders with little to no business experience. Finding connections to qualified and successful entrepreneurs and business executives who can help to move a company to the next stage is a critical early hurdle that can dramatically impact a startup's development path. The Office of Research Commercialization (ORC) plays a key role in this advisor matching process for NC State startups and in 2022 ORC launched a new Office of Research Commercialization Advisor (ORCA) Network to accelerate the development of NC State companies and provide new ways for members to connect with startups that might be of interest.

The new ORCA Network provides a comprehensive program to support participation in NC State startups and research teams from a diverse range of external advisors. While many successful entrepreneurs and business executives want to connect with and help new companies, their ability to volunteer time can vary depending on other business and personal commitments. To provide different avenues of interaction based on availability and interests, ORCA offers two levels of engagement.

The "Member" level provides an entry-level position for external advisors who are interested in learning more about opportunities to connect with NC State startups and research teams. This level contains no time commitment and is a way for new mentors to better understand the NC State startup landscape prior to being matched with any company. The second level is comprised of

"Mentors", volunteer subject matter experts who bring experience in specific business roles or technical fields. Mentors can be called in, based on their expertise, for "Think and Do" meetings, which help answer specific questions ("Think") or assist in planning around an inflection point for a particular startup company ("Do"). Mentors can also be matched with a specific company or team to participate in one-on-one mentoring via NC State's I-Corps Program, which provides entrepreneurial training to academic teams seeking to commercialize new technologies by challenging them to complete an assessment of the market opportunity through interviews with potential customers and partners. In addition to these engagements, ORCA Mentors are also provided with other opportunities to work with NC State companies, including assistance with recruitment of external management and introductions to potential partners and investors.

Engagement in the ORCA Network includes other more informal ways to connect as well, with Mentors and Members being invited to quarterly Happy Hours to promote networking among fellow advisors and engagement with the ORC startup community, and provide updates on other ORC programs and how to become more involved. Additionally, ORC will host an annual showcase in the Fall to highlight the strength of the Pack and promote new and growing NC State startups to the network and ecosystem partners through pitches and booth spaces.

**To learn more about the ORCA Network and ways to get involved, visit [go.ncsu.edu/orca-network](https://go.ncsu.edu/orca-network)**





## Ask the Pack Platform Launch Using AI to Match Startups and Mentors

Author: Amy Parker

Connecting with mentors and advisors with relevant background and expertise who are willing and available to help is always a challenge for early-stage startups trying to navigate the business world. Even when companies do successfully connect with a mentor that is a good fit, it can often seem like it happens by chance. The Ask the Pack platform at NC State was launched in late 2021 and provides a new avenue to more effectively address the mentor matching challenge. Powered by Raleigh-based startup Protopia, Ask the Pack is a virtual platform that connects NC State students, faculty, and startups with more than 250,000 NC State alumni and friends who are eager to give advice and guidance.

Unlike other platforms that require the user to download an app or log-in, Ask the Pack operates entirely via email once a request for help is submitted at ask.ncsu.edu to enable quick and efficient asking and answering of questions. Utilizing access to the 250,000 plus database of NC State alumni and connections, Protopia’s artificial intelligence

technology analyzes the content of the help request and emails the most relevant expert within the network to see if they can help by responding with an answer or offering to meet, all from within the convenience of their own inbox. If that person can’t help, the platform will continue to contact the next most relevant expert until a successful match is made. While the platform enables initial “one-off” connections and conversations to help with a specific request, it presents a unique and painless way for students, faculty, and alumni to grow their respective networks to accomplish their goals.

This university-wide initiative was the brainchild of the Office of Research Commercialization’s own Wade Fulghum, Assistant Vice Chancellor for Research Commercialization, who partnered with NC State’s Advancement Office and Alumni Association to make the vision of a campus-wide platform a reality. This partnership was key in growing the network for the platform and enables NC State research teams and startup companies working with the ORC to access a more broad and

diverse range of potential mentors and advisors outside of ORC’s own network, while other groups on campus can access ORC’s network as well. In addition to its use within the Wolfpack community, the Protopia platform is also being explored by NC State as a tool to better connect participating I-Corps teams within the Mid-Atlantic I-Corps Hub with relevant industry mentors, with an ultimate vision of connecting the innovation and entrepreneurial ecosystem from North Carolina to Pennsylvania.

Ask the Pack officially launched in September 2021 and usage continues to grow as more groups on campus promote the platform and its ability as a digital, AI-powered solution to solve an age-old challenge: how to connect with a mentor who is relevant and eager to help.

**You can learn more about the initial pilot at NC State by reading Protopia’s NC State case study:** [protopia.co/case-study-ncstate-university/](https://protopia.co/case-study-ncstate-university/).



## New Program Sparks Startup Grant Funding

Author: Amy Parker

For many early-stage companies launching out of universities that are working to commercialize innovative research discoveries, the cost of technical research and development work to de-risk a technology and attract commercial partners and investors can seem daunting. Enter the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, non-dilutive federal grant funding programs for startups that support R&D work to accelerate commercialization. Each participating federal agency administers its own program and designates R&D topics they are accepting proposals for.

This funding mechanism provides critical funding to early-stage startups to prove technical feasibility, however, it is a highly competitive process with only a limited number of awards given each year around specific R&D topics specified by each participating agency. In addition, the process for completing the proper company registrations and writing and submitting the proposal can prove to be a challenge to many new companies, particularly those with founders that are accustomed to writing scientific research proposals.

Recognizing this hurdle, the Office of Research Commercialization, in partnership with NC State’s Kenan Institute for Engineering, Technology, and Science (KIETS), created the SparkPlug Program, an initiative to create a formalized support process for NC State startup companies to maximize their potential for success in winning SBIR/STTR funding.

SparkPlug provides funding each year to select NC State startups that intend to submit SBIR/STTR proposals in the next four months. ORC works with selected startups to fully pay for professional grant writing assistance on behalf of the companies, providing access to experienced grant writing teams who work with each company to develop a grant funding strategy and write and submit proposals. To further increase SparkPlug participants’ odds of success, ORC also partnered with First Flight Venture Center (FFVC) to support NC State startup participation in the FFVC LiftOff Program, which provides access to grant writing assistance and other FFVC resources and boasts a 100% success rate for participants within two and half years of proposal submission.

**“The ORC Spark Plug Initiative is a wonderful resource accelerating the commercialization pathways for our NC State startups. KIETS is pleased to be among the partners supporting this important initiative which is already producing impressive results and we are grateful to be a part of this collaboration.”**  
-Raj Narayan, Associate Director, Kenan Institute

Since its launch in late 2019, SparkPlug has funded 15 NC State startups that have gone on to submit 8 SBIR/STTR proposals and generate a cumulative \$1.1M in SBIR/STTR funding. Applications for SparkPlug funding are accepted twice per year and companies that have licensed intellectual property from NC State within the last five years and have not previously won an SBIR/STTR award are eligible to apply.

**To learn more about the SparkPlug Program, visit:** [go.ncsu.edu/sparkplug](https://go.ncsu.edu/sparkplug)



# FY2022 STARTUPS

## **Astro Therapeutics**

*College of Veterinary Medicine, Clinical Sciences*

Astro Therapeutics is working to commercialize a novel therapy for the treatment of ocular inflammatory and immune-mediated diseases.

## **Illuminate Bio**

*College of Engineering, Chemical and Biomolecular Engineering, Electrical and Computer Engineering*

Illuminate Bio is working to commercialize the next generation of assays for the quantification of serum or therapeutic antibodies against SARS-Cov-2 variants.

## **MyoMech**

*College of Engineering, Biomedical Engineering*

MyoMech is developing an ultrasound sensor technology to detect muscle fatigue and improve mobility and optimize recovery in people with lower limb disabilities.

## **PowerN**

*College of Engineering, Civil, Construction, and Environmental Engineering*

PowerN is working to provide cutting-edge digital engineering solutions for safe and competitive nuclear energy by using its augmented reality-artificial intelligence-driven digital platform to de-risk large nuclear construction projects.

## **Chaos Neuromorphics**

*College of Sciences, Physics, College of Engineering, Electrical and Computer Engineering*

Chaos Neuromorphics was launched to commercialize innovations from Dr. William Ditto, a pioneer in the field of artificial intelligence and chaos computing. Its primary aim is to develop optical and electronic chaotic computing architectures for applications in artificial intelligence.

## **Lathyrus Biotechnology**

*College of Engineering, Chemical and Biomolecular Engineering*

Lathyrus Biotechnology is developing a platform technology that enables the rapid evolution and selection of microbes with traits and properties of commercial interest.

## **NetLocal Games**

*College of Humanities and Social Sciences, Communication*

NetLocal Games is a new startup company working to develop and commercialize a geo-distanced, location-based game to help players better understand how viral airborne infectious diseases spread.

## **Quantryd**

*College of Natural Resources, Center for Geospatial Analytics*

Quantryd was formed to develop a tool that enables ride hailing with georeferenced digital advertising on displays.

## **Constructive Genomics**

### **Limited**

*College of Sciences, Chemistry*

Constructive Genomics is developing a platform to biosynthesize new classes of enzymes, pharmaceuticals and biomaterials that will support sustainable materials and therapies of the future.

## **MSI Software Solutions**

*College of Sciences, Chemistry*

MSI Software Solutions is commercializing a software tool to visualize and process mass spectrometry imaging data.

## **Oncurie**

*College of Sciences, Chemistry*

Oncurie is working to develop a cure for metastatic cancer through use of its novel molecular radionuclide technology. It has a vision of a world where treatments for metastatic cancer are selective, mild, and curative, enabling patients to live a normal cancer-free life.

## **R5 Labs**

*College of Textiles, Textile Engineering, Chemistry, and Science*

R5 Labs is working to develop a process that produces a non-toxic, biobased plastic, presenting a closed loop, zero waste process that produces plastic resins that can be functionalized to include antibacterial, antiviral, and UV-protective properties.

## **Sonokine Biosciences**

*College of Engineering, Mechanical and Aerospace Engineering*

Sonokine Biosciences is working to develop cancer treatments that utilize a high intensity focused ultrasound along with delivery of immune therapies.

## **Washington's Hammer**

*College of Education*

Washington's Hammer is actively commercializing digital solutions that enable cloud-based workflow automation to streamline U.S. Naval ship repairs.

## **SP Innovations**

*College of Textiles, Textile Engineering, Chemistry, and Science*

SP Innovation is developing a vascular graft technology for shoulder repair that is cheaper to produce, more dynamic than existing solutions, and is biologically active.

## **Watson Nano**

*College of Engineering, Materials Science and Engineering*

Watson Nano was formed to further develop technology that enables large scale production of gold nanorods and silica-coated gold nanorods for use in multiple industries.

## **Teen Health Research**

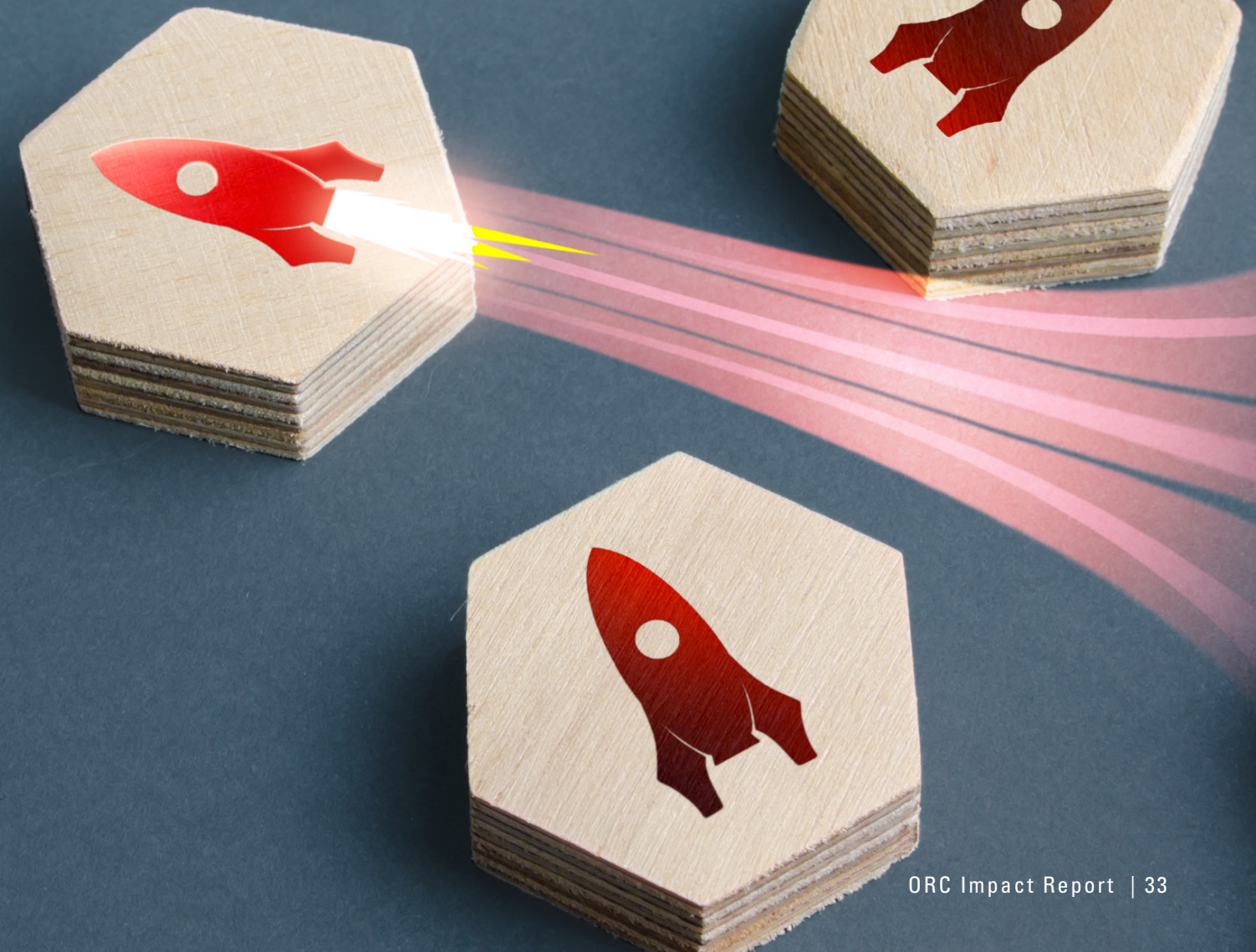
*College of Humanities and Social Sciences, Psychology*

Teen Health Research is working to further develop and commercialize Talk Tutor, a digital platform designed to facilitate and improve parent-child conversations about sex and promote teen sexual health.

## **Xsome Biotech**

*College of Veterinary Medicine, Molecular Biomedical Sciences*

Xsome Biotech is working to develop and commercialize inhalable vaccines using a lung-derived exosome.







## Chancellor’s Innovation Fund Awards Support to Six Promising Projects

Author: Matt Simpson

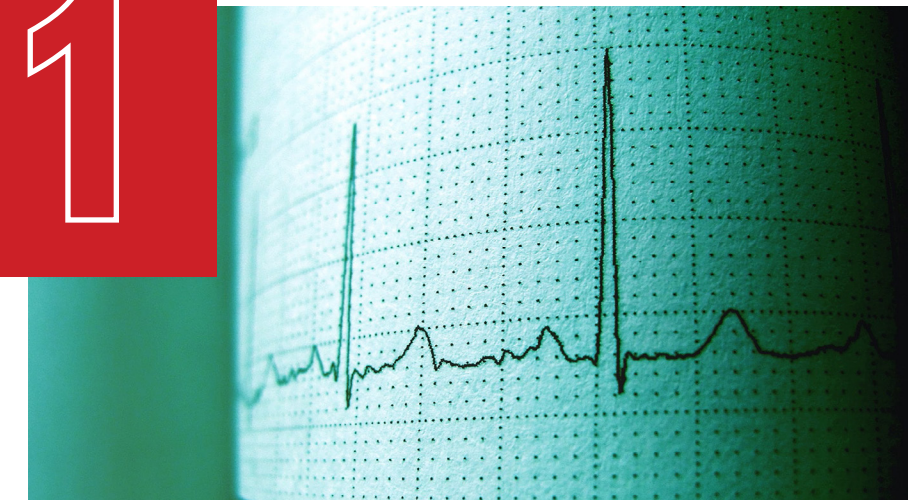
Innovation isn’t easy. Turning a research discovery into tangible technology takes time, resources and dedication.

That’s why at NC State, we aim to ensure that some of our best ideas have as much support as possible. And thanks to the Chancellor’s Innovation Fund (CIF), six more projects this year will receive seed funding and support from the Office of Research Commercialization.

This year’s projects include researching a better way to make EKGs wireless, a novel coating to simultaneously prevent and remove ice from aircrafts, faster COVID-19 antibody tests, and a number of other discoveries with the potential to revolutionize human healthcare.

**Learn more about the Chancellor’s Innovation Fund and how to apply by visiting [go.ncsu.edu/cif-funding](http://go.ncsu.edu/cif-funding)**

## Better Bluetooth EKGs



If you’ve ever been hooked up to an electrocardiogram (EKG), you probably know how quickly its mess of long leads can get tangled amongst themselves and other sensor wires. Not only does this limit mobility, but when the wires do get crossed, any one of the average EKG’s 12 leads can easily fall off or report faulty readings.

Jordan Besnoff, a research assistant professor in the Department of Electrical and Computer Engineering, and David Ricketts, a professor in the same department, have discovered how to use “backscatter communication” to wirelessly transmit EKG information over

Bluetooth to a smartphone, tablet or computer. Bluetooth EKG systems already exist, but those currently available on the market are quite bulky due to the heavy-duty batteries needed to power them. By using backscatter communication, Besnoff and Ricketts’ design eliminates the need for high-frequency signals — and in turn, any batteries at all. Transmitting the information via

lower frequencies takes less energy, enabling the sensor to power itself with nothing more than on-body energy sources, such as sweat.

CIF support will be used to test an early-stage prototype of the device, including demonstrating to potential industry partners that it’s both clinically viable and medical-grade quality.



## An All-in-One ‘Icephobic’ Coating

When ice forms on power lines, planes, ships or oil rigs, it’s not only a safety hazard but a financial one, as well. Currently, coatings to combat this problem fall into one of two categories: anti-icing or de-icing. Anti-icing solutions help prevent ice from forming in the first place, while de-icing solutions aid in ice removal.

Arun Kota, an associate professor in the Department of Mechanical and Aerospace Engineering, has developed a coating designed to both prevent and remove ice, which would be a unique “icephobic” solution. Kota’s natural, organic icephobic coating — called “NO-Ice” — helps prevent freezing on a surface and also makes it easier to remove ice when it eventually forms. NO-Ice

combines natural ingredients to create a completely biodegradable coating that can be applied to almost any surface as a spray, with a brush or using other techniques.

CIF support will be used to further test NO-Ice — in a scaled-up “icing tunnel” — and optimize its composition to be applied in spray form in order to attract potential partners in the aviation industry, which will be its first target market.



# Stronger Antibiotics to Battle Biofilm-related Infections

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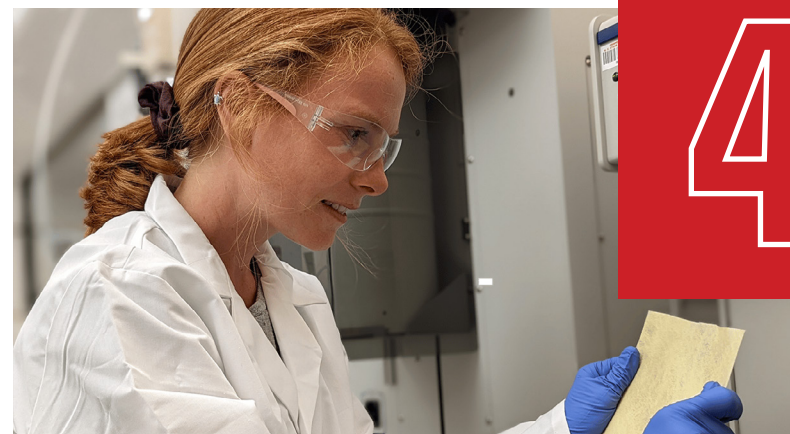


The World Health Organization regards multidrug-resistant bacterial pathogens as one of the top global public health threats facing humanity. Biofilms play a large role in this challenge. The dosage of conventional antibiotics it takes to eradicate a biofilm would be toxic or cause too many adverse side effects, leaving no efficacious treatment against bacterial biofilms on the table at this time.

Joshua Pierce, a professor in the Department of Chemistry, has developed novel compounds that could finally offer an effective tool in the fight against this dangerous form of infectious disease. Pierce has conjugated the compounds with Vancomycin — which is known as a “last-resort” antibiotic, and by itself, still is ineffective against biofilm-related infections — and shown the compounds can make it

potent enough to be effective against bacteria in a biofilm state. The technology could also be applied to other FDA-approved antibiotics.

CIF support, along with matching funds, will be used to complete pre-clinical trial work. Completing the CIF project milestones will generate data that directly addresses feedback from potential industry partners.



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# Greater Protection Against Lethal Toxins

Chemical weapons continue to present serious danger to soldiers and civilians alike in war zones across the world. And since World War II, there’s been little technological advancement in protective gear. Current offerings rely on activated carbon materials, which only adsorb but do not neutralize the chemical warfare agent — and often make the equipment heavy, hot and hard to wear.

Gregory Parsons, the Alcoa Professor in the Department of Chemical and Biomolecular Engineering, and his graduate student Sarah Morgan have developed “ChemBuckler,” which has the potential to be a revolutionary, next-generation protective fabric that not only adsorbs but also neutralizes chemical warfare agents on contact using zirconium-based metal-organic framework catalysts. Their technology produces durable fabric

composites that can be used to create better-fitting gear, which provides greater protection against toxins — with less burden on the wearer. The technology also has applications in personal protection from agricultural pesticides.

CIF support will be used to develop samples for the U.S. Army to test against its key performance characteristics.

5



# Custom Clotting Therapy for Chronic Wound Care

Chronic wounds affect millions of Americans each year. These types of wounds — which can take months to heal, if they ever do — also present a significant challenge in veterinary medicine, as well. When left untreated, chronic wounds can lead to infection, amputation and even death.

Ashley Brown, an associate professor in NC State and UNC-Chapel Hill’s

Joint Department of Biomedical Engineering, has developed neonatal fibrin-based nanogels that could one day be used to kickstart the body’s production of healing cells. Brown has found an industry partner to provide neonatal materials from pigs, which have been demonstrated to be functionally equivalent to human fibrin. The nanogels are synthesized using simple, scalable fabrication methods and can be stored at room

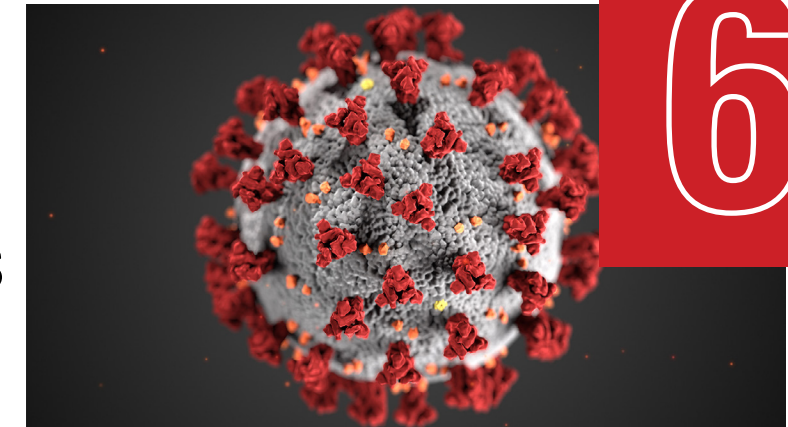
temperature. Improving wound healing in vivo, the nanogels are easy to deliver and designed to work for long periods of time. Brown’s platform can also piggyback other drugs into wound sites to further augment healing or prevent infection.

CIF support will be used to conduct pre-clinical trials in rodents, a critical first step in determining its safety and efficacy.

# Cutting-edge COVID-19 Antibody Tests

COVID-19 antibody tests can cost hundreds of dollars and take hours to process. Today’s commercial assays require skilled personnel to run — costing as much as \$1,000 per kit and taking between six and nine hours to yield results.

Stefano Menegatti, an associate professor in the Department of Chemical and Biomolecular Engineering, and Michael Daniele, an associate professor with dual appointments in the Department of Electrical and Computer Engineering and NC State and UNC-Chapel Hill’s Joint Department of Biomedical Engineering, have developed a “dual



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affinity ratiometric quenching” (DARQ) assay, which aims to reduce testing turnaround time to as little as two minutes, as well as significantly lower costs — to less than \$2 per test. A “simple mix-and-read” assay, Menegatti and Daniele’s technology would be ideal for both rapid testing at doctor’s offices and analytical staff in clinical or biopharmaceutical labs. The assay is also flexible. Future versions are being developed to address other antigens, which could expand the DARQ diagnostics’ reach

to cancer, autoimmune diseases and degenerative disorders.

CIF support will be used to further product development with their co-inventors, graduate students Katie Kilgour and Brendan Turner. The team will produce DARQ kits for beta testing, which will include validating that the DARQ assay quantifies anti-Sars-CoV-2 antibodies in patient samples, scaling up the assay’s manufacturing, and evaluating the DARQ’s consistency and shelf-life.





## 2021-2022 NC State Innovator and Entrepreneur of the Year Awards Announced

Author: Matt Simpson

For over 30 years, NC State University has held an annual Celebration of Innovation, awarding an innovator of the year and an entrepreneur of the year. On the evening of Oct. 12, for the first time since 2019, Chancellor Randy Woodson hosted the event in person again, at his residence on Centennial Campus, The Point.

“It’s great to get back together and to celebrate innovation and the innovators at NC State,” Woodson said at the event. “Thank you for your entrepreneurial spirit and everything you do to continue to build the economy of the country and the region through your science.”

This year, Woodson named both Craig Yencho and Ken Pecota as winners of the 2021-2022 Innovator of the Year award and named Marshall Brain as the winner of the 2021-2022 John S. Risley Entrepreneur of the Year award.



**Innovator of the Year**

### Dr. Craig Yencho and Mr. Ken Pecota

Department of Horticultural Science

Craig Yencho and Ken Pecota were both recognized with the Innovator of the Year award for their work to develop a cultivar that now accounts for nearly 90% of sweet potato production in North Carolina. Released in 2005, Yencho and Pecota’s “Covington” sweet potato makes up 20% of the total acreage of sweet potatoes grown in the U.S. and has become a lucrative European export. Since its release, the Covington variety has earned North Carolina sweet potato farmers over \$3.5 billion in revenue.

Yencho and Pecota’s collaboration in the Sweetpotato Breeding and Genetics Program has also led to the launch of multiple lines of ornamental sweet potatoes, 27 of which have been licensed and sold globally, generating an estimated \$20 million in retail sales.



**Entrepreneur of the Year**

### Mr. Marshall Brain

Department of Electrical and Computer Engineering

Marshall Brain was recognized with the John S. Risley Entrepreneur of the Year award for his work to help engineering students develop an entrepreneurial mindset and learn about launching new ventures. As director of the Engineering Entrepreneurs Program, Brain mentors hundreds of students each year, many of whom go on to enter — and win — NC State’s eGames, the university’s annual startup competition.

Brain is also a well-known entrepreneur in his own right, as the founder of HowStuffWorks.com, which was acquired for \$250 million in 2007 by Discovery Communications. Started as a hobby in 1998, HowStuffWorks.com at one point became one of the top-ten most-visited websites in the world.

## Kish named National Academy of Inventors Fellow

Author: Brent Lancaster

Fred Kish, M.C. Dean Distinguished Professor in the Department of Electrical and Computer Engineering at North Carolina State University, has been named as a Fellow of the National Academy of Inventors (NAI) in its 2021 class.

Kish, who joined the NC State faculty in 2019, is also the director of NC State’s Nanofabrication Facility. His research interests are in photonic integrated circuits, light-emitting diodes and AI-bearing III-V native-oxide technology.

The NAI Fellows Program highlights academic inventors who have demonstrated a spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on the quality of life, economic development and the welfare of society. Election to NAI Fellow is the highest professional distinction accorded solely to academic inventors.

From 1992-1999, Kish was at Hewlett-Packard, where he co-invented and led the commercialization of the highest performance (efficiency) red-orange-yellow visible LEDs produced at the time (wafer-bonded transparent-substrate AlGaInP LEDs). The efficiencies of these devices exceeded those of incandescent and halogen lamps with products based on this technology resulting in over \$2B in revenue to date. From 1999-2001, he was with Agilent Technologies as the III-V Department Manager.

In 2001, he joined Infinera Corporation, where he co-invented and led the effort to research, develop and commercialize the first practical (commercially deployed)

large-scale PICs and first commercial fully integrated system-on-a-chip for optical communications. The large-scale InP PICs are at the core of Infinera’s optical network products and have been the enabling technology behind over \$4B in PIC-based networking product sales. He served as senior vice president of the Optical Integrated Circuit Group at Infinera prior to joining NC State as the director of the NC State Nanofabrication Facility.

Kish is also a Fellow of the OSA and IEEE and a member of the National Academy of Engineering. His awards include the IEEE David Sarnoff Award, the IEEE LEOS Engineering Achievement Award, the OSA Adolph Lomb Award and the International Symposium on Compound Semiconductors Young Scientist Award. He has co-authored more than 125 U.S. patents, more than 150 peer-reviewed journal and conference publications and four book chapters on optoelectronic devices and materials.

To date, NAI Fellows hold more than 48,000 issued U.S. patents, which have generated over 13,000 licensed technologies and companies and created more than one million jobs. In addition, over \$3 trillion in revenue has been generated based on NAI Fellow discoveries.

Kish is the 10th current or emeritus faculty member in the College of Engineering at NC State to be named as an NAI Fellow.



Election to NAI Fellow is the highest professional distinction accorded solely to academic inventors.

### Fred Kish

M.C. Dean Distinguished Professor in the Department of Electrical and Computer Engineering at North Carolina State University







# NC State's Office of Research Commercialization

is here to help you advance your idea to the marketplace through a robust offering of services and programs designed to help you succeed.



## 2022 Daugherty Endowment Awardees

Author: Jaclyn McVey

The Daugherty Endowment awards ventures that have licensed NC State technology in the past three years. This category is made possible through The Richard and Marlene Daugherty Entrepreneurialism Endowment and the Kenan Institute for Engineering, Technology and Sciences and is held in partnership with NC State's Centennial Campus' Office of Partnerships and Economic Development and the Office of Research Commercialization.

Officially registered startup companies who have licensed NC State intellectual property in the past three years were allowed to compete in the Daugherty Endowment track, offering \$50,000 in prize money to winners of this track.

**1<sup>ST</sup>**

### \$25,000 First Place: Vizma Life Sciences

Vizma Life Sciences is developing next-generation, low-cost molecular imaging as an alternative to existing medical imaging technologies to deliver unprecedented diagnostic power that is safer and more convenient.

**2<sup>ND</sup>**

### \$15,000 Second Place: Mammae Biosciences

Mammae Biosciences is working to commercialize a cost-effective and scalable method for producing LacNAc, a key probiotic and beneficial, health-promoting human milk oligosaccharide (HMO), to meet the growing consumer demand for foods containing HMOs.

**3<sup>RD</sup>**

### \$10,000 Third Place: DNAlI Data Technologies

DNAlI Data Technologies is developing an end-to-end DNA data storage platform to enable long lasting and eternally relevant data storage that is also sustainable and environmentally friendly.

- Technology Transfer Services**
  - Technology Evaluation
  - Protection of Intellectual Property (IP)
  - Execution of Confidentiality and Material Transfer Agreements (MTA)
  - Marketing of Research Discoveries
  - Licensing of IP
  - ORC Advisors Network

- Creative Services**
  - Logo and Branded Materials Creation
  - Website Development
  - Pitch Deck Design and Layout

- Funding Support**
  - Research Gap Funding Program
  - Customer Discovery Training
  - New Startup Business Plan Competition
  - SBIR/STTR Grant Writing Funding
  - Angel Investor Network Funding

- Startup Company Support**
  - Company Incorporation
  - Regulatory Consulting
  - Business Plan and Grant Writing Assistance
  - Co-Working Space

**NC STATE UNIVERSITY** Office of Research Commercialization

To learn more contact us: [commercialization@ncsu.edu](mailto:commercialization@ncsu.edu)

Please visit our website: [research.ncsu.edu/commercialization](https://research.ncsu.edu/commercialization)





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