FROM INGENUITY TO IMPACT

FY 2019–2020 IMPACT REPORT

How faculty, staff and students at the University of North Carolina at Chapel Hill take ideas to market and innovations to scale

UNC | INNOVATION, ENTREPRENEURSHIP AND ECONOMIC DEVELOPMENT
Technology Commercialization

INNOVATE CAROLINA

The Vice Chancellor's Office for Innovation, Entrepreneurship and Economic Development leads Innovate Carolina, the University-wide initiative for innovation and entrepreneurship (I&E). Innovate Carolina works with people at UNC-Chapel Hill to move a greater number of valuable ideas into the world faster, where they can make the greatest social and economic impact possible. The Innovate Carolina team and its partners in the I&E campus network provide faculty, students and alumni with the tools and resources they need to make purposeful transformations in the world. These efforts include the work of the Office of Technology Commercialization, which manages University intellectual property and works with inventors to turn their discoveries into market-ready products and services.

Many at the University are tackling some of the most serious issues facing society today. UNC-Chapel Hill supports these individuals, teaches them the entrepreneurial mindset and skillset, and helps them move toward breakthrough solutions. By integrating creativity, design, technical knowledge and entrepreneurial thinking, Innovate Carolina creates an environment where people can put important ideas to use for the public good.

FROM THE VICE CHANCELLOR

Dear Carolina Innovation Community,

Faculty and students at the University of North Carolina at Chapel Hill find themselves owning numerous titles: researcher, professor, teacher, scientist, artist, investigator, explorer, expert, to name a few. Some may think that the title of *innovator* and/or *entrepreneur* applies only to a narrow class: an inventor of an intellectual product that will be licensed to industry or a startup.

At Carolina, we think of innovators in a much broader way. Our focus is on those who use their ingenuity to make an impact — creating social, scientific and economic benefit in our communities. Carolina innovators journey along the path of understanding problems and opportunities, testing interventions, and working together for better outcomes. They successfully implement unique and valuable ideas to improve the lives of their fellow citizens, both locally and globally.

From critical treatments for diseases to health policy changes to environmental technologies of tomorrow, this report is filled with examples of faculty and students conducting important work that represents the University's goal to serve the people of North Carolina and beyond. These stories of impact — and countless others not told in these pages — demonstrate the essence of the University's strategic plan *Carolina Next: Innovations for Public Good*.

Most significantly, we see evidence of a great convergence. More than ever, faculty and students are working across diverse research disciplines to collaborate and solve complex problems that can't be solved in isolation.

It's a privilege for our Office of Technology Commercialization — and our entire Innovate Carolina team — to work with the inventors, innovators and entrepreneurs featured in this report, plus the many others with whom we collaborate daily. As the University-wide initiative for innovation and entrepreneurship, Innovate Carolina has a passion for helping people find the tools and resources they need to turn their visions for better outcomes into realities.

The horizon for innovation at Carolina is bright. I am certain that, as those who now call themselves innovators and entrepreneurs, we will not only see great possibilities for progress ahead of us. Together, we'll put them to use for the people of North Carolina and the global community who look to us to shape the promise of what's new and next for the world.

Sincerely,

Judith Cone
Vice Chancellor for Innovation,
Entrepreneurship and Economic Development

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Introduction

TURNING YOUR INGENUITY INTO IMPACT

The most important aspect of an idea isn't where it starts. It's where it finishes. Stroll across the campus of the University of North Carolina at Chapel Hill, and you'll find laboratories and classrooms brimming with promising ideas. Many of the world's top scientists and researchers experiment and explore territories not yet imagined by others. It's here where nascent notions of better possibilities take off, research advances and new inventions are born. Our faculty and students don't just invent to create something shiny and new. They use their ingenuity to make an impact.

Yet, Carolina innovators recognize that every idea reaches a critical inflection point: Will it move onward and upward — beyond the University where it can make a positive human, social and economic difference in the world?

In the Office of Innovation, Entrepreneurship and Economic Development (IEED), we live to answer that question. And more frequently than ever, the answer is yes: An increasing number of Carolina-born inventions are moving into the commercial market where they bolster economic growth and transform lives.

The University's inventive spirit runs deep. In fiscal year 2020 alone, UNC-Chapel Hill researchers reported 170 new inventions. These latest discoveries contribute to the 3,456 total inventions now reported by Carolina faculty and students across the University's history. And for many North Carolina citizens and people around the world, these add up to something even bigger: new treatments for diseases like cancer, cystic fibrosis and AIDS. Hope for those suffering from rare and disabling genetic disorders. And new technological answers that create clean energy, provide access to healthy food and water, and keep us safe from chemical hazards.

How do UNC-created inventions reach the people who need them?

For many Carolina inventors, the path to impact occurs when the University licenses their technologies to external companies that can further develop and put their inventions into practice. It's a productive path that's led to 58 new technology licenses in fiscal year 2020 and 605 such licenses over the last 10 years. In real terms, these technologies become new medicines, therapies, devices and other innovations that help people live healthier, more productive lives.

Other Tar Heel innovators launch startup companies. Consider just one category of UNC-Chapel Hill startups: those created on campus or within three years of a faculty member or student leaving the University, whether the startup was based on intellectual property or not. In fiscal year 2020, 526 of such active UNC-affiliated startups generated more than 13,000 jobs and $14.1 billion in revenue in North Carolina. Globally, there were 526 total active UNC-affiliated companies that were responsible for creating more than 87,000 jobs and earning $15 billion in revenue.[1]

A company comparison illustrates the impact in even more discrete terms. Based on an analysis of data published by Innovate Carolina and Forbes, the cumulative revenue and jobs created by UNC-affiliated startups in fiscal year 2020 ($15 billion, 87,000 jobs) surpasses the combined totals of five large enterprises during the prior fiscal year: H&R Block, Twitter, Lyft, J. Crew and Revlon ($13.3 billion revenue and 72,000 jobs). Imagine the economic impact that such a group of leading companies could have in North Carolina or globally. You quickly see how UNC-affiliated startups bolster the economy across the state and beyond.

The story of Carolina's startups is just one part of a larger innovation picture focused on places and people. Wherever our ideas begin on campus, we want them to find new homes in places beyond the University — in companies, hospitals, schools, public agencies and communities. More importantly, we want ideas and inventions sparked at UNC-Chapel Hill to reach the citizens of North Carolina and our neighbors everywhere. When Carolina-born ideas make their way into even the smallest corners of our communities, they improve peoples' lives in the biggest ways possible.

[1]Includes two large firms: IQVIA (Quintiles) and Research Triangle Institute (RTI). RTI is a shared startup with NC State University and Duke University.

About Our Office

MOVING MORE IDEAS TO MARKET

The research, teaching and inventive spirit of Carolina's faculty and students creates a pipeline of unique and valuable ideas. When successfully implemented, these ideas become innovations that help people work smarter and live better.

To accelerate the number of innovations that move into the world and gain social and economic traction, the University created the Vice Chancellor's Office of Innovation, Entrepreneurship and Economic Development (IEED) in 2015. IEED brings a unified approach to innovation — one that combines innovation strategy, technology transfer expertise, startup coaching and services, market research, and investment programs. The IEED office is branded Innovate Carolina, which refers both to the strategy arm of IEED and the growing network of more than 300 people and programs across campus focused on innovation and entrepreneurship.

$726M

in federal research annually

$1.14B

in sponsored research annually

$826M

in life sciences research expenditures
HERD Survey, 2018

The Office of Technology Commercialization (OTC) is another major part of the IEED organization. OTC oversees all aspects of University intellectual property (IP). It offers vital expertise to Carolina faculty and students who are engaged in a large and growing portfolio of sponsored and federally funded research, which often involves innovations with commercial potential. As part of the vice chancellor's office, OTC:

- Translates ideas into products and services that strengthen the economy and return revenue to the University.
- Offers patent and market landscape research.
- Provides startup consulting, coaching, funding, mentorship and space.
- Administers proof-of-concept grants for technology development.
- Supports technology patent applications and licensing agreements.
- Structures partnerships that bring University research to market.

As the amount of research conducted by UNC-Chapel Hill investigators grows, so does the demand for IP-based expertise offered by OTC. The growth rate is steep. Research conducted at Carolina has quadrupled over the past 15 years. In fact, Carolina now conducts **$726 million in federally funded research annually,** which places it at No. 5 among universities in the US for such research. Further, the University now conducts more than **$1.1 billion of sponsored research** from all sources annually, making it the 12th largest US research university in research volume and annual expenditures. At a local level, Carolina's research productivity paves the way for increased intellectual property. For example, UNC-Chapel Hill is just one of the 16 public universities in the UNC System, but it conducts 62 percent of all UNC System research combined.

Ninety percent of UNC-Chapel Hill's federal funding comes from the National Institutes of Health (NIH), Agency for International Development (USAID), National Science Foundation (NSF) and the Department of Health and Human Services (DHHS). This distribution of funding reflects the University's emphasis on life science programs and its outstanding schools of medicine, dentistry, pharmacy, nursing, and public health.

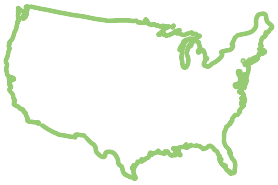
By helping to move a greater number of commercially viable ideas to market, OTC not only accelerates the University's research pipeline but also returns revenue to the University. For example, in fiscal year 2020, OTC reported $5.4 million in licensing revenue, which is returned to the University based on the licensing of UNC-Chapel Hill intellectual property. Such licenses can be related to tangible property, including research tools like cell lines, mice or antibodies. They may also be executed with UNC-affiliated startups or external companies. The licensing revenue earned during the most recent fiscal year increases total cumulative UNC-Chapel Hill licensing revenue to $82 million.

The OTC team collaborates with University researchers throughout the process of translating inventions into commercial innovations. This involves several steps, and the OTC team provides expertise, guidance and support along the commercial path. The team assigns a specific commercialization manager to work with each inventor so that they form long-term relationships built on mutual understanding. Working with an inventor, OTC may choose to license the intellectual property to another company or launch a startup company based on the technology.

If the inventor chooses to launch a startup company, they can work with several IEED-managed programs for support. For example, the KickStart Venture Services team provides startup founders with award funding, business development support, wet lab accelerator space, coaching, and key industry connections. The OTC team can also introduce startup founders to the Carolina Angel Network, the only official angel investor network for startups and ventures affiliated with UNC-Chapel Hill. UNC startup founders can also find support through Carolina Research Ventures, which invests in startups that commercialize or develop technology and inventions of UNC faculty, trainees and staff. Beyond University-based investment programs, the OTC team has built relationships with external venture capital firms and can help make connections for UNC-based startups when there is mutual interest in a technology.

RANKED 11TH

nationally in life sciences research expenditures *(HERD Survey, 2018)*



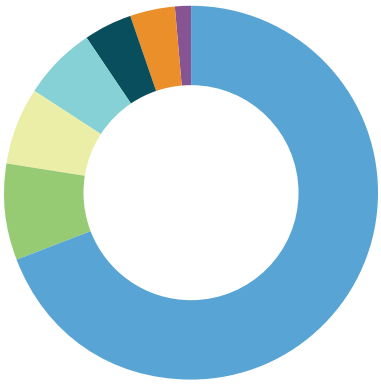
RANKED 5TH

US university for federal research

RANKED 12TH

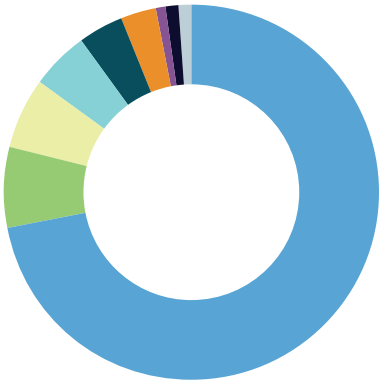
largest US research university in research volume and annual expenses

Research Funding Sources (FY2020): All Funding Sources

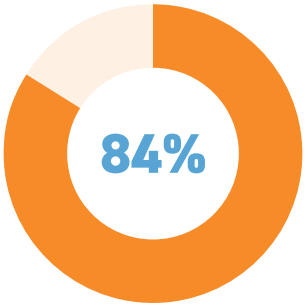


- Federal Sponsors **(69.46%)**
- Education & Research Institutions **(8.33%)**
- Foundations **(6.59%)**
- Business & Industry **(6.38%)**
- NC State Government **(4.21%)**
- Nonprofit Organizations **(3.67%)**
- Other **(1.36%)**

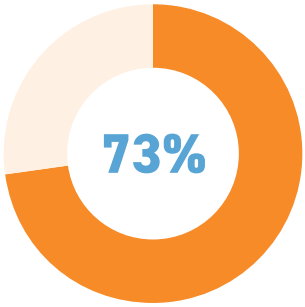
Research Funding Sources (FY2020): Federal Sources



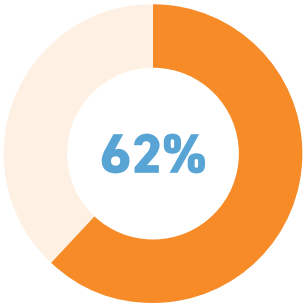
- National Institutes of Health (NIH) **(72%)**
- National Science Foundation (NSF) **(7%)**
- Department of Health and Human Services (DHHS) **(6%)**
- Agency for International Development (USAID) **(5%)**
- Department of Education (DOED) **(4%)**
- Department of Defense (DOD) **(3%)**
- Department of Energy (DOE) **(1%)**
- Environmental Protection Agency (EPA) **(1%)**
- All Others **(1%)**



of UNC-Chapel Hill IP-based startups work in life sciences



of UNC-Chapel Hill research activity is focused on life sciences *HERD Survey, 2018*



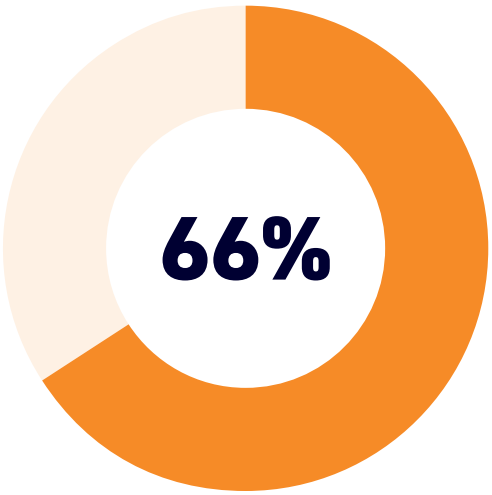
of all UNC System research is conducted by UNC-Chapel Hill

INNOVATING BETTER TOGETHER

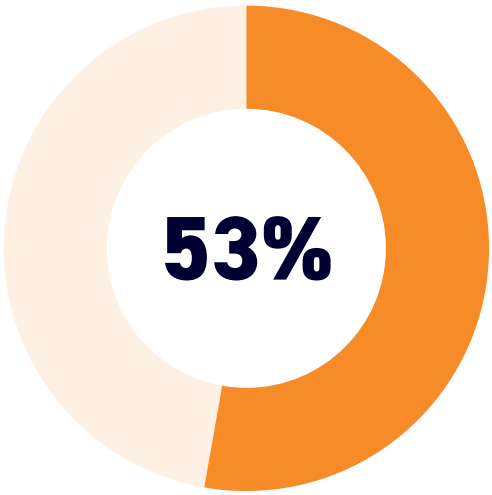
Faculty researchers collaborate across disciplines, departments and schools at UNC-Chapel Hill. They also partner with scientists at other institutions in North Carolina and around the world.

Collaborative Research Funding, 2018

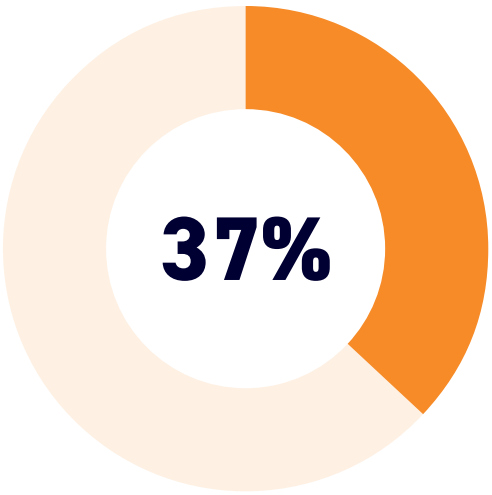
MULTI-INVESTIGATOR



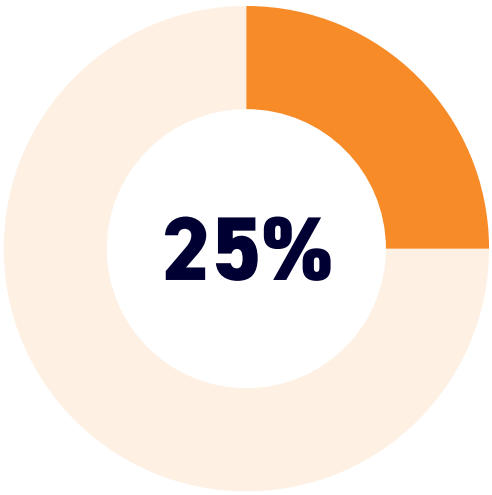
MULTI-DEPARTMENT



MULTI-SCHOOL



MULTI-PARTNERS



INNOVATION IMPACT DASHBOARD

In FY2020, OTC worked with UNC-Chapel Hill researchers on 170 invention disclosures, the submission of 111 new patent applications, the awarding of 49 issued US patents and 58 technology licenses.

UNC-CHAPEL HILL LICENSES, FY2020

Congruent with Carolina's research pipeline that is focused heavily on biomedical endeavors, the majority of its licenses are in the life sciences sector. In addition, a look at data from FY2020 provides a picture of how UNC-Chapel Hill's intellectual property was licensed:

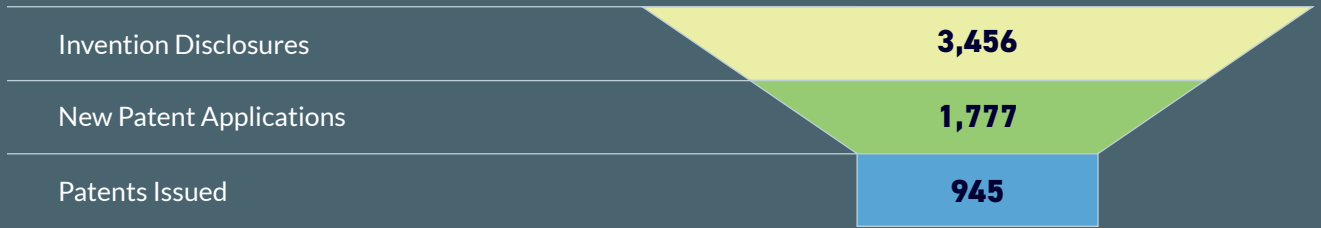
- **42 PERCENT** of licenses were related to tangible property (research tools, including mice, cell lines and antibodies)
- **42 PERCENT** of licenses were executed with Carolina startups
- **16 PERCENT** of licenses were executed with other companies

Through the work of its faculty founders and support from OTC, Carolina also launched three IP-based startup companies in FY2020.

CUMULATIVE: ALL YEARS

3,456	1,777	945	$82M	135
Invention Disclosures	New Patent Applications	Patents Issued	Licensing Revenue	IP-Based Startups Launched

CAROLINA IP PIPELINE

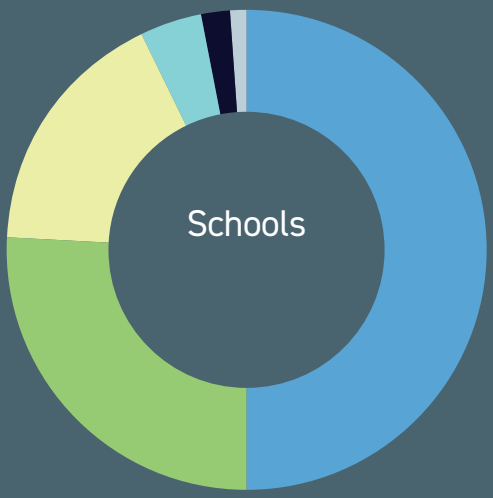


FY2020

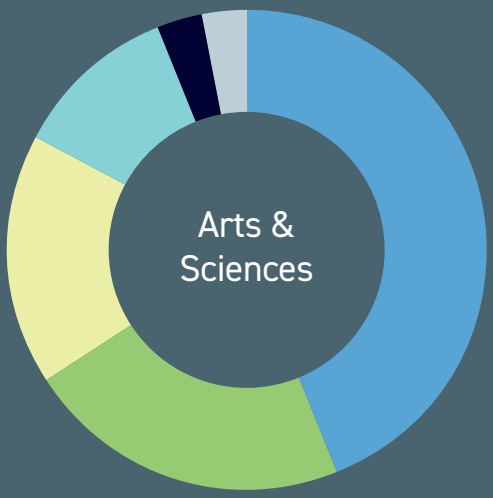
170	111	49	$5.4M	3
Invention Disclosures	New Patent Applications	US Patents Issued	Licensing Revenue	IP-Based Startups Launched

IP-Based Startups By School And Department

CUMULATIVE (ALL YEARS): 135 TOTAL IP-BASED STARTUPS



- School of Medicine **(50%)**
- College of Arts & Sciences **(26%)**
- Eshelman School of Pharmacy **(17%)**
- Gillings School of Global Public Health **(4%)**
- Adams School of Dentistry **(2%)**
- School of Education **(1%)**



- Chemistry **(44%)**
- Computer Science **(22%)**
- Physics and Astronomy **(17%)**
- Biology **(11%)**
- Mathematics **(3%)**
- Marine Sciences **(3%)**

Five-Year Comparisons

US PATENTS

66%
Increase

LICENSING REVENUE

58%
Increase

INVENTION DISCLOSURES

22%
Increase

NEW PATENT APPLICATIONS

26%
Increase

IP-BASED STARTUPS

25%
Decrease

Inventions Reported by Technology Type, FY2020

- Therapeutics **(40%)**
- Research Tools/Methods **(12%)**
- IT/Software **(10%)**
- Biomarkers/Diagnostics **(6%)**
- Energy **(5%)**
- Imaging **(5%)**
- Drug Delivery **(4%)**
- Education **(4%)**
- Industrial Process and Materials **(4%)**
- Computer Science **(2%)**
- Health/Safety **(2%)**
- Instrumentation **(2%)**
- Materials Science **(2%)**
- Medical Devices **(2%)**

CAROLINA IP-BASED STARTUPS: STRENGTH IN NUMBERS

135

IP-BASED STARTUPS LAUNCHED

(since 1958)

$4.5 billion

FUNDING RAISED

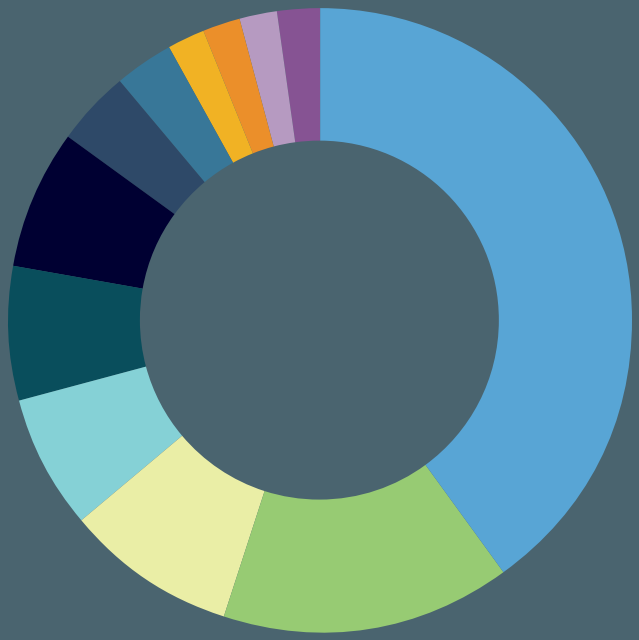
(since 1958)

$253.4 million

ANNUAL REVENUE

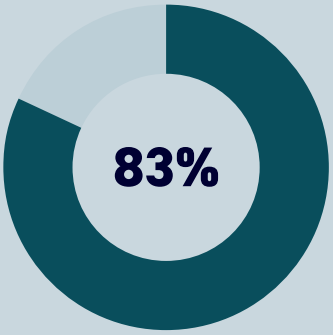
(Snapshot: 2020)

IP-Based Startups



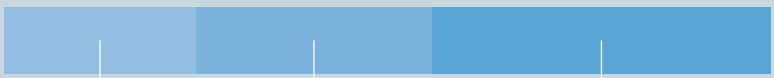
- Therapeutics **(40%)**
- Research Tools/Methods **(15%)**
- IT/Software **(9%)**
- Biomarkers/Diagnostics **(7%)**
- Imaging **(7%)**
- Medical Devices **(7%)**
- Industrial Process/Materials **(4%)**
- Drug Delivery **(3%)**
- Education **(2%)**
- Energy **(2%)**
- Health/Safety **(2%)**
- Instrumentation **(2%)**

UNC-Chapel Hill IP-Based Startups: Jobs and Location



of active UNC-Chapel Hill IP-based startups are headquartered in North Carolina

IP-BASED STARTUPS (Snapshot: As of June 30, 2020)



77 HQ in NC

93 active

135 total

JOBS (Snapshot: As of June 30, 2020

962 employees in NC

1,308 employees total

COVID-19 RESPONSE

When this impact report was published, the UNC-Chapel Hill community — and people across North Carolina, the United States and world — were engaged in fighting the novel coronavirus that causes COVID-19. Innovators at the University did not sit idle. By pursuing rapid scientific discoveries and development, bolstering front-line support for health care professionals, helping connect startup companies to valuable entrepreneurial response resources, and lending their energy and talents to countless other avenues, they helped protect peoples' lives and our economic well-being.

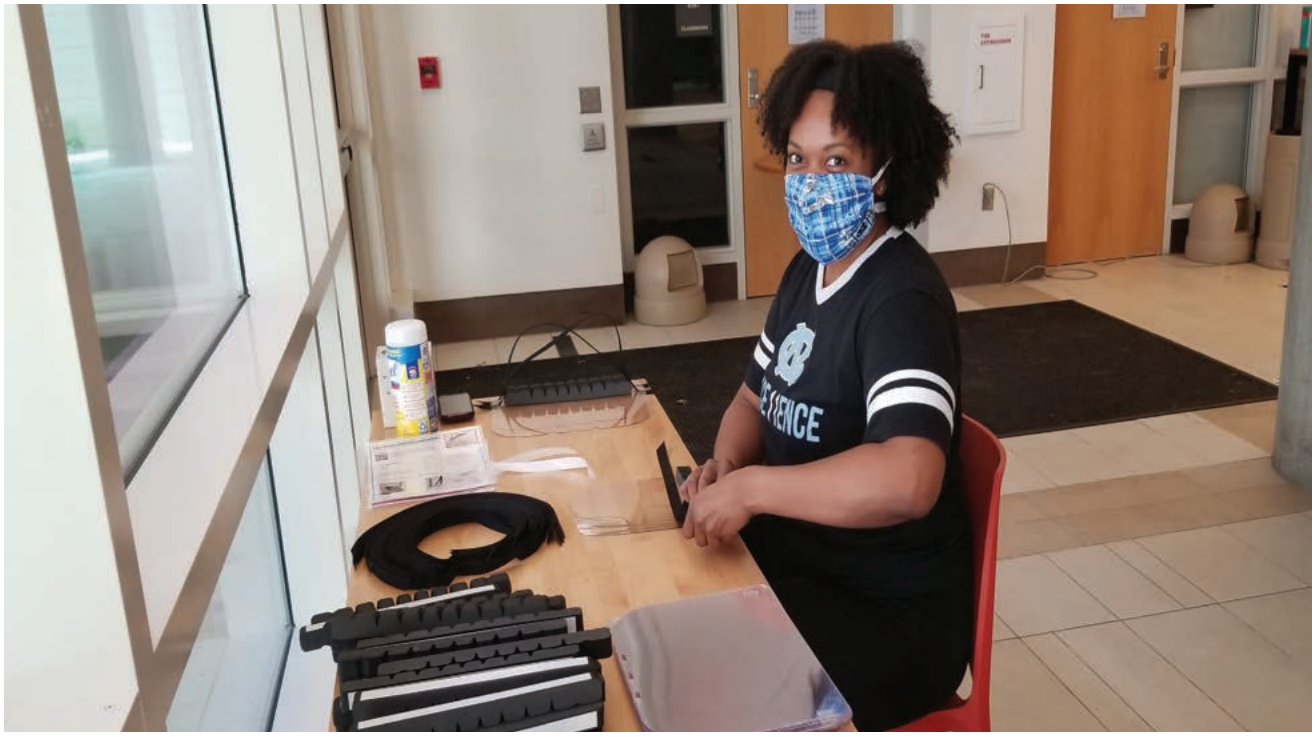
PROTECTING THOSE WHO PROTECT US

UNC-Chapel Hill makerspaces create face shields for medical caregivers.

The coronavirus pandemic sparked concerns about shortages in personal protective equipment (PPE) for health care workers treating patients diagnosed with COVID-19. Led by UNC-Chapel Hill's Be a Maker (BeAM) network and a group of medical student coordinators, Carolina faculty, students and staff — along with universities and other industry partners across the state — joined together with a singular focus: to protect the health care workers who protect us.

Beginning in early April 2020 as the crisis escalated, BeAM produced tens of thousands of face shields in just a few weeks. This essential equipment protects the facial areas of medical professionals from the body fluids of the COVID-19 patients they treat. The shields were designed by UNC-Chapel Hill faculty Rich Superfine, PhD, Glenn Walters, PhD and Theo Dingemans, PhD, in consultation with colleagues at NC State University and Duke University. All parts were specified by BeAM, sourced from external vendors and delivered to Carolina makerspaces, where volunteer teams worked — in a safe, socially distant environment — to process and assemble the shields. As shields were assembled, BeAM staff delivered them to be used by UNC Hospitals and other health care organizations.

Olivia Burston, an undergraduate biomedical and health science engineering major, was one of the student volunteers who helped assemble face shields at the BeAM makerspace in Murray Hall.



REMDESIVIR SEES POSITIVE CLINICAL TRIAL RESULTS

UNC-Chapel Hill began working with Gilead Sciences in 2014 to test the antiviral drug.

In late April 2020, Dr. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases (NIAID), reported that data from an international clinical trial testing the broad-spectrum antiviral drug remdesivir in around 1,090 patients showed "quite good news" and should result in a new standard of care for COVID-19 patients.

Remdesivir was developed through an academic-corporate partnership between Gilead Sciences and the Baric Lab at UNC-Chapel Hill's Gillings School of Global Public Health. The biopharmaceutical company sought the talents of a research team led by William R. Kenan, Jr. Distinguished Professor of Epidemiology Ralph Baric, PhD, who has studied coronaviruses for more than 30 years and pioneered rapid-response approaches for the study of emerging viruses and the development of therapeutics.

Fauci said that trial participants who took the drug usually recovered in 11 days, compared to 15 days in the group taking a placebo. Specifically, the trial studied the effects of a 10-day treatment course of remdesivir, which stops the novel coronavirus from making copies of itself by replacing a key building block within the virus.

Based on original story by the Gillings School of Global Public Health

Testing of remdesivir in the lab of Professor Ralph Baric at the Gillings School of Global Public Health set the stage for clinical trials to begin as the novel coronavirus spread across the globe.

HOPE FOR THE PANDEMIC IN A PILL

A new antiviral drug moved into clinical trials, offering hope for COVID-19 treatment — in part because it can be taken as a pill.

Scientists are hopeful that a new drug — called EIDD-2801 — could change the way doctors treat COVID-19. In the spring of 2020, the antiviral showed promise in reducing lung damage, finished testing in mice and moved forward toward human clinical trials.

Researchers at the UNC-Chapel Hill Gillings School of Global Public Health played a key role in the development and testing of EIDD-2801. Virologists in the lab of William R. Kenan Jr. Distinguished Professor of epidemiology Ralph Baric, PhD, worked with colleagues in the lab of Mark Denison, MD, Edward Claiborne Stahlman Professor of pediatrics at Vanderbilt University Medical Center (VUMC), and with George Painter, PhD, chief executive officer of the nonprofit DRIVE (Drug Innovation Ventures at Emory) and director of the Emory Institute for Drug Development (EIDD), where EIDD-2801 was discovered.

The results of the team's most recent study were published online in April by the journal Science Translational Medicine. The paper included data from cultured human lung cells infected with SARS-CoV-2, as well as mice infected with the related coronaviruses SARS-CoV and MERS-CoV.

The study found that, when used as a prophylactic, EIDD-2801 can prevent severe lung injury in infected mice.

When given as a treatment 12 or 24 hours after infection has begun, EIDD-2801 can reduce the degree of lung damage and weight loss in mice. This window of opportunity is expected to be longer in humans, because the period between coronavirus disease onset and death is generally extended in humans compared to mice.

If human clinical trials are successful, the drug could not only be used to limit the spread of SARS-CoV-2, but also could control future outbreaks of other emerging coronaviruses.

Based on original story by University Communications

Ralph Baric, the William R. Kenan, Jr. Distinguished Professor of Epidemiology at the Gillings School of Global Public Health, has studied coronaviruses for more than 30 years.

A MATERIAL DIFFERENCE

The Office of Technology Commercialization supports the quick transfer of research materials to rapidly advance COVID-19 drug testing.

As the COVID-19 pandemic unfolds, faculty from UNC-Chapel Hill are working on the front lines combatting the virus. But with research and discovery happening at a rapid pace, how can these researchers and scientists share critical research materials fast enough to develop and test drug therapies for the virus as quickly as possible?

Material transfer agreements, or MTAs, play a significant role in furthering research across universities and industries. These agreements are designed to govern the transfer of tangible research materials between universities when the recipient intends to use it for their own research purposes. Although most of the general public may not be aware of MTAs, the agreements and the teams that execute them are essential for making scientific progress possible.

At the Office of Technology Commercialization, licensing manager Carmen Melvin, JD, and licensing fellow Nathan Whitman, PhD, spearhead efforts to make sure MTAs are processed quickly so that important research can keep pace with scientific needs.

Whitman works closely with the lab of Ralph Baric, PhD, William R. Kenan, Jr. Distinguished Professor of Epidemiology at the Gillings School of Global Public Health. Baric is a leading expert in coronaviruses and emerging infections.

In 2019, there were seven MTA requests associated with Baric's lab. By late March 2020, there were already 15 MTAs initiated — most of them related to COVID-19. While some agreements have been for UNC-Chapel Hill to receive the virus, many have been for shipping out models that are used to study the virus, which is important since there is a shortage of certain models needed to study COVID-19.

Carmen Melvin, a licensing manager in the Office of Technology Commercialization, helps lead material transfer agreement efforts.

Nathan Whitman, a licensing fellow in the Office of Technology Commercialization, works closely with the lab of Professor Ralph Baric on material transfer agreements.

CHILD CARE CONUNDRUM

How can health care workers combat COVID-19 without child care coverage? A UNC-Chapel Hill task force helps them find personal and professional balance.

To care for your child or for pandemic-stricken patients? It's a choice that most health care professionals — or parents — never imagined they'd face. But due to an upsurge in COVID-19 cases and dwindling child care options, it became an unsettling reality.

Liz Chen, PhD, an assistant professor at the Gillings School of Global Public Health, co-led the UNC Task Force for Child Care for Health Care Workers. Its mission was urgent: to find solutions for emergency child care services needed by employees of the UNC Health system and School of Medicine. Coronavirus-induced school and daycare closings turned their lives into logistical conundrums. How could they be on the front lines caring for a swelling number of patients or maintaining essential hospital operations when there was no one to care for their own children?

The task force — comprised of Carolina faculty, staff, grad students, UNC Health leaders and other public health experts — focused on helping employees in departments most taxed by the COVID-19 surge: intensive care units, respiratory care, emergency rooms, food services and environmental services. For Chen and team, one quick answer was launching childcarenc.org, a website that includes information about emergency services and safety recommendations for Triangle-area health care workers. The site also provided parents and providers with in-home COVID-19 safety suggestions that they needed when making in-home care decisions for their families.

Liz Chen, an assistant professor at the Gillings School of Global Public Health and design thinking lead at Innovate Carolina, co-led a task force charged with finding child care solutions for UNC Health employees.

PREVENTING FUTURE PANDEMICS

Open science drug discovery partnership aims to invest $125 million to put drugs "on the shelf" for clinical trial testing in anticipation of future viral pandemics.

In April 2020, the Structural Genomics Consortium, UNC-Chapel Hill and the Eshelman Institute for Innovation announced the launch of the Rapidly Emerging Antiviral Drug Development Initiative (READDI). This initiative is a global organization aimed at discovering and developing drugs to put "on the shelf" for clinical trial testing in anticipation of future viral pandemics.

READDI is modeled after DNDi, a proven model for non-profit drug research and development. In READDI, projects will adopt extreme open science methods — sharing drug discovery progress in real time, so that all can benefit.

The nonprofit aims to raise $125 million to generate five new drugs with human safety and dosing data in five years to be ready for the next pandemic.

Based on original story by University Communications

READDI

WHAT THEY'RE TRAINED FOR

Biomedical engineers at UNC-Chapel Hill and NC State speed the development of an emergency ventilator.

Biomedical engineering student Kathlyne Bautista always knew that her coursework and training would set her on a path to make a life-changing difference for people. But before the coronavirus pandemic, she didn't realize just how soon that opportunity would arrive.

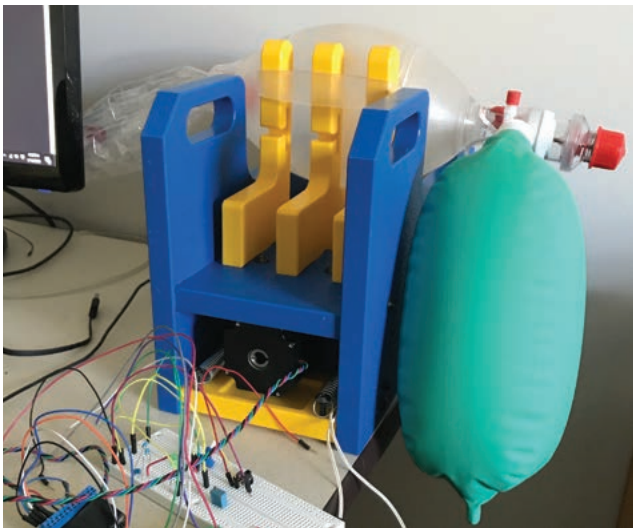
Bautista was part of the Carolina Respiratory Emergency — Ventilator (CaRE-Vent) team led by Yueh Lee, MD, PhD, an associate professor at the UNC School of Medicine and adjunct assistant professor in the UNC/NCSU Department of Biomedical Engineering. His research team sprinted to design and prototype an open-source ventilator in a matter of weeks that has the potential to help fill a critical equipment gap caused by a projected spike in COVID-19 patients. The team designed the ventilator so that it could be manufactured quickly and inexpensively — at less than $1,000 and with only six hours of skilled labor per unit.

And even in the best-case scenario — where the COVID-19 curve flattens to the point that the device is never needed for patients — the team's efforts have advanced knowledge in the biomedical design community about the best way to create emergency ventilators in the future.

The new prototype was inspired by an older device that was powered by a windshield-wiper motor and designed over a decade ago by Dr. Richard Feins, a retired professor who worked in the School of Medicine's Cardiothoracic Simulation Lab.

Progress on the new ventilator happened quickly due to cross-university collaboration. Lee's group worked closely with a team led by Landon Grace, PhD, an assistant professor of mechanical and aerospace engineering at NC State. Fused by the UNC/NCSU Joint Department of Biomedical Engineering, the teams at both universities rallied together to combine their medical and engineering expertise to do something bigger than they could do by themselves.

UNC/NCSU biomedical engineering graduate student Thomas Kierski works on the ventilator prototype at the manufacturing facility of Toshiba Global Commerce Solutions in Research Triangle Park. Photo courtesy of Toshiba Global Commerce Solutions.



A prototype of the emergency ventilator designed by a team led by Yueh Lee, an associate professor at the UNC School of Medicine and adjunct assistant professor in the UNC/NCSU Department of Biomedical Engineering.

AN N95 MASK ALTERNATIVE

Biomedical engineering professor works to develop a high-protection face mask.

Usually when Devin Hubbard, PhD, walks into the biomedical engineering lab at UNC-Chapel Hill, he might turn on the 3D printers and get to work. But this time was different. As the coronavirus pandemic ramped up, Hubbard wasn't there to use the printers. He was there to borrow a few to take home with him. His foresight paid off, because just a couple of weeks later, he was using those same printers to create a physical prototype of a device that may protect doctors and nurses as they care for COVID-19 patients.

Hubbard, a core team of students and colleagues from the FastTraCS program have been working on an innovation that may help covert standard surgical masks — which offer health care workers limited protection — into masks that do a better job of keeping coronavirus particles at bay.

An early 3D-printed respirator prototype developed by Ethan Smith, one of his biomedical engineering students, sparked an idea for Hubbard. After testing Smith's initial prototype, Hubbard wondered: Rather than trying to 3D print a full respirator, what if the team took Smith's original respirator design and cut it into a hard, but flexible plastic frame that could be placed around the fabric of an existing mask?

Hubbard's idea is simple, but powerful: Could adding this frame to existing — and much more plentiful — standard tie-on surgical masks fill a huge PPE gap that is bedeviling hospital and government leaders across the country who are searching for N95 masks?

Key to the design's success, Hubbard discovered, is the specific way a respirator fits on the face. Even though the design is made of a rigid plastic, it's made to flex so that when you tension the frame, it hugs your chin and nose and conforms to your cheeks.

Hubbard filed a provisional patent on the frame, which can be created in multiple sizes and manufactured at mass scale by industry partners at a low cost.

Devin Hubbard, a teaching assistant professor in the UNC/NC State Joint Department of Biomedical Engineering, designed a plastic frame that health care workers may be able to use with standard tie-on surgical masks. Photo courtesy of Mary Lide Parker.

INNOVATION BRIEFS

Carolina innovators and entrepreneurs are pushing forward to turn next-generation possibilities into today's realities. Activities and opportunities are vast: new industry partnerships, greater startup investment opportunities, expanded commercial outreach at local and national conferences, a new startup accelerator, and a pilot program for applying novel scientific collaborations to the world's pressing problems. Explore how Carolina innovators are making progress on ideas that make an impact.

Mireya McKee is the interim director of KickStart Venture Services (KVS), a program within the Office of Technology Commercialization that offers coaching, connections, space and early-stage funding to Carolina faculty working to develop IP-based startups. As of June 2020, KVS provided consulting and $2.5 million to 94 companies. This funding had a significant impact on the companies to raise follow-on funding. The companies have gone on to raise over $862 million to date, a 345-fold leverage over the dollars provided by KVS. In late 2019, KVS opened a wet lab accelerator in the Genome Sciences Building.

KickStart Venture Services: 10 Years of Impact

Time moves fast when you're working with startups. The Carolina innovation community blinked, and 10 years have passed since the first version of the **KickStart Venture Services** (KVS) program started at UNC-Chapel Hill. KVS helps UNC-born startups with funding, coaching, mentorship, wet lab accelerator space, investor connections and leadership formation.

From its inception in 2009, KVS has provided vital, early-stage funding to Carolina startups through its commercialization awards program. The program is designed for early-stage companies based on research innovations that have at least one founder who is a faculty member, student or staff person at UNC-Chapel Hill. The awards are stepping-stones that propel companies to be more successful in attracting significant funding via grants, angel investments and venture capital firms. As of June 2020, KVS provided consulting and $2.5 million in awards to 94 IP-based startups. These companies went on to raise $72.9 million in federal SBIR/STTR grants and $862 million in total funding.

Expanding Industry and Investor Networks for UNC Life Sciences

During 2019-20, Office of Technology Commercialization (OTC) team members attended international conferences to make strategic connections between UNC-Chapel Hill inventors, startups, investors and thought leaders in the life science and investment communities. In January 2019, OTC staff ventured west to San Francisco, where they forged critical relationships at the annual **JP Morgan Healthcare Conference,** which attracts more than 450 public and private companies. While in San Francisco, the team also attended the concurrent Biotech Showcase, which is one of the top investor conferences, represents more than $400 billion in investment capital, and offers the chance to engage with global life science decision makers. During these two events, OTC staff met with more than 20 companies and investor groups, strengthened connections with these companies and discussed their interest in UNC-based technologies and startups. The team attended the conference in 2020 with similarly productive results.

In June 2019, the OTC team traveled to Philadelphia for the **BIO International Convention,** which attracts more than 17,000 biotechnology and pharma leaders. During the 2019 BIO Convention, the OTC team engaged in more than 70 meetings to discuss technologies and innovations developed at UNC-Chapel Hill. It also held one-on-one partner meetings with representatives from 62 companies. While participating in the 2020 convention, which was held in a virtual format, the team held an additional 50 meetings with pharma, biotech and investment firms. These meetings allowed the University to:

- Expand industry and investor networks.
- Introduce unlicensed, available technologies to potential industry partners and investors.
- Support startups by making connections with potential investors and industry partners.
- Hear direct feedback from industry experts and investors on Carolina technologies.

Pinnacle Hill: A New Company for New Medicines

UNC-Chapel Hill not only invents in the laboratory. It also develops innovative partnerships. For instance, the University and Deerfield Management partnered to create a new company called **Pinnacle Hill,** which seeks to discover new medicines that address significant unmet medical needs. Deerfield committed up to $65 million of targeted funding and drug development expertise to support promising new drug research across a wide range of therapeutic areas. Research and development conducted at Pinnacle Hill is supported by funding, expert drug development guidance, experienced project management oversight and business strategy. These efforts will improve and accelerate the product development process and allow founding UNC-Chapel Hill scientists to concentrate on their research.

Pinnacle Hill focuses on drug research projects that are approved and directed by a joint steering committee comprised of members from UNC-Chapel Hill and Deerfield leadership teams. Each selected project has the potential to receive funding to support investigational new drug-enabling studies. Projects selected for support through Pinnacle Hill receive a complete development plan with funding to support further research across the UNC-Chapel Hill campus. Profits from successful projects, if any, will be shared by Deerfield and UNC-Chapel Hill.

Executive Vice Chancellor and Provost Bob Blouin, PharmD, speaks during the Pinnacle Hill announcement event with Deerfield Management.

In April 2019, Pinnacle Hill hired Jon Collins, PhD, a seasoned pharmaceutical executive from GlaxoSmithKline, as its chief scientific officer to lead Pinnacle Hill's drug discovery and development initiatives. Later in the year, Pinnacle Hill announced its first project agreement, which will support the work of Lindsey James, PhD, an assistant professor in the Eshelman School of Pharmacy's chemical biology and medicinal chemistry division. Her work focuses on multiple myeloma, a devastating cancer that develops in bone marrow. Pinnacle Hill's second project agreement, which was announced in June 2020, will support the work of Ben Philpot, PhD, Kenan Distinguished Professor and associate director of the UNC Neuroscience Center in the School of Medicine. Philpot is working to develop a potential treatment for Angelman syndrome, a neuro-genetic disorder characterized by developmental delays, abnormal brain activity and severe seizures.

Convening Around Devices and Diagnostics

Great ideas get even stronger when inventors convene and connect. That's why IEED partnered with the Eshelman Institute for Innovation to plan and co-host the first **UNC Device and Diagnostics Summit** in fall 2019. The summit was a creative cross-hatching of

academic and industry knowledge. More than 115 UNC-Chapel Hill faculty and researchers registered to attend.

By connecting with other Carolina faculty and executives from leading device and diagnostics companies, researchers gained new perspectives on the current state of the industry and envisioned new ways to shape its future. They engaged with key opinion leaders and practitioners to explore issues and bottlenecks within the field. Attendees also participated in track sessions and roundtable discussions, which sparked insights among pharmaceutical, biotechnology and device professionals. While there, Carolina researchers heard presentations from the leaders of numerous organizations, including Medtronic, Research Triangle Institute, Becton Dickinson, Janssen Pharmaceuticals, Navigant Consulting and the Gillings School of Global Public Health.

Funding Future Technologies

Sometimes the only thing a valuable technology needs to become market ready is a bit of modest funding and direction. For a growing number of Carolina inventors working on unlicensed University technologies, that nudge comes from the Technology Development Grants program. This funding initiative sponsored by the Office of Technology Commercialization (OTC) is designed with a singular focus: to advance the development of promising technologies to commercially relevant endpoints. With just a few thousand dollars put to work in the right way, researchers find that what may not have been possible before suddenly is: completing a project that results in a technology that is more likely to be patented and licensed to a commercial entity.

More than 20 UNC-Chapel Hill faculty have received nearly $600,000 in technology development grants to move their ideas forward. In doing so, they've found that the grants program is an iterative, results-focused process. After their proposals are selected for funding, researchers meet with members of the OTC team to discuss their projects and establish associated milestones. Along the way, they provide regular progress updates and final reports on the outcomes of their projects. This structured approach results in a win-win for the investigator and public: a greater chance of advancing commercially viable technologies that will make a human and economic impact.

Chad Pecot, MD, an associate professor and associate director of translational thoracic oncology at the UNC Lineberger Comprehensive Cancer Center, received a $30,000 technology development grant from the Office of Technology Commercialization. His company EnFuego Therapeutics creates RNA-interference drugs to silence cancer-related gene mutations.

Two renovated floors in Carolina's Genome Sciences Building will be home to the new Convergent Science Innovation Pilot. This pilot program will bring together cross-disciplinary teams of researchers, entrepreneurs and industry practitioners to develop new technologies and move them to market.

Startup Discovery and Development

Hunkered in their labs, Carolina faculty work on technologies that could turn into tomorrow's breakthroughs. From new devices and diagnostics to novel treatments and even cures, their intellectual property becomes the foundation for promising startups that may transform lives. Yet almost all of these young companies face significant funding challenges. How can they raise the capital they need to move from early research and development to create commercial products that are available to patients, businesses and consumers?

Carolina Research Ventures (CRV) is one way that UNC-Chapel Hill fills this gap for founders from its faculty and researchers. In 2014, the University launched CRV and its associated Carolina Research Ventures Investment Fund (CRVIF). With initial committed capital of $10 million from the UNC Health system, the fund has invested in eight companies since its inception. Two of these have been realized with attractive rates of return. In 2019, the University and UNC Health system committed an additional $10 million to the fund.

CRV hired Hatteras Venture Partners to manage the initial capital commitment. CRV expects to also make direct investments in companies as it builds out its team. It recently hired Jimmy Melton as its managing director. His experience across both academia and industry, from startups to large enterprises, is being tapped to continue building CRV's capabilities and success supporting University-sourced companies.

The CRVIF portfolio includes firms with diverse missions. These missions include: reducing churn for banks by allowing customers to move recurring digital payments across cards; measuring patient experiences with cloud-based analytics; fighting cancer with new small molecule and gene therapies; and novel RNA-targeted therapies for a range of serious diseases. Two firms in CRV's portfolio entered into recent strategic partnerships with key corporate partners. This will help further finance the development of those technologies, as well as potentially strengthen their ties to UNC-Chapel Hill.

CRV is an important part of Carolina's discovery platform. With fresh capital and the expectation of raising more in the future, it will help ensure knowledge created at the University gets from the labs into the marketplace.

Convergent Science Innovation Pilot: Synergy in Action

Synergy in action. It's a guiding principle for a new pilot program that aims to bring Carolina researchers together to help solve complex scientific problems faster. To meet emerging market opportunities and societal challenges more directly than ever, Carolina is renovating more than 20,000 square feet of lab and collaboration space in the Genome Sciences Building to launch the **UNC Convergent Science Innovation Pilot.** This initiative will mobilize new diverse teams of researchers, designers, experts and entrepreneurs.

The Convergent Science Innovation Pilot will combine UNC's extensive innovation program infrastructure with researchers and practitioners in a dedicated space at the intersection of the University's main campus and health affairs campus. It will activate campus and regional partnerships and allow top University

Ursula Mead is the founder and CEO of InHerSight, one of 19 companies that received an investment from the Carolina Angel Network as of June 2020. CAN is the only official angel investor network for startups and ventures associated with UNC-Chapel Hill.

researchers to work in new and more effective ways through a three-year launch and test phase.

During the pilot, Carolina innovators will engage with industry and external partners to stimulate potential areas of translational research around pressing global problems. The pilot will also bring immersive technical and innovation support services to selected convergent research teams to help speed the development of their promising technologies. This initiative will help move promising technologies to market by offering proof-of-concept and prototyping capabilities, expert business development support, and connections to industry and strategic partners.

When ready, some technology teams will move into the KickStart Accelerator. This wet lab accelerator space is located in the Genome Sciences Building adjacent to the convergent science offices and coloration spaces. It is here where emerging UNC-affiliated startups work to grow their young companies. The accelerator is operated by Kickstart Venture Services, a core program of IEED/Innovate Carolina.

Just-In-Time Insights for Innovators

How can we ensure that innovators at UNC-Chapel Hill have the information they need — when they need it — to successfully move their ideas toward commercial and social impact? During 2019, the IEED team convened a group of experts in university commercialization, instructional design, digital learning and online user experience to consider this question.

After consulting with faculty and other stakeholders on campus, the group began developing a prototype for **Pathways to Impact™,** a performance support system that will combine digital education with face-to-face tailored guidance for Carolina innovators. The system will offer just-in-time information, so individuals can access and understand topics relevant at specific times in their innovation journeys. A key aim is ensuring that Carolina's large and diverse community of innovators knows where and how to access the University's robust ecosystem of entrepreneurial support.

Once the system is launched, people will be able to use it as their go-to source for accurate and current information on the policies and procedures associated with translation at UNC-Chapel Hill. The ultimate goal is even more direct: more ideas moving forward faster, with less frustration, limited time lost and fewer opportunities missed. A faculty-focused beta site is underway, which sets the future stage for a full product launch.

Heels and Halos

For most young startups struggling to raise capital, someone who believes and invests in their ideas can make all the difference. Perhaps that's why the **Carolina Angel Network (CAN)** has taken flight so fast. CAN is the only official angel investor network for startups and ventures associated with UNC-Chapel Hill — and it's boosting early-stage, UNC-affiliated startups by connecting them with accredited investors who are alumni or friends of the University. Think of it as a match-making service made in blue heaven.

Since being founded in November 2016, CAN attracted 181 member investors and invested $12.2 million in 19 companies across 27 investment rounds (as of June 2020). It already boasts its first company exit: Bivarus, a survey-based cloud analytics firm that was acquired in 2018 by Press Ganey, a national provider of patient experience measurement.

CAN also works with angel networks created by Duke University and NC State University to support startups founded by alumni, parents, staff, faculty and students in the Research Triangle region. By working in concert, these university angel groups often invest in companies whose leaders share ties across their institutions. The result? Amplified funding and support for promising companies.

A Showcase of Ingenuity

What if you could look ahead to see the next big ideas from UNC-Chapel Hill? Every spring a community of innovators from the University and local region get to do exactly that during the **UNC Innovation Showcase.** The showcase is hosted by Innovate Carolina as the premier annual celebration that attracts the top innovations and startup ventures launched by Carolina students, faculty, alumni and local entrepreneurs.

In its 10th year, the 2019 showcase broke records and new ground. It attracted the most attendees ever — 535 total people, including 150 investors — plus 50 presenters and exhibitors. The number of presentations was only exceeded by the diversity of ideas pitched, which focused on life sciences, human health, consumer products, technology, educational initiatives, environmental advances and social innovations. The 2019 showcase also hosted the final round of the inaugural Carolina Challenge Makeathon, a multi-week, campus-wide competition that allows students to design, build and pitch tech and physical prototypes. Due to COVID-19, Innovate Carolina celebrated showcase innovators for 2020 via digital channels.

Go-to-Market Gatherings

What brings together roughly 100 faculty, grad students, researchers, scientists, investors, legal pros and regional entrepreneurial enthusiasts once a month at Top of the Hill Brewery? One answer is the house-crafted beers and locally sourced eats served up by one of Chapel Hill's most beloved downtown hotspots. But a more intriguing one is the vast insight shared during the Carolina Innovations Seminar, which attracts innovators from across the region.

On nine Thursday evenings during the academic year, the Office of Technology Commercialization (OTC) hosts this evening seminar series, which explores innovative trends taking place at the intersection of higher education, research, industry, entrepreneurship and venture creation. The speaker lineup has included a wide range of impressive experts: leaders from First Flight Venture Center, gene therapy company AskBio, Deerfield Management, the North Carolina Biotechnology Center, the North Carolina Department of Commerce and life science company Novan, to name a few.

CAROLINA TECHNOLOGIES IN THE NEWS

UNC-Chapel Hill's campus isn't the only place buzzing with enthusiasm about Carolina-born innovations. The breakthrough research, transformative technologies and commercial impact driven by the University's intellectual property are also making headlines in the media. Read a few examples of news articles that spotlight top startup companies and noteworthy licensing agreements connected to UNC-Chapel Hill technologies.

Liquidia Plans to Use $50M From IPO to Fund Drug Development

July 27, 2018

In the media world, print products appear to be going extinct. But the PRINT technology platform developed by Morrisville-based drug development company Liquidia Technologies is drawing eyeballs and investment in a very public way.

Liquidia shares began trading on the Nasdaq Capital Market on July 26, 2018 under the ticker symbol "LQDA," opening at $12.45 and closing at $11.10.

The company stands to raise more than $50 million in this initial public offering of stock, based on the share price it set for the IPO. It priced about 4.5 million shares of common stock at $11 per share, for gross proceeds of about $50 million. It also gave underwriters the option to buy about 680,000 more shares, which, if fully exercised within 30 days, would boost total proceeds to about $57.5 million before underwriting commissions and discounts.

Liquidia will use the IPO proceeds to advance two product candidates now in development.

The company was spun out of the University of North Carolina at Chapel Hill in 2004 by scientists and entrepreneurs Joe DeSimone, PhD, and Ed Samulski, PhD. It subsequently gained equity financing from heavy-hitter investors including the Bill and Melinda Gates Foundation, GSK, PPD, Pappas Ventures, Morningside Group, Wakefield Group, Canaan Partners and New Enterprise Associates.

Article by WRAL Techwire
Full story at wraltechwire.com

Ribometrix Takes Aim at "Undruggable" RNA with $30M Series A Funding

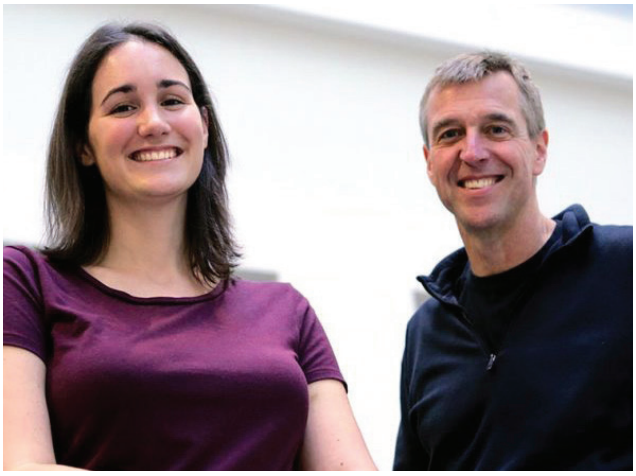
November 13, 2018

Most drugs target proteins in the cell, but the world of RNA has remained largely untapped by companies making chemical-based, or small-molecule drugs. That's changing though — just in the last couple of years, there's been a mini-boom in biotechs trying to overturn the long-held dogma that messenger RNA molecules (which carry the genetic instructions for proteins to the cell's protein-making machinery) are undruggable.

The latest startup on this quest is Ribometrix out of Durham, NC, which announced a $30 million Series A round of financing to fund the development of small molecule drugs targeting RNA involved in cancer and neurodegeneration. To do this, the company is studying the structures that RNA molecules form when they fold into themselves — think of a piece of string that gets crumpled up into a ball. These sorts of RNA structures are the kind that small molecules can grab onto. Figuring out the 3D structures of folded RNA is critical to finding effective RNA-binding drugs, says CEO Mike Solomon.

To determine RNA structures, the company has taken technology from the research group of Kevin Weeks, PhD, of the University of North Carolina at Chapel Hill, and built it out into a drug development platform.

Article by Xconomy
Full story at xconomy.com



Ribometrix co-founders: Katie Warner, PhD, vice president of RNA biology and UNC-Chapel Hill alumna; and Kevin Weeks, PhD, Kenan Distinguished Professor of Chemistry at UNC-Chapel Hill.

G1 Therapeutics Reports More Promising Results for Cancer Drug

December 5, 2018

Research Triangle Park-based clinical-stage biopharmaceutical company G1 Therapeutics has reported more positive results for its investigational oncology drug, trilaciclib.

The company said a randomized Phase 2 clinical trial demonstrated that trilaciclib — when used with chemotherapy — improved the progression-free survival rate of patients with metastatic triple-negative breast cancer (mTNBC). They remained on the therapy longer than with chemotherapy-only treatments, and experienced no trilaciclib-related serious adverse effects.

Trilaciclib is a potential first-in-class treatment, administered before chemotherapy, to protect bone marrow cells — a process known as myelopreservation — and immune system function during chemotherapy. It is a short-acting intravenous inhibitor of CDK4/6 — two enzymes involved in cancer formation.

Article by WRAL TechWire
Full story available at wraltechwire.com

Mucommune Receives Over $3 Million to Advance Muco-Trapping Antibodies

March 20, 2019

Mucommune LLC has been awarded over $3 million in five separate federal grants over the past several months to advance its muco-trapping antibody technology. The company was launched in 2016 by Sam Lai, PhD, an associate professor at the Eshelman School of Pharmacy.

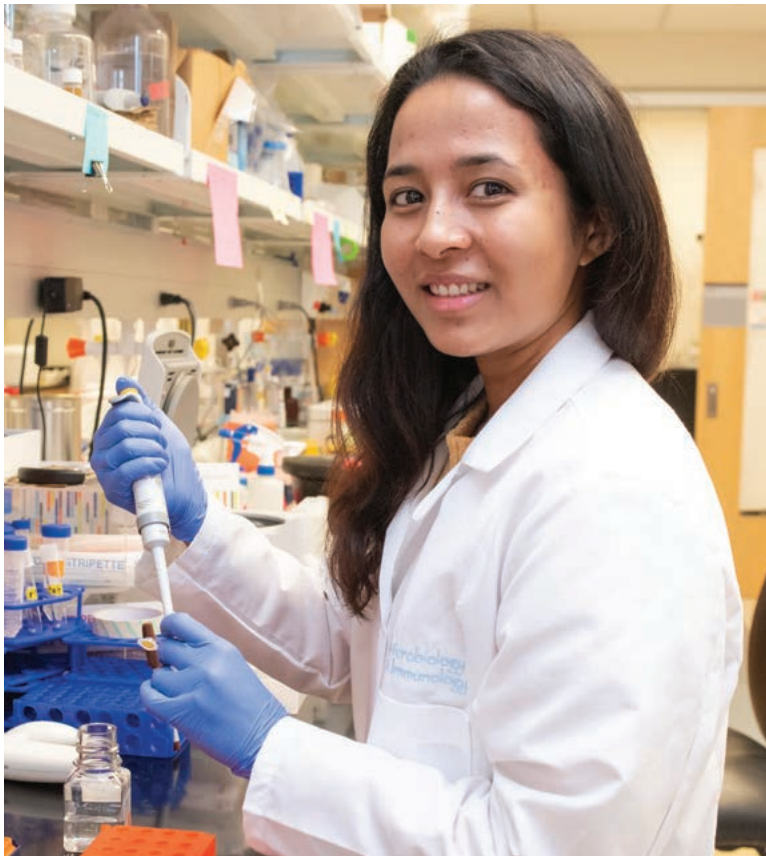
The muco-trapping antibody technology advanced by Mucommune is based on engineering the Fc region of IgG antibodies to interact with mucins. Tuning the Fc region to combine with mucins enables antibodies to immobilize viral and bacterial pathogens in different mucosal secretions, including respiratory airways, GI tract and female reproductive tract. Once the pathogens are trapped in the mucus, they can be rapidly eliminated, blocking infections.

The development of muco-trapping antibody technology has been supported in part by the Eshelman Institute for Innovation. The Institute was created in 2014 by $100 million gift from Fred Eshelman, Pharm.D., for the purpose of providing funding for bold, transformative ideas and stimulate commercialization of intellectual property and entrepreneurial development for students, faculty and staff at the School.

Article by Eshelman School of Pharmacy
Full story at pharmacy.unc.edu

Note: Mucommune has now been divided into two companies focusing on different therapies: Mucommune (female non-hormonal contraception) and Inhalon (respiratory infections).

A researcher works in the lab of Sam Lai, an associate professor at the Eshelman School of Pharmacy who founded the startup Mucommune. The company's technology harnesses antibody mucin interactions to support women's reproductive health.



StrideBio and Takeda Sign Collaboration and License Agreement to Advance Novel Gene Therapies for Neurological Diseases

March 28, 2019

StrideBio, Inc, a leading developer of novel adeno-associated viral (AAV) based gene therapies, announced the signing of a collaboration and license agreement with Takeda Pharmaceutical Company Limited (Takeda) to develop in vivo AAV based therapies for Friedreich's Ataxia (FA) and two additional undisclosed targets. These programs aim to utilize novel AAV capsids developed by StrideBio to improve potency, evade neutralizing antibodies and enhance specific tropism to tissues including the central nervous system.

A total of three targets are specified under the collaboration, with the initial target being Friedreich's Ataxia. StrideBio is eligible to receive approximately $30 million in upfront and near term pre-clinical milestones, as well as an additional $680 million in future development and commercial milestones from Takeda. StrideBio will also receive royalties on worldwide net sales of any commercial products developed through the collaboration.

Article by PR Newswire
Full story at prnewswire.com

908 Devices Secures $17.5 Million in Growth Funding

April 29, 2019

908 Devices, a pioneer of analytical devices for chemical and biomolecular analysis, announced it has closed $17.5 million in a growth equity funding round. This Series E funding brings the company's total to $70M, making 908 Devices the most well-resourced upstart in the multibillion-dollar mass spectrometry market.

The round was led by Northpond Ventures, a global venture capital firm dedicated to science and technology. Northpond's Sharon Kedar, a co-founder and partner at the firm, will join the 908 team as a board member. New capital also comes from Sands Capital Ventures, a venture capital firm investing in innovative and scalable businesses that have the potential to become market leaders.

908 Devices continues to experience increased demand for its purpose-built devices. ZipChipTM, a game changing front-end separation device for enhanced mass spectrometry analysis, is being used in the research and development of critical biotherapeutics and has been adopted by all of the top 10 global biopharmaceutical companies. The MX908TM, a rugged handheld chemical detection device, is utilized by first response and military organizations around the world for critical time-sensitive applications such as trace-level detection of fentanyl, synthetic opioids and other priority chemical threats.

Article by PR Newswire
Full story at prnewswire.com

908 Devices Addresses Emerging Nerve Agent Threat

June 14, 2019

908 Devices, a pioneer of analytical devices for chemical and biomolecular analysis, today announced the expansion of their MX908 multi-mission trace chemical detection device capabilities to include Novichok agents, an emerging chemical warfare threat. The company is debuting this enhancement in the MX908 CW Hunter mission mode at the 2019 International Association of Fire Chiefs International Hazardous Materials Response Teams conference in Baltimore, June 13–16.

Following a 2018 UK attack, the US Department of Health and Human Services released new guidance in January to first responders nationwide for Novichok chemical warfare agents, also known as A-series agents or fourth generation agents. Novichok agents are more persistent than other nerve agents and can be as toxic as VX. HazMat and military chemical response teams need quick, confident answers in the event of

an attack to minimize casualties and limit the spread of contamination. Until now, response personnel have had limited capability to detect and identify Novichoks in the field. The MX908 is the only commercially available field device that can identify Novichoks at trace levels and deliver results within 60 seconds, expediting response times and increasing both public and responder safety.

Article by PR Newswire
Full story at prnewswire.com

FDA to Make Decision on Epizyme Drug for Rare Cancer by January

July 25, 2019

The Food and Drug Administration will review an investigational drug for a rare type of cancer that affects soft tissues under the skin.

Cambridge, Massachusetts-based Epizyme said that the agency had accepted its application for accelerated approval of the drug tazemetostat in metastatic or locally advanced epithelioid sarcoma ineligible for curative surgery, based mainly upon data from 62 patients in a Phase II study. The Prescription Drug User Fee Act target date — the FDA's deadline to reach a decision on whether or not to approve the drug — is Jan. 23, 2020.

Article by MedCityNews
Full story at medcitynews.com

From a Potential $700M Deal to New Funding, Durham's Ribometrix is Sizzling

October 1, 2019

Ribometrix, a Durham company specializing in RNA-based therapeutics, will partner with Vertex Pharmaceuticals of Boston to discover and develop drug candidates for serious diseases in a deal that could ultimately be worth more than $700 million to Ribometrix.

Under the terms of the agreement, Vertex will pay Ribometrix about $20 million upfront, which includes an equity investment in the company. Ribometrix is eligible to receive more than $700 million in total potential payments if specified research, development, regulatory and commercial milestones are met. In addition, Vertex will pay tiered royalties on future net global sales on any products that result from the collaboration.

Ribometrix was founded by Kevin Weeks, PhD, Kenan Distinguished Professor of Chemistry at the University of North Carolina at Chapel Hill, and Katie Warner, PhD, a UNC graduate who is now vice president of RNA biology at the company.

Article by WRAL TechWire
Full story at wraltechwire.com

Sarepta and StrideBio Announce Multi-Target Strategic Collaboration to Advance Novel Gene Therapies

November 14, 2019

Sarepta Therapeutics, Inc., the leader in precision genetic medicine for rare diseases, and StrideBio, Inc., a leading developer of novel adeno-associated viral (AAV) based gene therapies, announced the signing of a collaboration and license agreement to develop *in vivo* AAV-based therapies for up to eight central nervous system (CNS) and neuromuscular targets.

Pursuant to the agreement, Sarepta is granted an exclusive license on selected targets to leverage StrideBio's novel, structure-driven capsid technology, intended to enhance specific tropism to tissues of interest and evade neutralizing antibodies. The parties also plan to focus on strategies intended to address re-dosing challenges in patients who have received AAV-delivered gene therapy.

Scientists Natalie McDonald, PhD (left), Carolina Lin (center) and Aaron Goetz work in a lab of UNC-affiliated startup Ribometrix. The company is discovering small molecule drugs that target RNA to treat cancer, neurological disorders, immunological diseases and rare diseases, including Huntington's disease.

StrideBio will conduct all investigational new drug (IND) enabling research, development and manufacturing for the first four CNS targets, which are MECP2 (Rett syndrome), SCN1A (Dravet syndrome), UBE3A (Angelman syndrome), and NPC1 (Niemann-Pick).

Note: StrideBio is a company that was formed from a technology developed in the labs of Aravind Asokan, PhD, at UNC-Chapel Hill and Mavis Agbandje-McKenna at the University of Florida.

Article by Globe Newswire
Full story at globenewswire.com

AskBio, UNC Team Up to Develop Gene Therapy for Angelman Syndrome

March 20, 2020

There's hope on the horizon for people struggling with the rare neurogenetic disorder Angelman syndrome, thanks to a newly formed partnership between a Triangle gene therapy company and the University of North Carolina at Chapel Hill.

Asklepios BioPharmaceutical (AskBio), a clinical-stage gene therapy company based in the Research Triangle Park, has joined forces with the university, "leveraging groundbreaking research" with the company's proprietary adeno-associated virus (AAV) technology to develop a viable therapy for the rare neurogenetic disorder.

"Individuals with Angelman syndrome face lifelong challenges, and our gene therapy approaches hold the potential to correct this disorder at its genetic roots," said Mark Zylka, PhD, director of the UNC Neuroscience Center. "We are incredibly excited to partner with AskBio, as they have been vanguards of clinical gene therapies for rare diseases."

Note: AskBio is a company co-founded by Richard Jude Samulski, PhD, professor of pharmacology and former director of the Gene Therapy Center at UNC-Chapel Hill, with Xiao Xiao, PhD, professor of pharmacoengineering and molecular pharmaceutics at UNC-Chapel Hill, and life sciences executive Sheila Mikhail, JD.

Article by North Carolina Biotechnology Center
Full story at ncbiotech.org

INNOVATOR INSIGHTS

It's one thing to read about innovators. It's quite another to hear from them. As one hears UNC-Chapel Hill faculty, students and alumni describe their innovation journeys, lessons abound: why they became passionate about using science to solve problems, how they collaborate to find evasive answers, their lists of go-to resources and tools, and the hard-won advice they offer to other innovation-inclined researchers. From graduate students who became startup CEO's to faculty who are bringing life-changing technologies to the market, Carolina innovators share insights for putting ingenuity into action.

Q & A

DESIGNING MOLECULES TO CREATE HEALTHIER OUTCOMES

Ronit Freeman

Ronit Freeman, PhD, an associate professor in the Department of Applied Physical Sciences, believes in the power of interdisciplinary endeavors. After all, this scientist, whose academic training crosses the fields of chemistry, computer science, nanotechnology and other fields, is also a talented ballroom dancer. That kind of versatile approach to life manifests itself in her molecular self-assembly research. Freeman works with others across many scientific fields to design complex molecular structures that have the potential to improve medical therapies and the body's own healing process.

Q **What research problems are you investigating and trying to solve?**

My training in various disciplines including chemistry, computer science, nanotechnology and regenerative medicine drives me to investigate problems whose solutions are beyond the scope of a single area of research practice.

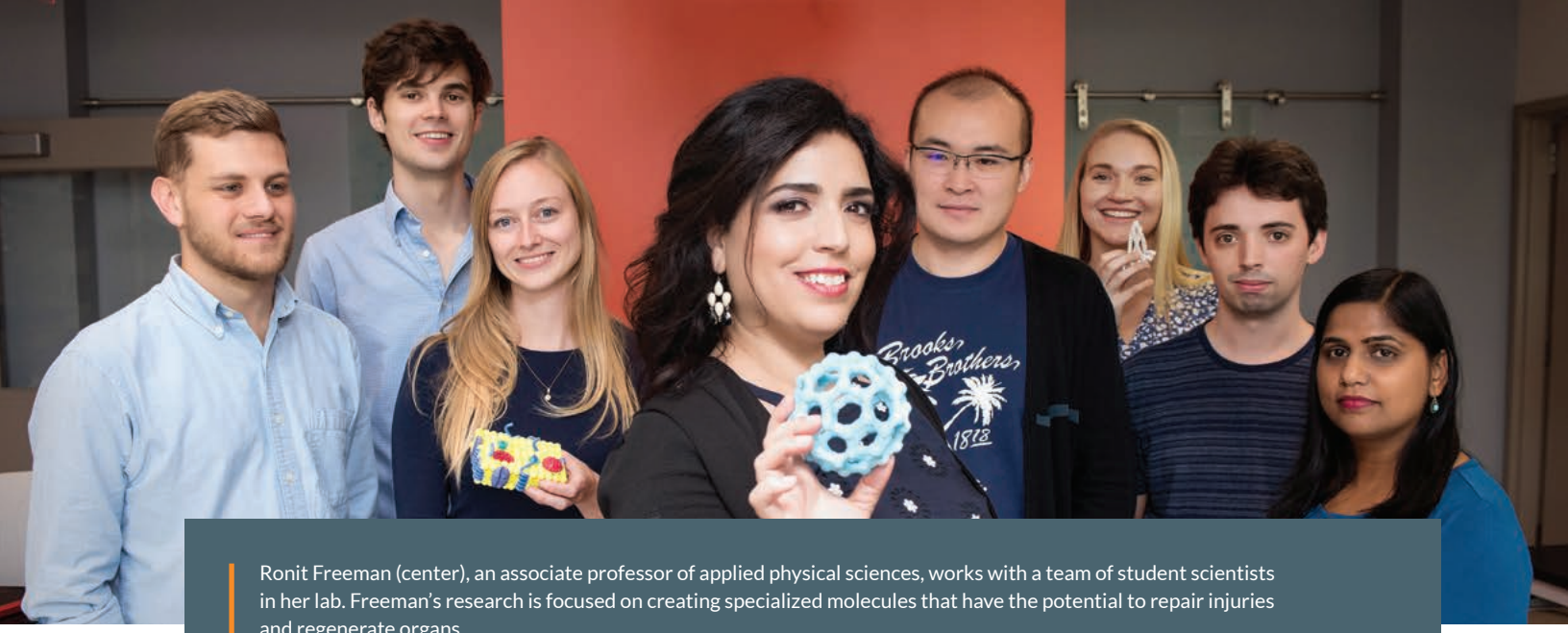
I work in an area called molecular self-assembly, creating molecules programmed with instructions that allow them to join together into complex structures with a specific shape. These structures are designed to mimic the natural environment that normally surrounds cells. Can we inject the nanomolecules into the bloodstream so they could serve as microscopic vehicles to deliver therapeutic compounds? Could we modify the materials so that they would attract the body's own healing compounds to an injured area to kickstart the repair process? These are a few of the questions we are trying to solve.

The potential of that process is breathtaking. One day, the specialized molecules we are creating — DNA-Peptide hybrids and macroscopic scaffolds — could repair injuries and regenerate organs. Success would mean better lives for countless patients.

Q **How do you apply an entrepreneurial mindset to your research?**

My entrepreneurial approach to research focuses on the problem — we identify a problem and frame it as a question that can be investigated using available scientific techniques. Problem definition means engaging multiple stakeholders, studying the economics of the relevant industry, talking to potential customers and consulting with leading scientists. It also requires talking with funding agencies, fellow professionals and end users in order to understand each group's needs. I then work to mobilize a network of people and resources needed to convert that problem into an opportunity.

We are in discussions on founding a startup to commercialize the lab's discoveries. The potential of spinning off my research forces me to think more broadly and creatively, and to solve technical issues that would not necessarily emerge within a smaller-scale lab environment. It also helps to hone my presentation and negotiating skills, and ability to manage multiple teams and limited time and resources.



Ronit Freeman (center), an associate professor of applied physical sciences, works with a team of student scientists in her lab. Freeman's research is focused on creating specialized molecules that have the potential to repair injuries and regenerate organs.

Q **How have you built your team? And what role has working across disciplines or with outside partners played?**

When trying to solve problems such as how to regenerate tissues and organs, you cannot do it without interdisciplinary research. So, my lab boasts chemists, engineers, biologists, nanotechnologists, as well as materials scientists. Since arriving at UNC in 2018, I forged partnerships with clinician-scientists and surgeons. They understand very clearly what the problems are and how we can test them with the materials we are proposing.

Another successful partnership is with applied mathematicians who can model our systems and provide insights to the design rules and big data analysis of our experiments. Working with these different partners and diverse team members can be challenging — each use a different scientific language with different terms. To do this effectively, you need to understand how they think about the problem and take the time to listen.

Q **What resources on campus have helped you on your innovation journey?**

UNC is a catalyst for innovation. From the moment I joined, I received enormous support. I was invited to attend a faculty entrepreneurship workshop, which allowed me to meet other faculty members who are successful entrepreneurs and hear about their journeys. The University is instrumental in broadening my network to include experts that aid in cultivating my ideas from conception through implementation and beyond.

Innovation involves not just the development of a single idea in the laboratory but also the strategic positioning of ideas in the larger world. The UNC campus understands that and works to promote mine and others' inventions through a variety of channels — securing strong patents, highlighting key findings, features in newsletters and websites — which ensure the ideas and designs are accessible to multiple audiences. Working at a university, I have access to equipment, space and expertise while developing my ideas. The technology transfer offices are on hand to provide business advice, which is invaluable.

Q **How do you balance your full-time teaching and research responsibilities with your interest in innovation and entrepreneurship?**

There is a synergy between teaching, research and entrepreneurship. Research and teaching have allowed me to keep abreast of the most forward-looking results in my field, think more broadly and critically about how to transfer my technology, develop new science that could lead to new business opportunities, and identify and recruit new talent. I believe that having an entrepreneurship mindset enhances my skills in education. I can bring in my own experiences, and I feel sharing these with my students influences them to think about innovation and entrepreneurship as career paths.

Q **What advice would you give to other faculty members who want to pursue an innovative idea?**

Innovation requires fostering a positive environment for learning and creativity. Encourage your team to work imaginatively, to improvise and try unconventional approaches to problem-solving, and then get out of their way. Never be shy to ask for help and, most importantly, value failure. Even failed ideas can serendipitously turn into better ones. View failure as the ultimate educator.

Q & A

CREATING A FASTER POINT-OF-CARE DIAGNOSTIC TO IMPROVE PATIENT CARE

Ricky Spero

Ricky Spero, PhD, is co-founder and CEO of Redbud Labs, a microfluidic chip (biochip) manufacturer whose patented technology allows mixing of extremely small volumes of fluids. An alumnus of UNC-Chapel Hill, Spero is an active participant in the local innovation and entrepreneurship community. This scientist and his team at Redbud Labs are creating a next-generation diagnostic that will improve patient care and reduce hospital costs in critical-care settings, including trauma and surgery. The company's microfluidic mixing technology enables scientists to perform point-of-care molecular diagnostics, analyzing thousands of genes simultaneously at speeds up to 10 times faster than traditional methods.

Q **Tell us a little bit about yourself and Redbud Labs. What problem are you trying to solve?**

It takes years and millions of dollars to develop a new diagnostic device. Our mission is to change that. We make components that overcome common but technically challenging design barriers. When our customers choose to use our products, their devices perform better and cost less.

Q **How are you taking an entrepreneurial approach? And how does that approach amplify the problem-solving capacity of your work?**

Our approach is unconventional. We've taken very little investor money. We're a component vendor, not a diagnostics company. And we've been very, very patient. We make certain that our technology is ready before we send it out the door. We don't overpromise or overhype. The result is an organization that's intellectually honest to its core. When we say our products work, our customers believe it. That credibility is essential, because we ask our customers to bet their products' success on our ability to deliver.

Q **What resources at UNC helped you on your innovation journey?**

UNC's culture is both entrepreneurial and a little skeptical. That's a perfect combo for doing scientifically challenging work. UNC is also well-networked into the broader Triangle. I can't imagine a better platform to launch a life science company.

Q **Can you talk about the importance of having a faculty mentor as part of your entrepreneurial journey?**

My co-founders, Rich Superfine and Russ Taylor, are extraordinary scientists, inventors and builders. They're the ones who taught me what it means to be technologically omnivorous. They remain involved at Redbud, and that has helped make these qualities core to our culture.

Q **What's been your biggest challenge in getting your idea off the ground?**

This sounds a little abstract, but for a given type of financing, some activities are a better fit than others. Our biggest challenge was getting the technology roadmap, business model and financing model to align. It took us a while, but once these three things were aligned, everything got easier.

Q **As a graduate student, how did you balance your full-time academic and research responsibilities with your interest in innovation and entrepreneurship?**

I had good timing. I was just wrapping up my PhD when Rich and I started talking about forming a company. UNC also awarded me the Innovation Fellowship. That was essential. Without it, I wouldn't have been able to bear the risk of starting a company.

Q **What advice would you give to other grad students who want to hone their own entrepreneurial skills?**

I used to believe that the most important thing was to have good ideas. I still believe that, and I suspect most scientists do too. But now I believe that good ideas come from good execution. So just get started and look for new ideas in the results of your work.

Q & A

A SIMPLER WAY TO SEE THE COMPLEX

Paul Dayton and Ryan Gessner

Paul Dayton, PhD (right), professor and interim chair of the UNC/NCSU Joint Department of Biomedical Engineering, and Ryan Gessner, PhD, a UNC-Chapel Hill alumnus, are co-founders of startup company SonoVol. The company is pushing in vivo imaging to the edge. SonoVol's easy-to-use scanning technology allows scientists who are developing drugs and therapies with the potential to cure diseases to spend more time on their science and less time operating imaging equipment. In short, the company's work means getting better drugs to market, faster — with less expense. Dayton serves as the head of SonoVol's scientific advisory board, and Gessner works as the company's CEO.

Q **What does SonoVol do? And what problem are you trying to solve?**

SonoVol is a life science research tools company. Our goal is to make easy-to-use instruments that enable disease researchers and drug developers to have a non-invasive window into the body to better understand incredibly complex biological systems. We operate within the niche market of in vivo imaging technology. A handful of companies make in vivo imaging tools, and they exist on pretty much every major university campus across the world as well as at pharmaceutical companies and government labs. However, usage of these instruments is often low. You can find an imaging

center on many campuses with several million dollars' worth of in vivo equipment in it, and many of the systems in there are collecting dust. These are cutting-edge tools that allow researchers to better study disease, but they are, more often than not, extremely underutilized.

Q **How did you identify the need for your first product, the Vega?**

The Vega emerged as the solution to a particular set of problems we faced while trying to support cancer researchers with our imaging methods years ago while Ryan was in graduate school. If the Vega had existed then, I think I would have been able to publish twice as many papers with our collaborators in the Lineberger Cancer Center. As an example, one of the problems I faced was the time required to perform imaging scans. I used to be able to do about 8 to 12 scans on a very busy day. Today, one of our Vega customers does about 50 scans in two hours.

Another indication that the market wanted this technology was people asking us at conferences where they could purchase a system that would allow them to capture microvascular images like ours. The answer was they couldn't. So we built a system to bring this UNC technology to the market.

Q **As a UNC startup, how did you take advantage of resources available on campus?**

We worked with KickStart Ventures Services, which helped us set up all the infrastructure to actually become a company, name it, set up a license for the technology from UNC, and put together an advisory board. It's nice to not have to go find a tax accountant, and a graphic design firm for a logo, and an attorney, etc. They basically took a big load off of our shoulders when it came to navigating the initial red tape that's involved once a business takes off, at all levels (institutional, state, federal, etc.). KickStart provided support in getting initial funding, for instance, by reviewing our federal grants before submission to improve our likelihood of success. They also helped us secure space in the Genome Sciences Building (GSB) and work through UNC's Facilities Use Agreement process.

Q **Has your work led to collaborations with people from different schools, departments or other organizations?**

Absolutely. We have secured many different grants from both the NIH and NSF with collaborations in industry and academia. At first, we would limit our collaborations with people at UNC, but over time, our network has grown, and we now have collaborations with universities across the country: UC San Diego, Johns Hopkins, University of Minnesota and Duke. We have also discovered an entirely new application market for our technology in regenerative medicine, which we've received over $2 million in grant funding to pursue. We wouldn't have found it if not for conversations with people at tradeshows.

Q **How did you develop an entrepreneurial mindset in launching SonoVol?**

A big part of this for us has been stubbornness — to not quit when our initial grant application got rejected again and again. Eventually, we succeeded with that first pilot-funded study from the National Science Foundation, and about 10 other grants followed. But the willingness to keep going even though your initial attempts fail has been our key to success.

Q **How do you envision your products making a positive impact in the world?**

Our objective as a company is to make life easier for people who are developing drugs and therapies to cure diseases. So, to the extent that our easy-to-use equipment frees up mental bandwidth and time for scientists in disease research labs or pharmaceutical companies to focus on what's driving disease and how to stop it, we will have succeeded. More than just making life better for our users, our technology also has the capacity to help researchers figure out whether or not the drug they are studying will actually work when it enters clinical trials. This will help get better drugs to market sooner, with less expense.

FACULTY STARTUPS AND STANDOUTS

What propels top academic researchers to launch startup companies? Or to dedicate time and energy to moving inventions into the commercial market? While their specific reasons vary, the core motivation is a constant: a passion for solving problems.

Some of the most recent startup companies and technology innovations from Carolina faculty push the limits of what's possible: better ways to deliver HIV-fighting drugs, novel devices that detect chemical hazards, solar energy tech that's both clean and affordable, and RNA-based drugs that silence cancer-related gene mutations, to name a few.

AnelleO

PERSONALIZED DRUG DELIVERY IN 3D

Rahima Benhabbour, PhD, is using 3D-printing technology and her startup company AnelleO to create a breakthrough in women's health.

Rahima Benhabbour has always been an advocate for women's health issues. As an assistant professor in the UNC/NC State Joint Department of Biomedical Engineering and an adjunct professor at the UNC Eshelman School of Pharmacy, her passion is to develop innovative technologies that prevent HIV infections and other health conditions in women.

As fate would have it, watching a TED Talk featuring global 3D-printing company Carbon was the inspiration she needed to jumpstart her innovative idea. As she watched Carbon CEO and Chancellor's Eminent Professor of Chemistry Joe DeSimone, PhD, demonstrate his 3D printer on stage, her mind quickly turned. She began to wonder how she could apply 3D-printing technology to intravaginal rings (IVR).

"I'm from north Africa. I'm a woman. The thought of helping women — some that don't have a way of protecting themselves or controlling their lives — that's my ultimate passion," she says. "It's a dream for me to give back."

As she watched the 3D printer at work, Benhabbour saw how it could quickly print intricate features and asked herself, "What if we could add those intricate features to an IVR, customizing them for drug delivery?" And with that, her company AnelleO was born.

Engineering Personalized Care

Currently, women seeking to use IVRs are given a one-size-fits-all product. By creating an alternative that is not only efficient in drug delivery but can be customized to individual women, Benhabbour is making more personalized and effective care a reality.

"Unlike traditional technology, 3D printing gives us the ability and engineering to play around with the design and properties of a product. We can engineer parts that would not have been possible before," she says. "The main goal of developing this 3D technology is to have the ability to change the ways in which women's products are manufactured and designed. And the applications for the technology are endless — including prevention of HIV, sexually transmitted infections and unintended pregnancies."

Panita Maturavongsadit, PhD, who is now a research assistant professor in the Joint UNC/NCSU Department of Biomedical Engineering, worked as a postdoctoral research associate in the lab of Rahima Benhabbour, the faculty founder of startup company AnelleO. The company uses 3D printing technology to develop intravaginal rings that provide customized drug delivery for HIV, sexually transmitted infections and unintended pregnancies.

Since launching in 2016, AnelleO continues to grow and work on its first product, AnelleO PRO, a once-a-month progesterone-releasing ring for infertility and assisted reproductive technology. Current products approved for progesterone supplementation are limited to messy and unpleasant vaginal gels or inserts and painful IM injections that have to be administered daily. Designed to safely and steadily release progesterone over an extended duration, AnelleO PRO could potentially replace current therapies and help more than 1.5 million women.

A Kickstart From Campus Resources

One resource instrumental in helping Benhabbour get the company started was the KickStart Commercialization Award.

"You may have an idea, but no funding. KickStart Venture Services helps make connections and gets things moving, while serving as an ongoing resource," she adds. "The main hurdle has been to find business leads. KickStart helps faculty launch and carry their startups, because we're too busy in our academic lives to be the lead of a company. We need that support with the business know-how."

A critical source of funding came from the Eshelman Institute for Innovation (EII) at the Eshelman School of Pharmacy. EII provided a $200,000 grant titled "Fabrication of Geometrically Complex Intravaginal Rings by Continuous Liquid Interface Production (CLIP) 3D Printing Technology" that helped Benhabbour initially create the technology. Such financial backing, along with the additional entrepreneurial support from EII in partnership with KickStart and the broader Innovate Carolina team, bolstered Benhabbour's early efforts to bring her concept to life.

The Office of Technology Commercialization team assisted with guidance on patents and licensing, while helping Benhabbour navigate conflicts of interest. Benhabbour also participated in the Faculty Innovation Workshop, an annual, invite-only event for UNC-Chapel Hill faculty hosted by Innovate Carolina. Nominated by

Denali Dahl, a biomedical engineering doctoral student, works as a graduate research assistant in the lab of Rahima Benhabbour, an assistant professor of biomedical engineering and founder of AnelleO.

deans, workshop participants are invited based on the promise they show toward entrepreneurial thinking.

"As scientists, we like to have the ability to think and get our brains to the point of thinking through new things. Because of the workshop, I'm now implementing design thinking in my lab," she says.

In growing AnelleO, Benhabbour is also thankful for the many opportunities presented for collaboration with different schools and departments across campus.

"None of the ongoing projects I have in my lab are in a silo. Everything is collaborative," she says. "One of the most attractive things about UNC is to have world-class experts in the field to collaborate with. The sky is the limit. Go and innovate. See how far you can get. Taking advantage of the expertise around me is what helped launch AnelleO."

For faculty members hesitant to pursue that big idea, Benhabbour admits it can be hard, but offers encouraging advice.

"What I've learned is that if you have an idea, put it out there and talk to multiple people," she adds. "Instead of looking at how something won't work, just think of what it can be."

AnelleO's first product could potentially **replace progesterone therapies** for more than **1.5 million women.** The technology may eventually be used to **prevent HIV, sexually transmitted infections and unintended pregnancies.**

TURNING THE TABLES ON UNHEALTHY PRODUCTS

UNC-Chapel Hill public health venture Counter Tools gives communities and policy makers insights to reduce the impact of tobacco and other harmful products.

Kurt Ribisl, co-founder of Counter Tools, is the chair and Jo Anne Earp Distinguished Professor in the Department of Health Behavior at the Gillings School of Global Public Health.

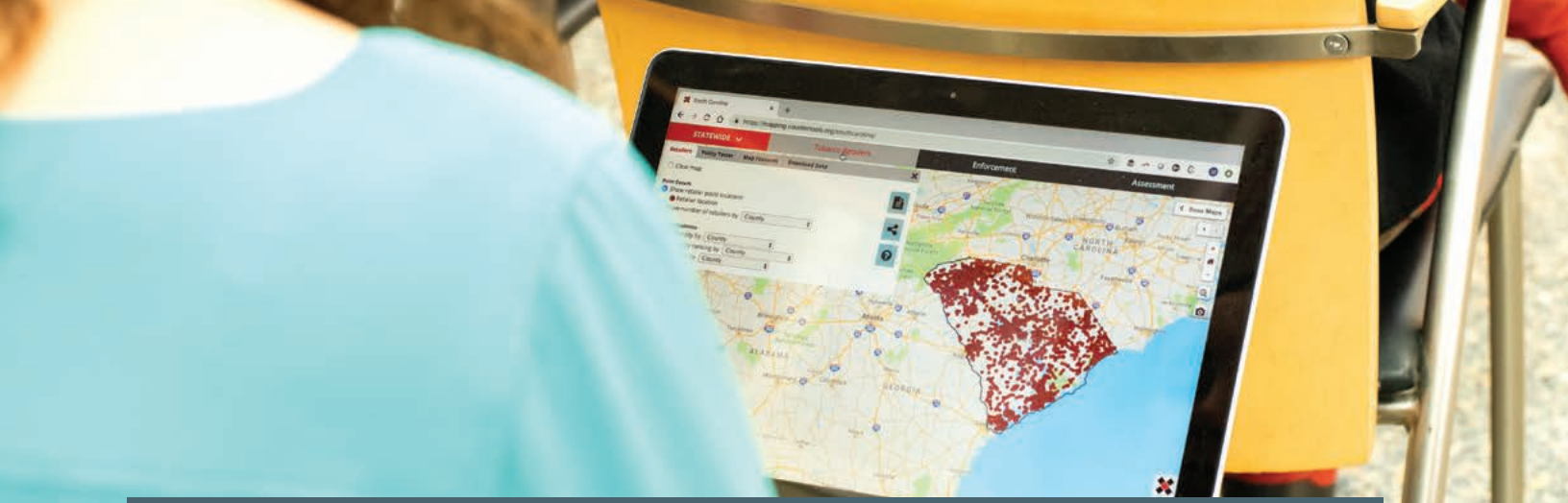
Where we live, work, learn and play can have a profound impact on our health. And in many communities, the corner store is a mainstay — a place where local residents gather. But often, corner stores don't offer the healthiest choices. Counter Tools, a social venture launched by public health faculty at the University of North Carolina at Chapel Hill, is looking to change the trend.

Counter Tools empowers communities to become healthier places by helping them put policies in place that affect the retail environment. The organization collaborates with communities and state and local government agencies to improve tobacco control, food access and/or alcohol control, no matter where they are in the policy change continuum.

"We have a vision for a nation where everyone has the opportunity to live a healthy life in a healthy place," says Nina Baltierra, former Counter Tools executive director. "We know that communities have a profound effect on lives — and the retail environment, the built environment, is what we can focus on for change."

Counter Tools helps public health practitioners and community members collect data on their local retailers, visualize disparities using maps and mobilize for policy change. The organization educates communities about the findings, helps them formulate policy solutions, engages strategic partners, and raises awareness of challenges and solutions — all through its proprietary software tools and technical assistance. Counter Tools even works with local communities to persuade decision makers to enact solutions.

The organization was born from an online resource destination for tobacco research support called CounterTobacco.org, which was created by Kurt Ribisl, PhD, and Allison Myers, PhD, at UNC-Chapel Hill. They participated in programs offered by the Kenan-Flagler Business School to help promote entrepreneurship.



Counter Tools' proprietary software collects data and uses mapping visualizations that give public health practitioners, community members and policy members insights needed to reduce the negative effects of tobacco and other harmful consumer products.

At the outset, Ribisl, a professor and chair of the health behavior department at the Gillings School of Global Public Health, and Myers, an adjunct associate professor, created the website as a resource focused on tobacco point-of-sale history, impact and policy solutions. As part of the CounterTobacco.org site, the software created by Myers and Ribisl is used to research geographic disparity. The team quickly discovered these tools could be used for a wider purpose to serve the greater good, and they created Counter Tools, first offering the Store Mapper and Store Audit Center tools to public health practitioners.

"Counter Tools works in 21 states and helps shape policies that will restrict the sale of harmful products, such as menthol cigarettes, and promote the sale of healthier food options at stores, " says Ribisl.

Counter Tools maintains strong ties to the University, working with interns from the Gillings School of Global Public Health as well as receiving evaluation help from the School of Nursing. As the leading voice in place-based public health, Counter Tools will continue to make a positive difference in communities across the nation.

"Being the national name in point-of-sale policies that affect public health, Counter Tools is the go-to organization that connects you to others that can help you with those initiatives," says Baltierra. "We are the experts, the connectors and translators of science and best practices that communities can put into practice."

Counter Tools works with **six national organizations, 21 state agencies and five local agencies** to shape public health policies. With its partners, Counter Tools **reduces the negative health impact** of substances like **tobacco, alcohol and junk food** sold in retail stores.

980 Devices

HANDHELD HAZARD DETECTION

UNC-affiliated company 908 Devices is changing the landscape of mass spectrometry. In 2019, it was awarded a contract to work with the US Department of Defense.

Quietly advancing from a startup to a nearly 100-employee company, 908 Devices is making an impact through its work in chemical and biomolecular analysis. It was only a matter of time before the defense community realized the significance of this UNC-affiliated company's technology and its potential for saving lives. The US Department of Defense will use 908 Devices' High-Pressure Mass Spectrometry™ (HPMS) technology platform for its new Aerosol and Vapor Chemical Agent Detector program. The program is designed to detect, identify, alarm and report the presence of traditional and advanced threat vapors and aerosols. And 908 Device's HPMS technology is the exact type of breakthrough that the Defense Department needs.

Current technologies exist that can detect a chemical agent but can't process if the agent is something potentially harmful. Through HPMS technology, more than 2,000 variants can be differentiated immediately, which is crucial when making measurements in the field.

The MX908TM is a handheld tool provided by 908 Devices, a company whose fundamental technology was developed by scientific founder Michael Ramsey, the Minnie N. Golby Distinguished Professor of Chemistry. First responders use the device to quickly detect chemical, explosive, drug and hazmat threats.

"Mass spectrometry is a powerful chemical measurement tool which can provide a lot of molecular specificity — right down to the exact molecule you're detecting," says Michael Ramsey, PhD, 908 Devices scientific founder and Minnie N. Goldby Distinguished Professor of Chemistry.

The Ramsey Lab developed the fundamental technology, and the 908 Devices team figured out a way to take it from the lab to the field.

"Putting chemical analysis into handheld devices has been a goal for decades. We've been able to take an instrument that was relegated to the lab and make it hand portable," says Ramsey.

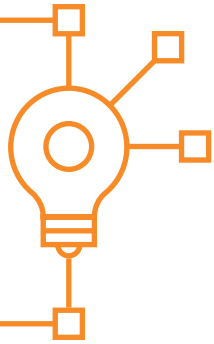
"The technology we invented and was further advanced at UNC with 908 Devices allowed us to realize these handheld devices that weigh a few pounds. The enabling realization was the ability to perform mass spectrometry at unprecedented high pressures; roughly a million times higher pressure than conventional mass spectrometers, thus HPMS. The higher-pressure operation allows significant reduction in the size, weight and power for the necessary vacuum system compared to laboratory mass spectrometers."

As a UNC-affiliated startup, 908 Devices benefited from innovation and entrepreneurship resources across campus, including working with the Office of Technology Commercialization for license negotiation. Ramsey continues to work with KickStart Venture Services to share his experiences and insights with other up-and-coming entrepreneurs, serving as a mentor to encourage students who are in the midst of their innovation journeys.

> **Putting chemical analysis into handheld devices has been a goal for decades. We've been able to take an instrument that was relegated to the lab and make it hand portable.**
>
> **MICHAEL RAMSEY**
>
> 908 DEVICES SCIENTIFIC FOUNDER AND MINNIE N. GOLDBY DISTINGUISHED PROFESSOR OF CHEMISTRY

With locations in Boston, Carrboro, NC and Campbell, CA, 908 Devices also makes products ranging from rugged, handheld chemical detection tools to compact, tiny footprint analyzers and fast separation devices, the latter of which was also invented in the Ramsey Lab. These purpose-built and user-centric devices serve a range of industries, including safety and security, life sciences, clinical diagnostics, oil and gas, and other applied markets.

908 Devices' product can prep and **analyze biological fluids 10 times faster** than legacy technologies. Faster, more powerful molecular analysis used for **safety, security and food science** could mean **thousands of lives saved.**



Mucommune & Inhalon Biopharma

TRAPPING WHAT AILS YOU

Pharmacy professor Sam Lai's startup companies Mucommune and Inhalon Biopharma use muco-trapping antibody tech to fight infections and enable non-hormonal contraception.

Getting a stuffy head or nose is as common as the common cold. But what the average person sees as a run-of-the-mill annoyance or part of being sick, UNC-Chapel Hill associate professor Sam Lai, PhD, envisions as a breakthrough opportunity to keep people healthier.

Lai and his team at the Eshelman School of Pharmacy discovered that when pathogens — viruses, bacterium or other microorganisms — can be trapped in mucus, they can be rapidly eliminated, blocking infections. That led him to found Mucommune — a startup company that harnesses antibody mucin interactions to support women's reproductive health — and Inhalon, a company that uses the same technology to prevent respiratory infections.

Sam Lai, an associate professor at the Eshelman School of Pharmacy, is the founder of startup companies Mucommune and Inhalon.

"If you can block pathogens from penetrating mucus, you can prevent the spread of infections locally — or prevent infections from transmitting altogether," says Lai, associate professor at the pharmacy school and director of its pharmaco-engineering program.

Lai's muco-trapping antibody technology enables antibodies — proteins in the immune system that fight intruders in the body — to immobilize viral and bacterial pathogens in different mucosal secretions, including respiratory airways, the gastrointestinal tract and the female reproductive tract.

For example, respiratory syncytial virus (RSV) causes infections of the lungs and respiratory tract, and it's a common virus that affects children. According to the National Institute of Allergy and Infectious Diseases, in the United States nearly all children become infected with RSV by age two, with 75,000 to 125,000 hospitalized each year. Around the world, RSV affects an estimated 64 million people and causes more than 150,000 deaths each year.

Currently, there is no vaccine or treatment for RSV, but Lai and his team are targeting the virus as they develop antibodies to treat respiratory infections.

"We wanted to advance something that would have a health benefit, and we took interest in two of the mucosal surfaces: airways in the lungs and the female reproductive tract," he adds. "In the lungs, there are many respiratory infections where there are no effective treatments available. We took inspiration in antibodies and discovered a real function for them in mucus."

As he and his team continued to work on the muco-trapping antibody technology, they discovered they were making progress in both respiratory health and female reproductive health. As a result, the company split and formed Inhalon Biopharma to focus on the respiratory work, raising more than $4 million in non-dilutive funding. The firm also secured initial investments from Breakout Labs, a fund that supports scientist-entrepreneurs as they transition their technologies out of the lab and into the market.

> **The University is very supportive of faculty entrepreneurship. Part of the support is reflected in the number of seasoned entrepreneurs that the school has helped make available to faculty.**

SAM LAI

ASSOCIATE PROFESSOR AND DIRECTOR
OF THE PHARMACO-ENGINEERING PROGRAM,
ESHELMAN SCHOOL OF PHARMACY

As the team explored applications in female reproductive health, it focused on addressing the lack of non-hormonal contraception. Many women do not like hormonal contraceptives due to side effects and medical contraindications. So Lai and the team began to develop antibodies that could block sperm through mucus — paving the way for the development of a safe, groundbreaking non-hormonal contraceptive based on muco-trapping antibody technology.

The work of Mucommune and Inhalon is getting attention, with Lai and his team receiving more than $5 million in six separate federal grants. They are also part of a consortium that was awarded $7.8 million from the National Institute of Child Health and Human Development to bring the first anti-sperm antibodies for contraception into the clinic.

As a Carolina faculty member, Lai was able to access various resources and networks across the University.

"The Eshelman Institute for Innovation Microincubator labs gave us the environment and space needed to get the work going when we didn't have much money to start. It was exceedingly important," he adds. "My approach was unconventional and, as a result, it was very difficult to get funding on this topic. The grant from the Eshelman Institute really allowed me to keep pursuing the work. It would have taken us years longer without the critical resources."

In addition, Lai received grants and support from other groups including the NC TraCS Institute, KickStart Venture Services and the Office of Technology Commercialization.

"The University is very supportive of faculty entrepreneurship. Part of the support is reflected in the number of seasoned entrepreneurs that the school has helped make available to faculty," says Lai. "The people at UNC are the single greatest resource."

Muco-trapping technology from Mucommune and Inhalon is designed for **non-hormonal contraception** and the **prevention of respiratory diseases.** One disease targeted by this technology — respiratory syncytial virus — **sickens an estimated 64 million people** annually.

Huang Group

SOLAR THAT SELLS

Professor Jinsong Huang, PhD, is working to change the renewable power industry with his perovskite solar cell method that will make solar energy more affordable.

If someone asked you to wager a guess on when solar energy first came of age, and you said the seventies, you'd be correct — but only if you meant the 1870s.

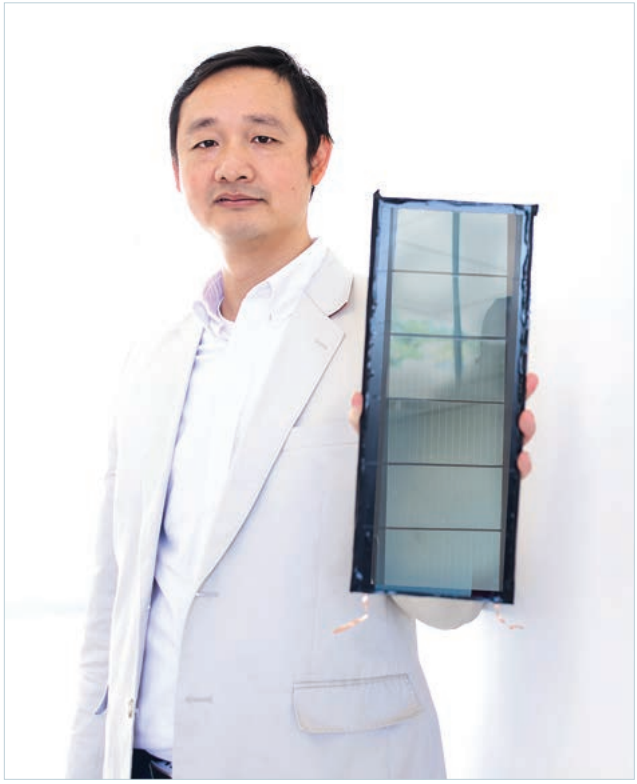
That's when French inventor and renewable energy pioneer Augustin Mouchot used his diverse expertise in mathematics and physical sciences — along with his keen interest in the sun — to invent the earliest solar-powered engine.

Advances in solar energy have been vast since Mouchot first demonstrated his invention at the World Expedition in Paris in 1878. Fast forward to today, and one of the most exciting developments is taking place at UNC-Chapel Hill. Professor Jinsong Huang and his research group are tapping into the spirit of Mouchot's cross-disciplinary research approach to develop their own innovation — one that promises to usher in a new era in affordable renewable energy.

Huang, a professor in the applied physical sciences department, leads a research team that includes experts from multiple fields to pioneer a novel method for stabilizing perovskite solar cells.

Perovskite solar cells have become increasingly popular subjects of renewable energy research as they demonstrate high solar-to-electricity conversion efficiencies at a low production cost. But their stability when exposed to moisture and oxygen remains a critical hurdle to overcome before the cells can truly become market ready. The Huang Group is addressing this challenge with a new method that would enhance the resistance of the perovskite solar cells under ambient conditions.

"Solar energy is abundant. You only need to have a small part of sunlight to create electricity," Huang said. "Our



Jinsong Huang, a professor of applied physical sciences, leads a research group focused on developing perovskite materials to create a new generation of solar cell technologies.

> **My group is really diverse. We have top-notch scientists with backgrounds in chemistry, physics, engineering and materials science. Solving problems is in our blood.**
>
> **JINSONG HUANG**
>
> PROFESSOR IN THE DEPARTMENT OF APPLIED PHYSICAL SCIENCES

The perovskite technology developed in the lab of professor Jinsong Huang (right) has the potential to make solar energy more affordable on a mass scale.

new method of harvesting solar energy is cheaper than the popular method. We want to make energy using the sun, converting it to clean energy that is affordable. We are trying to provide electricity using clean energy, but without increasing your bill."

In its work, the Huang Group collaborates with other departments across campus, bringing together expertise from areas like chemistry, engineering and materials science.

"We are working with people in multidisciplinary areas and in different fields. Our goal is to reduce the cost of solar energy, and we need to consider how affordable the solution can be," Huang said. "My group is really diverse. We have top-notch scientists with backgrounds in chemistry, physics, engineering and materials science. Solving problems is in our blood."

To further the work, Huang has benefitted from resources across the University, including the Office of Technology Commercialization's patents, copyrights and trademarks team.

Huang's innovative research is getting noticed for its potential, securing grants and funding.

"We were lucky to receive grants from the Department of Energy, the National Science Foundation and the Department of Defense. That's been great and really promising," he said. "The future is moving the research out of the lab to market. Industry and the University should work closely to move the technology to market."

Huang's work in solar energy creates the potential for perovskite solar cells to be commercially produced for use in clean energy and other applications. It also has the potential to benefit global populations.

Huang will also be part of UNC-Chapel Hill's Institute for Convergent Science, which is being designed to bring together researchers, students and scholars from many scientific disciplines to discover new breakthroughs that can only be seen through a melding of viewpoints.

"The way that you think of how to power up your house, power up your car, almost everything — it changes the way you think about how to get energy," he said. "Once you have the knowledge, you can make life easier. With a solar panel, you could go anywhere and never worry about power for your computer, your cell phone or for your car."

Professor Jinsong Huang's small, lightweight **perovskite technology** may **make solar energy affordable for all.** The goal is to provide **clean energy that doesn't increase your electricity bill.**

SOVE

WINNING BRACKETS

Professor Ching-Chang Ko, DDS, PhD, and dental school alumna Christina Jackson, DDS, are forming the company SOVE based on Jackson's work that uses 3D printing to craft orthodontics.

When Dr. Ching-Chang Ko first saw Christina Jackson's application to the Adams School of Dentistry at UNC-Chapel Hill, he knew he wanted someone with her unique background to learn orthodontics. After all, few of the other 230 applicants in the 2014 class had a bachelor's of science degree in mechanical engineering from MIT.

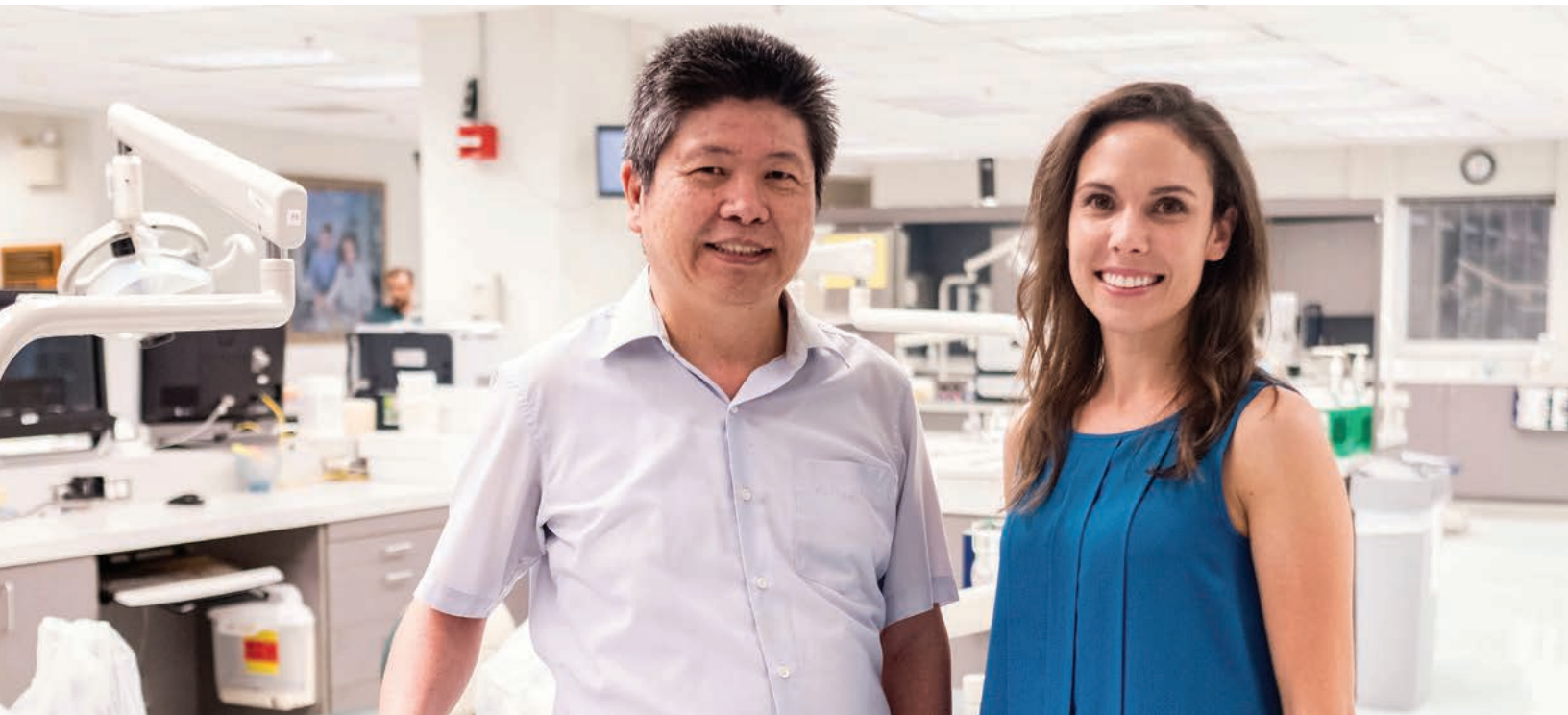
Ko, formerly the chair of the department of orthodontics at the Adams School of Dentistry who has an engineering degree himself, knew the potential someone with that background could bring to orthodontics.

"We only accept six applicants, which means she is excellent," says Ko. "Her background caught my eye. I have a doctoral degree in engineering, and very few orthodontists have that background. I felt that her background matched mine, so I have tried to mentor her."

Ko, who has since been named the chair of orthodontics at the Ohio State University, suggested that 3D metal printing in orthodontics might make a good subject for Jackson's required first-year research projects. She took the idea and ran with it — so much so that the pair are forming their own company based on Jackson's work.

"3D metal printing is a relatively new technology and hasn't been used to make orthodontic appliances and brackets," Jackson said. "We've taken the results of my thesis research on the accuracy of 3D printing, and we're designing new orthodontic appliances which can only be made through 3D printing, not with conventional manufacturing."

Most orthodontic brackets are created by taking molds of the mouth, building the brackets to fit the teeth, and having the orthodontist make periodic adjustments to the brackets.



Jackson's process significantly decreases the time to make brackets while increasing their accuracy. Instead of a mold of the patient's teeth, Jackson takes a digital scan of the mouth and feeds the data into the 3D printer. The new brackets are custom fitted to the patient and don't require regular adjustments.

"What it will hopefully mean is that you get a faster treatment because you have a custom bracket," said Jackson, who earned her doctorate of dental medicine at Harvard University's School of Dental Medicine before coming to Chapel Hill to get a second master's degree and a certificate in orthodontics. "That would help you move your teeth in just the right way the first time, and you wouldn't need the orthodontic adjustments. Right now, orthodontists use a one-size-fits-all bracket and make adjustments to the wires to get them in the perfect position. In the custom bracket, all of that is taken care of in the bracket itself."

Ko thinks patients could see cost savings with the process, since molds are not required to be made first. The 3D process only takes a couple of days, compared to brackets made from molds, which usually take about two weeks to create.

Jackson and Ko's plans for bringing the new technology to market include launching a startup named SOVE. As they're working to start the company, Jackson and Ko have turned to a number of resources at UNC-Chapel Hill for guidance. At the outset, they worked with the Office of Technology Commercialization to assess and protect the idea, navigate the patent process and secure a provisional patent.

Jackson and Ko also partnered with KickStart Venture Services, which helped them with market research and analysis, introduced them to interns from the School of Law, connected them to grant writing consultants and assisted with the regulatory pathway approval.

"KickStart Venture Services is there to help early-stage companies at UNC meet their commercial milestones on the technical and business side. Without them, I think we still might be trying to figure out what to do next," says Jackson.

Jackson says the entrepreneurial process requires that you constantly look for ways to explore new paths and resources. "The opportunities won't come to you," says Jackson. "You have to go out there and make the next step happen."

Original story by University Communications
Additional source: On the Heels of Innovation podcast

Christina Jackson, co-founder of SOVE, shows off an example of a 3D-printed orthodontic bracket. These brackets hold the potential to offer a custom fit that provides patients with faster, more accurate treatment, without the need for regular adjustments.

EnFuego Therapeutics

MUTING GENETIC MUTATIONS

School of Medicine professor Chad Pecot's startup company EnFuego Therapeutics creates RNA-interference drugs to silence cancer-related gene mutations.

With more than 1.5 million people in the United States diagnosed with cancer in 2019 alone, Chad Pecot, MD, is determined to make a lasting impact on the lives of those going through treatment. An associate professor and associate director of translational thoracic oncology at the Lineberger Comprehensive Cancer Center, Pecot — a cancer survivor himself — understands what patients go through during treatment.

In his case, he was cured through surgery and chemotherapy, but as an oncologist he knows all too well that not all cancer patients experience the same outcome. His journey led him to launch EnFuego Therapeutics, a company merging science and technology to create RNA interference (RNAi)-based drugs for treating cancer.

"Many, many people die of cancer, and although we've made a lot of progress in cancer research and treatment, there's still just such a long way to go," says Pecot. "What really attracted me to what I work on — and what led to me starting EnFuego Therapeutics — is the power of RNA interference technology."

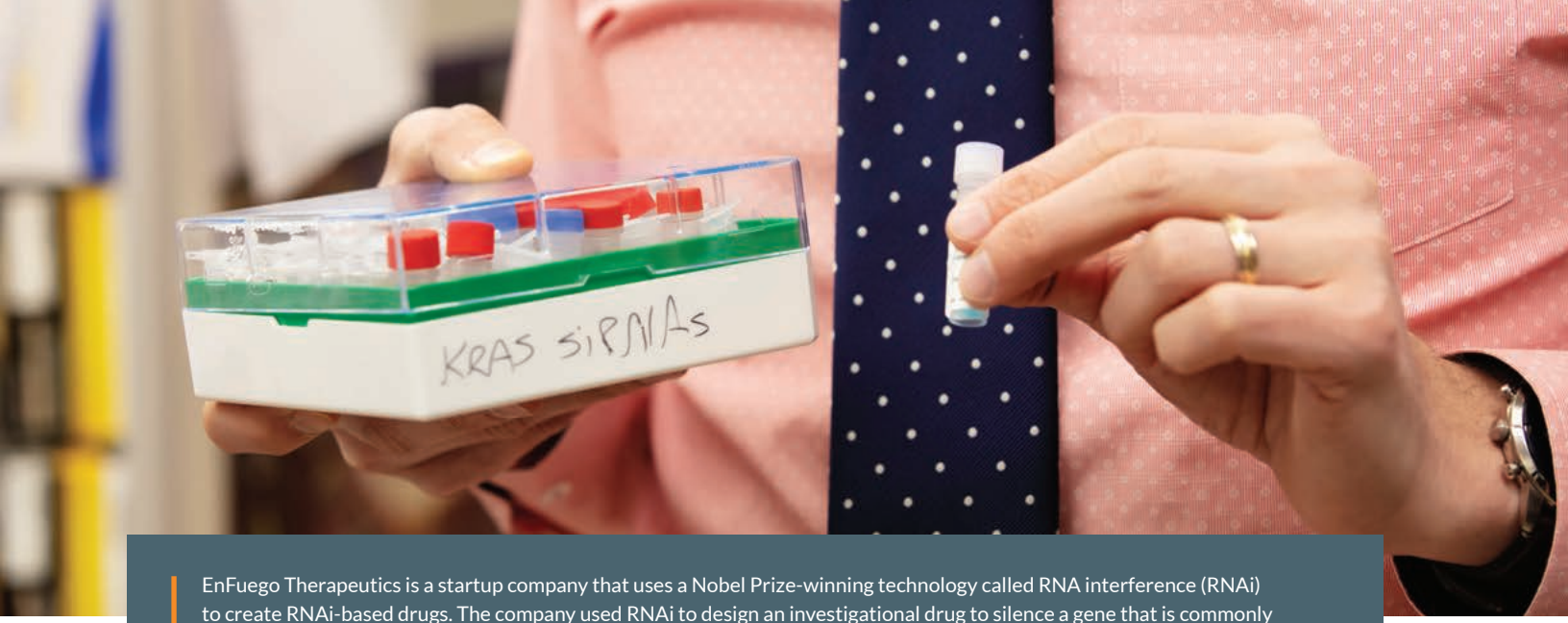
Discovered in 1998, RNAi is a way in which very small, synthetic, double-stranded RNAs can be created and then used to silence a gene. The technology created excitement for many drug companies when it won the Nobel Prize in 2006.

"The implications of this technology are tremendous because there are many genes in many diseases — cancer being one of them — that we know are important in making the disease process happen," says Pecot. "A lot of drugs being developed don't have a way of hitting many of the genes that we know are important. So that's what EnFuego Therapeutics is all about. We are trying to create RNAi-based drugs for treating cancer."

Chad Pecot, an associate professor and associate director of translational thoracic oncology at the Lineberger Comprehensive Cancer Center, is the founder of startup company EnFuego Therapeutics.

Many drug companies have tried to further develop RNAi technology for cancer therapeutics, but have not had much success. Not one to back down from a challenge, Pecot had a passion to help cancer patients that pushed him to explore RNAi technology further.

"Many drug companies bailed on the possibility of this being a good treatment for cancer. I realized if other drug companies weren't going to try to license it and take it to people, then it's either going to die or I'm going to do it," Pecot says. "It would be a shame to think that something that could potentially reach a large number of people would be abandoned because it didn't fit the portfolio or business plan of a big company. I eventually realized that it would always bother me if I decided not to give this a shot."



EnFuego Therapeutics is a startup company that uses a Nobel Prize-winning technology called RNA interference (RNAi) to create RNAi-based drugs. The company used RNAi to design an investigational drug to silence a gene that is commonly mutated in lung, pancreatic and colon cancers.

And although there have been many advancements and great progress in the treatment of cancer, it can often return.

"A lot of therapies in cancer often end up being knockout blows to the tumor, but they don't kill it. We can often think a knockout is a win, and it's not. The tumor will get back up, and they always get back up… and they often end up winning in the end," says Pecot. "Unfortunately, chemotherapy is not curative in most cancers. Because I was fortunate to be cured, I want the same result for everyone else. We have some interesting new approaches that we want to evaluate that we're hoping can be more of an extinguishing event through combinations that RNAi allows you to approach."

In launching EnFuego Therapeutics, Pecot has used innovation and entrepreneurship resources available at Carolina to develop his startup journey, including KickStart Venture Services within the Office of Technology Commercialization (OTC). KickStart Venture Services supports faculty startup formation, business development and growth by providing coaching and mentoring, early-stage funding, connections with key service providers, management, investors and space.

"Hands down, the most valuable resource I was able to tap into and that I am very grateful for is KickStart Venture Services," says Pecot. "From networking and understanding the biotech landscape, to questions about how a startup works and the ins-and-outs of venture capital, KickStart helped me tremendously."

> **Unfortunately, chemotherapy is not curative in most cancers. Because I was fortunate to be cured, I want the same result for everyone else.**
>
> **CHAD PECOT**
>
> ASSOCIATE PROFESSOR AND ASSOCIATE DIRECTOR OF TRANSLATIONAL THORACIC ONCOLOGY, LINEBERGER COMPREHENSIVE CANCER CENTER

EnFuego was awarded a $30,000 technology development grant from OTC as well as a $100,000 grant from the North Carolina Biotechnology Center to work on its innovative technology and approach to cancer treatment. As EnFuego continues to grow, Pecot looks to raise additional funding to continue the evaluation of RNAi technology as well as secure incubator space.

"We're going after the big players in cancer, trying to develop drugs against several very well-validated targets of cancer that would otherwise have been regarded as undruggable," adds Pecot. "We want to find ways to synergize some of these approaches that would otherwise be very hard to do with current therapeutic strategies."

Creativity Hub: Sustainable Access to Clean Water

CLEAN WATER FOR ALL

A cross-disciplinary faculty team led by professor Theo Dingemans, PhD, is developing a purification tool to make clean water a reality for people around the world.

As populations grow, people across the planet thirst for an increasingly scarce resource: clean water. In fact, the Centers for Disease Control estimates more than 660 million people worldwide lack access to an improved source of water. Yet, current technologies that desalinate water are expensive and can be energy intensive.

A UNC-Chapel Hill research team is tackling this challenge through the Creativity Hubs, an evolving virtual research network that concentrates talent and resources on bold ideas for defined periods of time — free from typical organizational boundaries. The goal is to move new discoveries and ideas into practice. The Creativity Hubs initiative was developed by the Office of the Vice Chancellor for Research to foster fluid, cross-disciplinary research.

Theo Dingemans, principal investigator for the Sustainable Access to Clean Water Creativity Hub and professor of applied physical sciences, along with a team of faculty and researchers from UNC-Chapel Hill and the University of Texas at Austin, is developing an innovative, affordable membrane-based water purification tool. The team is designing the new technology to safely remove a broad range of water contaminants.

"We are going after the holy grail where we design a membrane that can be used for desalination," says Dingemans. "This new type of membrane can operate at lower energy and can produce safe drinking water at less than one dollar per cubic meter of sea water. At the rate we're consuming fresh water, we need technologies that are affordable and robust."

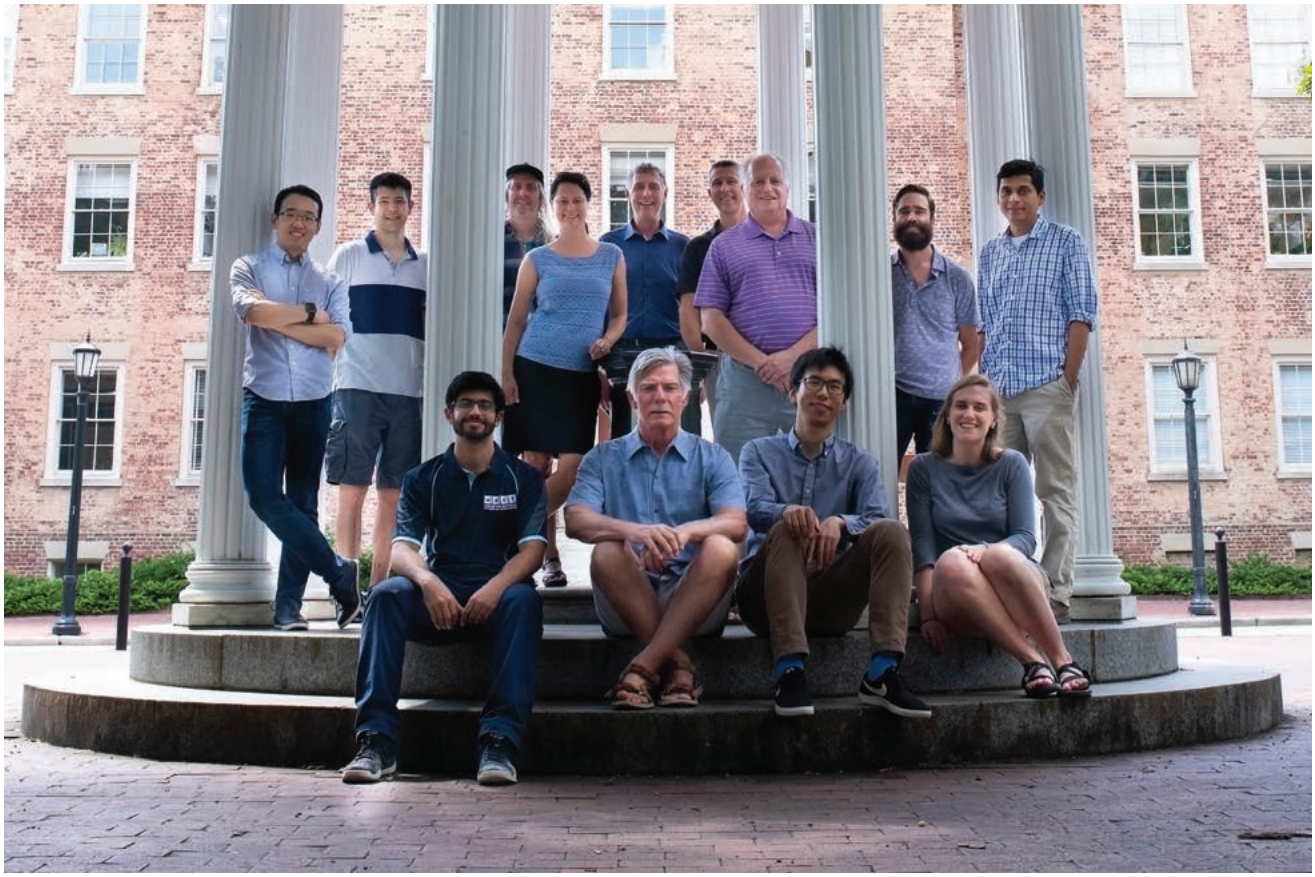
Building on graphene and graphene oxide nanocomposite membrane technology developed by the Dingemans lab, the team aims to develop new filters that make water purification more energy efficient. The

Theo Dingemans, professor and associate chair of applied physical sciences department, leads the Creativity Hubs team focused on developing a purification technology to provide clean water to people worldwide.

> **We are going after the holy grail where we design a membrane that can be used for desalination. At the rate we're consuming fresh water, we need technologies that are affordable and robust.**

THEO DINGEMANS

PROFESSOR OF APPLIED PHYSICAL SCIENCES AND PRINCIPAL INVESTIGATOR FOR THE SUSTAINABLE ACCESS TO CLEAN WATER CREATIVITY HUB



A purification technology being developed by a multi-disciplinary team of UNC-Chapel Hill researchers may change the lives of **1.8 billion people worldwide** who don't have **access to clean water.**

Anna Fraser (right), a doctoral candidate in the chemistry department, holds a sample of the purification membrane tool being developed by the Sustainable Access to Clean Water Creativity Hub.

new technology will lay a foundation for large-scale, affordable membrane production and be used for a whole range of pollutants — including removal of heavy metals, which can be extracted and then reused.

"It's a complicated, challenging problem for our team," adds Dingemans. "From chemistry to physics to engineering, if we all team up, we have the expertise to tackle this. Independently, we wouldn't be as successful. It would be hard to go out and apply for a grant that would allow us to collaborate on this problem from day one."

Dingemans' team is made up of polymer chemists, membrane engineers, computational modelers and engineers from the College of Arts & Sciences' applied physical sciences and mathematics departments and the Gillings School of Global Public Health. It also receives support from the Office of Technology Commercialization, which helps it identify commercial uses for the technology.

As inaugural winner of the Creativity Hubs, the team was able get the technology off the ground with a $250,000 award, plus $250,000 in additional funding available in year two of the project.

"This hub is an interesting opportunity. Coming from different disciplines, we can all meet in one room to tackle this challenge. In the past, this was not possible," says Dingemans.

Dingemans' team is working on patents for the separation technology. As part of the process, it discovered other applications and is developing tools for membrane design that can be used in a much broader context.

In 2018, Dingemans participated in the Chancellor's Faculty Innovation Workshop, an annual, invitation-only event for UNC-Chapel Hill faculty hosted by Innovate Carolina. The workshop became an integral part of his innovation journey.

"For me, it was really wonderful to be at the workshop and hear what other companies my colleagues are starting. That's stimulating and motivating," he adds. "My initial goal as an academic was to be a scientist and publish papers. Along the way, my goal changed. I wanted to do science that makes a difference in the real world. Having access to colleagues who have gone through this is extremely helpful in pushing people over the doorstep."

Dingemans sees firsthand the value of academics, scientists and researchers from multiple disciplines working together.

"I think the Sustainable Access to Clean Water Creativity Hub is a great example of convergent science," he adds. "To have the patience to have a group of people define a problem, break it down into parts and think through solutions is going to be incredibly important in the future. UNC will play a big role in this."

410 Medical

WHEN MINUTES MATTER

The LifeFlow device developed by UNC-affiliated company 410 Medical allows clinicians to provide faster emergency care to critically ill patients.

As a patient in an emergency situation, the last thing you want to worry about is if doctors, nurses, clinicians and EMTs have the tools available to provide the best possible care. Time is of the essence, especially when it comes to major challenges such as sepsis, trauma and shock.

One UNC-affiliated startup company working to improve patient care and lessen the burden on health care providers is 410 Medical. Through its unique product LifeFlow, the company improves the care of the sickest patients, including those with shock and sepsis, saving lives and significantly reducing hospital expenses. In fact, it's estimated that sepsis affects more than 30 million people worldwide each year.

"Sepsis costs US hospitals more than $24 billion annually and is the number one cause of in-hospital death. It is a significant problem both economically and health-wise, and every hospital is working toward improving outcomes," says Kyle Chenet, 410 Medical CEO. "Early, rapid fluid resuscitation is part of the solution, and LifeFlow offers providers an effective and simple new tool, especially important in shock, when minutes matter."

Kyle Chenet is CEO of 410 Medical, a company co-founded by Mark Piehl, a clinical associate professor of pediatrics at the School of Medicine.

Medical emergencies such as sepsis, anaphylaxis, severe dehydration, cardiac arrest, hemorrhage, respiratory failure, drug reactions and many others require rapid fluid delivery in the early stages of treatment. LifeFlow enables clinicians to respond to these critical conditions with an immediate solution for fluid delivery.

401 Medical's **device delivers 500ml of life-saving fluids** much faster than current methods — in **less than two minutes.** The technology can help **30 million people affected by sepsis** — the **No. 1 cause of in-hospital deaths** — every year.

LifeFlow, a device developed by startup company 410 Medical, can deliver 500ml of fluid in less that two minutes. This rapid response is critical for emergency patients being treated for sepsis, trauma and shock. 410 Medical received an investment from the Carolina Angel Network, which is the only official angel investor network for startups and ventures associated with UNC-Chapel Hill. Photo courtesy of 410 Medical.

"Current methods of delivering fluids quickly are often slow and inefficient. Nurses, doctors and paramedics need a device that they can grab in a chaotic emergency situation, quickly set up and deliver a fluid bolus," adds Chenet. "We're hearing great stories from providers about the real impact that LifeFlow is having in patients."

When Chenet first connected with Mark Piehl, MD, the chief medical officer and co-founder of 410 Medical, he knew there was something special about the company and the LifeFlow product. Piehl, who is a clinical associate professor of pediatrics at the UNC School of Medicine, conceived the idea for LifeFlow while he was a practicing clinician at WakeMed Hospitals, where he served as medical director of WakeMed Children's Hospital from 2009 to 2015. Chenet was inspired by Piehl's passion for treating critically ill patients, the unmet needs related to fluid resuscitation and the simplicity of LifeFlow.

"For any new company, the core team and values are really important. At 410, we are incredibly passionate about improving care for critically ill patients, and that passion helps foster the effort, creativity and excellence that we bring to our work each day," Chenet says. "We are proud to be a North Carolina story. Mark was born and raised in North Carolina. LifeFlow is manufactured in North Carolina and used in local hospitals, including UNC Hospitals, Duke University Hospital and WakeMed, where some of the original work was done and with whom we've had an exceptional partnership from the beginning."

> **Current methods of delivering fluids quickly are often slow and inefficient. Nurses, doctors and paramedics need a device that they can grab in a chaotic emergency situation.**
>
> **KYLE CHENET**
> CEO OF 410 MEDICAL

A UNC-Chapel Hill investor program helping boost startups like 410 Medical is the Carolina Angel Network (CAN), which connects accredited investors who are alumni or friends of the University to UNC-affiliated startups. CAN is the only official angel investor network for startups and ventures associated with UNC-Chapel Hill.

In addition to investment funding from CAN, 410 Medical received support from the Triangle Venture Alliance, a partnership between UNC-Chapel Hill, Duke University and NC State University.

"410 Medical was the first investment that all three groups did together, and it was great to be part of that. The groups did an excellent job of coordinating together and streamlining the diligence process," says Chenet. "Having a group like CAN that can serve as a sounding board, help with strategy or operations and can provide connections to others in the network is vital."

IP-BASED STARTUP ROSTER, FY2019-20

The ingenuity of UNC-Chapel Hill faculty and students doesn't just surface in laboratories and lecture halls. It makes its way to the commercial market, where UNC-affiliated startup companies create jobs, generate revenue, and transform how people work and live across North Carolina and around the world.

The startups listed below were all formed during fiscal year 2019 and 2020 based on the intellectual property of Carolina innovators. Their missions are both complex and diverse: from developing gene therapies for hemophilia and muco-trapping antibody technologies that fight infections to improving the delivery of medicines through precise syringes and 3D-printed devices. But their common bond is singular and simple: translating their research-born ideas into companies that become the best conduits for their technologies to reach the people whose lives they will improve and save.

AI Tracking Solutions
Combining machine learning and artificial intelligence to provide cloud-based, fully automated video tracking analysis software to the microscopy community.

AnelleO
Developing a 3D-printed intravaginal ring that can be used as a platform for treating a wide range of women's health conditions.

Assure Technologies
Providing a novel, simple and affordable precise syringe device that provides consistently accurate measurements for a variety of drug preparations.

Archimmune
Harnessing immuno-oncology approaches and novel nanoparticles to target tumors.

Bedrock Therapeutics
Developing the first effective gene therapy for hemophilia patients who are unable to respond to current therapies.

Eldec Pharmaceuticals
Developing an effective anti-inflammatory therapeutic to treat lung inflammation.

EnFuego Therapeutics
Creating RNA-interference drugs to silence cancer-related gene mutations.

Epigenos
Developing a platform technology that uses novel approaches for modulating cellular epigenetic machinery to create therapies for cancer and rare diseases.

IMMvention Therapeutix
Improving the lives of patients with rare and prevalent auto-inflammatory diseases by developing novel disease-modifying therapies that inhibit inflammation.

Inhalon Biopharma
Advancing muco-trapping monoclonal antibodies for use in treating and preventing respiratory infections.

Pulvinar Neuro
Providing cutting-edge neurotechnology through a portable device that allows non-invasive brain stimulation research.

Torque Bio
Developing novel AAV vectors with prolonged stability of encoded transcripts.

SNP Therapeutics
Providing precision, gene-guided nutrition by evaluating a patients' genome data and providing information that can inform treatment options.

SOVE
Using 3D printing to develop an orthodontic system to solve the problems frequently encountered with current esthetic options.

INVENTOR OF THE YEAR

The Inventor of the Year Award recognizes a UNC-Chapel Hill inventor for their contributions to University inventions and patents. It also honors his or her commitment to the University's culture of encouraging innovation, disseminating knowledge and promoting entrepreneurial initiatives. The Office of Technology Commercialization presents this award annually, and recipients provide a short presentation during the final Carolina Innovations Seminar of the year. The presentations highlight the recipient's personal experiences in innovation and entrepreneurship.

2019 Inventor of the Year

KIM BROUWER MAKES MEDICINES SAFER FOR ALL

Twenty years ago, Kim L. R. Brouwer, PharmD, PhD, was a young clinician scientist in Carolina's School of Pharmacy focused on making a difference in patients' lives.

She specialized in pharmacokinetics, the branch of pharmacology concerned with the movement of drugs within the body. Brouwer's particular interest was the science of drug transporters, proteins that play key roles in the absorption, distribution and excretion of many medications — and contribute to the variable response that patients have to the same drug.

In response to this challenge, Brouwer co-invented B-CLEAR® (US Patent No. 6,780,580), which promised the possibility of a reliable method to measure and predict how drugs are handled by the liver to help ensure that they are safe for use before they go to clinical trials and the market.

Today, the technology she helped create is exclusively licensed from the University to Qualyst Inc. And Brouwer, as a Qualyst co-founder and former chair of the company's scientific advisory board, was honored as Carolina's Inventor of the Year during the 2019 UNC Celebration of Inventorship hosted by the Office of Technology Commercialization.

Kim Brouwer, the William R. Kenan Jr. Distinguished Professor in the Division of Pharmacotherapy and Experimental Therapeutics at the Eshelman School of Pharmacy, was named UNC Inventor of the Year in 2019.

Brouwer joined the Carolina faculty in 1986, where she served as director of graduate studies at the School of Pharmacy from 1996 to 2004, and chair of the Division of Pharmacotherapy and Experimental Therapeutics from 2004–2015.

As the William R. Kenan Jr. Distinguished Professor in the Division of Pharmacotherapy and Experimental Therapeutics of the Eshelman School of Pharmacy, Brouwer directs an NIH-funded research program focused on the liver. One of the body's largest and most important organs, the liver is responsible for keeping the body operational, including breaking down and converting substances (including many medications), extracting energy and removing toxins.

Brouwer specialized in the study of liver cells called hepatocytes, which extract substances from the blood, direct many metabolic functions, and also produce and secrete bile. Her work looks at the movement of drugs from the liver to the bile, gallbladder and intestine through a path known as the biliary tract. This critical pathway is responsible for the beneficial and adverse effects of many medications.

She also serves as the associate dean for research and graduate education in the School of Pharmacy and is a professor in the curriculum in toxicology. She has mentored more than 104 undergraduate, professional, graduate and postdoctoral students and published more than 230 research papers, reviews and book chapters.

"We have seen a dramatic shift in the way we educate our graduate professional students today," Brouwer said. "We encourage them, when they have an idea, to begin to think how they can channel that to the benefit of patient care or science more broadly. My generation was not taught to think in that way."

During a short talk at the event, Brouwer shared the hard lessons she learned as an entrepreneur over the past two decades.

"I'll try to keep it positive and upbeat, but the reality is it is not always an easy road," Brouwer said. "We were scientists, not entrepreneurs, and we did not have the business training to do this ourselves. We had to rely heavily on CEOs, and sometimes that takes you in a great direction and sometimes not." The same is true of investors, she added.

"I'll talk a little bit about the science, but more about the many business challenges we faced and my perspective on how and what we could have done better," Brouwer said. "Successfully bringing an innovation to market requires time, effort, passion, perseverance and a measure of luck."

Original Story by University Communications

Executive Vice Chancellor and Provost Bob Blouin, PharmD (left), professor Kim Brouwer, PharmD, PhD (center), and Dhiren Thakker, PhD, emeritus professor and former interim dean at the Eshelman School of Pharmacy.

Successfully bringing an innovation to market requires time, effort, passion, perseverance and a measure of luck.

KIM BROUWER

THE WILLIAM R. KENAN JR. DISTINGUISHED PROFESSOR IN THE DIVISION OF PHARMACOTHERAPY AND EXPERIMENTAL THERAPEUTICS, ESHELMAN SCHOOL OF PHARMACY

Kim Brouwer developed the technology **B-CLEAR®,** which **keeps patients safer** by providing a reliable way to measure and **predict how drugs are handled by the liver.**

2020 Inventor of the Year

MICHAEL RAMSEY: 'BELIEVE IN YOUR IDEAS AND PERSEVERE'

For 30 years, Michael Ramsey, PhD, has been an innovator in the life sciences industry, using technologies with an origin in microelectronics to build chemical measurement devices.

To a young standout student who grew up on a farm in rural Ohio, faced an uncertain higher educational path and was once enamored with the notion of earning just one patent, the future reality of receiving 165 patents—not to mention founding three successful startups—might seem hard to believe. But looking back now, Michael Ramsey points to the importance of learning to believe—both in himself and what his ideas could make possible—as critical to advancing science and the public good.

Ramsey, who holds the Minnie N. Goldby Distinguished Professor of Chemistry Chair, was honored as the recipient of UNC-Chapel Hill's Inventor of the Year Award during the 2020 UNC Celebration of Inventorship. He is also a faculty member in the Department of Applied Physical Sciences and UNC/NCSU Joint Department of Biomedical Engineering.

An ongoing theme throughout Ramsey's storied career, perseverance has created a pathway for his success as a researcher, innovator and entrepreneur. It's a trait that became particularly salient to attendees of the online seminar when they heard Ramsey speak about his work as he received award, which is given each year to a UNC-Chapel Hill researcher in recognition of their contributions to inventions and patents.

"I remember starting out my career hoping I could just get one patent to put on my CV," says Ramsey. "Receiving this recognition is an honor, and I appreciate being selected."

Over the last 30 years, Ramsey's work has focused on the life sciences industry, using technologies with an origin in microelectronics to build chemical measurement devices. Although his original training and early work began in laser spectroscopy and laser technology, he quickly became interested in using microfabrication tools to make structures to acquire chemical and biochemical information. This eventually led to his work in the miniaturization of chemical measurement technologies.

Michael Ramsey, the Minnie N. Goldby Distinguished Professor of Chemistry Chair, was named UNC Inventor of the Year in 2020.

One secret to his success? With every project or proposal, he aims to find an unmet need and figure out how to develop a product that will meet that need while being useful to society.

"In terms of my research, I want to work on technologies that will have societal benefit," he says. "And the way

to achieve that societal benefit is to envision a product maybe five-to-ten years in the future and develop something that will actually improve people's lives."

Ramsey has successfully launched three life science companies. He's the scientific founder of Caliper Technologies, renamed Caliper Life Sciences and acquired by PerkinElmer for $600 million in 2011. He is also the scientific founder of venture-backed companies 908 Devices, a company developing revolutionary compact mass spectrometry and chemical separations-based products, and Genturi, a genomics tools provider.

Technologies he's developed are broadly capable and are being employed in forensics and biotech applications. Handheld devices have been created that can detect most variants of fentanyl and other drugs well below their lethal levels to help front -line workers combat the opioid crisis. His work has enabled a compact analyzer that can be used next to a bioprocess reactor to monitor and control the process with insights never before practical. Through his curiosity and innovative mindset, Ramsey has persevered through challenges that would have discouraged many.

"The first technology I worked on that resulted in patents was a microfabricated fluidic device to perform chemical separations, but I had no experience in either microfabrication or chemical separations," he says. "Because I had no previous experience in the area of the problem we were trying to solve, it took me two years to raise the funding to start that initial research. I've had many proposals turned down and lots of people tell me that I had silly ideas, but you've got to believe in your ideas and persevere."

Ramsey encourages other entrepreneurs and innovators not only to persevere through the tough times but to get as many different perspectives as possible to make their ideas better.

"While at Oak Ridge National Laboratory (ORNL), there was a more senior person who had expertise in the area of the problem we were trying to solve, and I would talk with him frequently," he says. "I'd ask, 'Am I crazy? Is this really a silly idea?' He'd give me supportive feedback and his opinion if it was an idea worth pursuing, and that was very important."

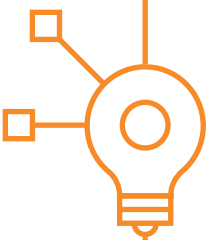
From his experience at ORNL, Ramsey was able to fine-tune the ways in which he combines teams that will work together most effectively. While many academic research groups typically combine mostly graduate students with a few postdocs, Ramsey prefers to mix up experience levels within the group to further his capabilities.

"I've always had staff scientists in my research group, in addition to graduate students and postdocs. These more senior researchers expand the capabilities of the group and allow us to simultaneously work on more diverse projects," he adds.

Even with all his success, Ramsey has no plans of slowing down and is currently working on his fourth startup, Codetta Bio. His career path is one he may not have initially envisioned, but it was a path forged by his persistent mindset. He's come a long way from that first issued patent to list on his CV.

"I grew up on a farm and wasn't even sure I would go to college," says Ramsey. "I didn't even know what graduate school was until a professor brought it up to me and said, 'I presume, you're going to graduate school?' I asked, 'What's that?' I've just followed my interest step by step. Translating technology from academic research into the private sector is important, so without the support of the institutions I've worked for, that wouldn't have happened," he adds.

Ramsey is a member of the National Academy of Engineering and a Fellow of the National Academy of Inventors, the Optical Society of America, the American Chemical Society and the American Institute for Medical and Biological Engineering. In addition, Ramsey has published more than 300 peer-reviewed papers and presented nearly 600 invited, plenary or named lectures. He has 165 issued and 15 pending patents.



Michael Ramsey has launched **three life science companies,** including Caliper Technologies that was **acquired for $600 million.** He holds **165 issued and 15 pending patents.**

INVENTIONS REPORT: FY2019–20

Filing an invention report is how faculty and students start the process of taking their ideas to market through a license, startup company or other path. The following roster describes inventions reported at UNC-Chapel Hill during fiscal years 2019 and 2020. From new therapeutics, drug delivery technologies and medical devices to innovations in energy, computer science, health, safety and other areas, Carolina researchers are busy developing new advancements that will ultimately make a human, social and economic impact.

Biomarkers/Diagnostics

Engineered Lactate Oxidoreductases

Glucose Oxidase With Improved Activity

covID: A Microfluidic Device for Diagnostic Detection of COVID-19

Developing Methods to Identify Bacterial Strains That Induce Colitis

Engineered Glycerol 3-Phosphate Oxidase and Its Sensor Application

Novel COVID-19 Virus Surveillance Method for Fecal Samples

Non-Invasive Diagnostic of Prosthetic Deterioration in Joint Replacement

Recombinase Polymerase Amplification Lateral Flow Assays to Detect and Differentiate the Malaria Species Plasmodium Falciparum and Plasmodium Ovale

iC-MAP Discovery of Biomarkers for Early Detection of Liver Cancer

Clinical Utility to Predict Toxicity Anti-Angiogenesis Drugs in Cancer Patients

Detecting Tumor Mutation Burden With RNA Substrate

Detecting Cancer Cell of Origin

De Novo Compartment Deconvolution and Weight Estimation of Tumor Tissue Samples (Decoder)

Purist Tumor Classifier

Personalized and Adaptive (Panda) Therapy

Use of Physical and Dynamic Fibrin Properties for Coagulation Testing

Image Analysis With Deep Learning to Predict Breast Cancer Grade, ER Status, Histologic Subtype, and Intrinsic Subtype

Computer Science

Echo-Reconstruction: Audio-Augmented Scene Reconstruction With Mobile Devices

Generating Descriptions of Image Relationships

Tangent Image Representation for Spherical Images

High-Speed Computer-Generated Holography Using Convolutional Neural Networks

Linear View-Change BFT With Optimistic Responsiveness

Rate Sorted Arithmetic Coding

RNN/SLAM for Fused Real-Time Surface Reconstruction

Layered 3D Holography With Foveation for Augmented Reality Displays

Hardware-In-Loop High Quality Holography for Augmented Reality Displays

Drug Discovery

Nanoparticle Delivery of Nucleoside Phosphate Against COVID-19 Infection

Burn Inhalation Injury Targeting Nanofiber

Ligand for Oligonucleotide Delivery

Aneurysm Targeting Nanofiber

Developing Polyplex-Mediated AAV Delivery Vehicle for Gene Therapy

Method of Loading Single Stranded RNA Into Extracellular Vesicles

Mode of Nitric Oxide Delivery Influences Solution Concentration and Biological Action

Extended Nitric Oxide-Releasing Compounds

Method of Loading Molecules or Nanosized Materials Into Extracellular Vesicles

Biological Agent Compositions

Materials for Loading Oligonucleotides Into Extracellular Vesicles

Method of Loading Oligonucleotides Into Extracellular Vesicles

Method of Maximizing Extracellular Vesicles Yield Through Filtration

Stabilized Extracellular Vesicles and Preparation Methods Thereof

Education

Be CALM Curriculum for Middle Schoolers

3 Point Anatomy Builder

3 Point RPD design

DOCSpeaks

SweepStat Hardware

SweepStat Software

Surgical Simulators

Autism Program Environment Rating Scale (Preschool/ Elementary and Middle/High School)

Energy

Chemicals for a Fluoride Ion Shuttle Battery

Conversion of Halide Perovskite Surfaces for Enhanced Solar Cell Stability

Engineering Toward Improved Efficiency for Suppressing Perovskite Solar Cells

Efficient Perovskite Solar Cells With Near-Infrared Sensitive Layers

Perovskite/Silicon Tandem Photovoltaic Device With a Rough Interface

A Perovskite Ink for Scalable Fabrication of Efficient and Stable Perovskite Modules

Doping Modification of Sn Containing Metal Halide Perovskites

Light Guided Crystal Growth Method for Metal Halide Perovskite

Growth of Large Area Perovskite Multicrystals on Flat and Rough Substrates

Lead Sequestration in Perovskite Solar Modules With Abundant, Low-Cost and Stable Cation Exchange Resins

Enhanced Efficiency and Stability in Perovskite Solar Cells

Stabilizing Perovskite Solar Cells

All-Faradaic Electrochemistry

Health/Safety

Multi-Modal Indoor Air Quality Sensor

Reusable Storage Case for Particulate Respirators

FastMask Face Mask

Extraction of PFAS with Molecularly Imprinted Electrodes

Integrated Education

Diagnostic Accelerator

Composition for PFAS Remediation in Drinking Water

Immersive Laboratory Experiences

The 2beathiv Project

Hybrid Desalination Membrane Architecture With Enhanced Selectivity

Grow-Up Declarative Memory Task

The Thought Impact Scale

Functional Dyspepsia Hypnosis Protocol

Waterproof Sock With Custom Foot Orthosis Incorporated

Imaging

Image-Based Methods for Estimating a Patient-Specific Reference Bone Model for a Patient With a Craniomaxillofacial Defect and Related Systems

In Vivo Phase-Incrementing MRSI (pi-MRSI) for Multi-Biomarker Imaging

Development of Novel PET Agent for Parathyroid Detection

Methods for Evaluating Mechanical Anisotropy for Breast Cancer Screening and Monitoring Response to Therapy

Retrospective Artifact Correction of Pediatric MRI via Unsupervised Deep Learning

Multifold Acceleration of Diffusion MRI via Slice-Interleaved Diffusion Encoding (SIDE)

A Method to Diagnose and Monitor Pulmonary Fibrosis Using Ultrasound Multiple Scattering

Double-Profile Intersection (DoPIo) Elastography: a Method to Quantify Tissue Elasticity

Quantitative Viscoelastic Response (QVisR) Ultrasound

Location of Pulmonary Nodules With Ultrasound

18f-Labeled PSMA Ligands for Pet Imaging

MR Synthetic Images to Improve Detection of Abnormality

A Method for Generating Images of Microvasculature Using Ultrasound

Multiscale Coherence Imaging for Assessing Epithelial Tissue Health

3D MR Fingerprinting Using Parallel Imaging and Deep Learning

A Compact X-Ray Device for Tomosynthesis, Fluoroscopy and Stereotactic Imaging of Extremities at the Point-Of-Care

Flexible X-Ray Detectors and Methods of Fabrication and Integration Into Readout Circuit Board

High-Speed, Small-Footprint X-Ray Tomography Inspection Systems, Devices and Methods

Systems and Methods for X-Ray Imaging and Scanning of Objects

Stationary Intraoral Tomosynthesis Imaging Systems, Methods and Computed Readable Media For 3D Dental Imaging

Multi-Modality Dental X-Ray Imaging Device and Methods

Method for Generating Multi-View Synthetic Dental Radiographs for Intraoral Tomosynthesis

Superresolution Microscopy

Deep Learning for Fast and Spatially Constrained Tissue Quantification From Highly Accelerated Data in Magnetic Resonance Fingerprinting

Industrial Process And Materials

Post Loading of APIs in 3D-Printed Medical Devices

Reactive All-Aromatic Polyamideimide Macromonomers

Novel Method to Synthesize Radiolabeled Amino Acids

New Master Cell Bank for rAAV Vector Production

Novel Device for Light-Catalyzed Radiolabeling Reaction

Design and Fabrication Methods of Radially Arrayed Lattice Architectures for Controlled Device Properties

Wrinkled Capsules for Treatment of Subterranean Formations

Core-Shell Particles for Treatment of Subterranean Formations

Method of Synthesizing Small-Diameter Carbon Nanotubes With Electron Field Emission Properties

Decarboxylative Xanthylation of Carboxylic Acids

Wettability Characterization Using Interfacial Fluid Dielectric and Conductive Responses

Information Technology/Software

COVID-19 Monitor

COVID Symptom Checker Triage Chatbot

Automated Quiet Eye Platform for Performance Assessment and Training

Artificial Intelligence-Based Synthetic Sampling (Synsam) Technology to Boost Machine-Learning Prediction Performance

Device for Assessment of Hands-On Aseptic Technique

Software for Identifying Events in Time-Series Data

Collabucate - Personalized Team Strategies

Precision Sports Medicine Software Platform

EEG Software

Pubmed Access Through Tiered Interaction and Exploration (PATTIE)

Patient Portal Chatbot

Stoptox: An In-Silico Platform as an Alternative to Animal Testing for Acute Systemic and Topical Toxicity

Data-Driven Mathematical Modeling of Crossmatch Data: Enhanced Virtual Crossmatch

High-Definition Cyclic Voltammetry Software

Innovation and Engagement Participation and Impact Support Database

Sensory Experiences Questionnaire (SEQ)

Software Containing Novel Algorithms for Analysis of Electrocochleograms

A Motor Unit Decomposition Algorithm

Interference Removal From Electromyogram Signals

Customer Success Platform

Landscape of Effective Neoantigens Software (Lens)

UNC nXhuman Virtual Patient Software

Verifying Object Measurements Determined From Mobile Device Images

Determining Changes in Object Structure Over Time Using Mobile Device Images

Branelie Health Software

Amirabilia

Hedra: An M-Health Decision Support Tool to Facilitate Safe and Effective Planned Exercise for People With Type 1 Diabetes

Intelligent Ecological Momentary Assessment (iEMA) Platform

Minimal Dictionary Language (MDL)

Instrumentation

"Wedge Chamber" Device for Mounting Samples for Microscopy

Condensed Liquid Aerosol Particle Spray (CLAPS)

Targeted Multifocal Lens for Biological Sample Processing Applications

A Method to Obtain Real-Time PCR Data While Limiting Photobleaching in an Encoded Bead Array

Flow Cells Utilizing Surface-Attached Structures

Flow Cells Utilizing Surface-Attached Structures, and Related Systems And Methods

Small Volume Sample Collection Device and Related Systems and Methods

System, Fluidics Cartridge, and Methods for Using Actuated Surface-Attached Posts for Processing Cells

Modular Active Surface Devices for Microfluidic Systems and Methods of Making Same

Magnetic-Based Actuation Mechanisms for and Methods of Actuating Magnetically Responsive Microposts in a Reaction Chamber

Systems and Methods for Nucleic Acid Purification Using Flow Cells With Actuated Surface-Attached Structures

Materials Science

Programmable Microgels for Cell Encapsulation to Enhance Cell Persistence

Brush-Like Graft Copolymers as Molecularly Engineered Adhesives and Tissue-Like Elastomers

Reactive High-Performance Polymers for 3D-Printing Applications

A Porous Construct for Craniofacial Bone Regeneration

A Universal Method for Isotactic Poly (Alkyl Vinyl Ether)S

Membranes for High-Temperature Gas Separation

Hydrogen-Bond Enriched Ion Exchange Membranes

Polymeric Membranes for Water Filtration

Thin Film Polymer Membranes and Methods

Poly (Substituted-Norbornene) Materials With Variable Molecular Weight by Ligand- and Chain-Transfer-Controlled Catalysis

Medical Devices

Low-Profile Suprapubic Cystostomy Conduit

A Horizontal Impeding Force System to Improve Strength and Enhance Gait Performance

Self-Sensing Cantilever-Based Device for Detecting Corneal Biomechanics

Brain Infusion Cannula Safety Sheath

A Novel Biodissolvable Film for Localized and Efficient Treatment of Vulvodynia

Development of an Innovative Personalized Portable Intraoral Speech Therapy Device

Dynamic Hand Spasticity Device

Simplified Treatment of Postpartum Hemorrhage (Stop) — An Innovative Hand-Held Device for Treatment of Postpartum Hemorrhage in Low-Income Settings

Balloon Design for Transcatheter Aortic Valve Replacement

Tracheostomy Baby Smart Monitor

Handheld Robotic Injector With Plunger Force Measurement for Raulerson Syringe

A Device and Method of Cell Therapy Delivery

Utilization of Early Auditory Potentials as a Microphone for (Semi)-Implantable Hearing Devices

Local Muscle Vibration Stimulator

Other

Light Switch Dog Treat Bowl

Research Tools/Methods

SARS-CoV-2 Mouse Model

mirDrop, a Droplet-Based, Single-Cell microRNA Sequencing Product

Human ACE2 Expressing Mice

Chemically Inducible Hetero-Trimerization Tool

PEL-Cas9

The Suspension/Supporters of Cell Culture Inserts

Direct Visualization of Integrated Stress Response Activity

The Suspension Device for the Cell Culture Inserts

Surgical Template for Rat Mandible

Tools for Directed Evolution in Mammalian Cells

Prepronociceptin-IRES-Cre Driver Mice

Mouse Model of Spontaneous Non-Alcoholic Fatty Liver Disease

Methods to Enrich Enteroendocrine Cells and Their Subtypes in the Contiguous, Intestinal Monolayer Systems

PRESTO-TANGO

Mice Humanized for FCAR: The Iga Receptor (CD89)

Ccdc8 Knockout Mouse

Specific Localization of Particles Within Microfabricated Microstructures

Engineered Reader Proteins for Detection of Methylated Lysine on Histones

A Microfluidic Device to Enable Cheaper, Higher-Throughput, and More Efficient Transformation of Bacteria

Method of Making Human Mouse Xenografts

Diffn Selection of Tandem Mass Spectrometry Precursors

4D Cell Culture Technology

Method to Detect Impact Location

Buffer Fluid Concentrate

PAIR-MaP

AAV2.5-G9 Construct

L276I LGMD2I Mouse Model

Activity-Based Protein Profiling of Gut Microbial ß-Glucuronidases

Novel Method for Screening Von Hippel Lindau Substrates

Exosome Standards

Microfluidic Device for Studying Signaling Dynamics in Direct Cell-to-Cell Communication

Assembly Microplate for Primary Hepatocyte Culture

Cell Line: CH12 Lymphoma

Cell Line: WB-F344 Rat Liver

Mouse: EGFR Flox/flox

Mouse: tg801 Transgenic

Cell Line: AALEB

Antibody: H2A And H2B

Plasmid: PFA6a-kanMX6-P3nmt1

Cell Line: UNCCF7T

Methods to Create In Vitro Intestinal Mucus Systems

Engineering of Three-Dimensional Mucus Architectures to Study Mucosal Impairment, Screen Therapeutics, and Uncover New Methods for Combating Infections

Therapeutic

Gene Therapy for the Treatment of Huntington's Disease

Treatment of Implantation Failure in Endometriosis

Viral Replicon Particle (VRP) Vaccine for SARS-Cov-2

Invention of Dengue Virus Vaccine Candidates to Elicit Broad Spectrum Genotypic Immunity

Dual Targeting Chimeric Antigen Receptors With Split Costimulation and Shared CD3zeta

System to Improve Airway Gene Therapy Vector Delivery

Nano-Fdump for Cancer Therapy

Hunter Syndrome Gene Therapy Preclinical Data Package

Material and Method to Generate Mutation in Tumors

Discovery of Novel PRC2-Targeted Bivalent Chemical Degraders

Humanization of Scfv Targeting CSPG4

Use Of Mir-122 in Prevention or Treatment of Liver Metastasis

Intrathecal and Intravenous Combination Gene Therapy for the Treatment of Infantile Batten Disease

Development of Highly Potent Neutralizing Mab Against SARS-Like Coronaviruses

Compositions of Remdesivir and Its Analogs for Parenteral and Aerosol Use

Composition for Treating Cancer Cells and Synthetic Method for the Same

Codon-Optimized SLC13A5 Expression Cassette

Kinase Inhibitors of Emerging Coronavirus Pathogenesis

IP6K Inhibitors for Treatment of Related Diseases

Structure-Based Rational Design of G-Protein-Biased Opioid Receptor Agonist/Analgesics With Reduced Arrestin Recruitment

AAV Capsid-Promoter Interactions Determine CNS Cell Selective Gene Expression In Vivo

Novel Inhaled Immunotherapy Against Acute Respiratory Infections

Patch Graft Compositions for Cell Engraftment

Development of AAV Neutralizing Antibody Escape Mutants

Ultrasound-Activated Low-Boiling Point Phase-Change Contrast Agents for the Treatment of Antibiotic-Resistant Chronic Wounds

AAV Gene Therapy Vector Expressing Codon-Optimized Hidua Gene for Treating MPS I

AAV Gene Therapy Vector Expressing Codon-Optimized Hids Gene for Treating MPS II

Reversing Antibiotic Resistance With Exogenous Nitric Oxide

Novel AAV5 Mutants Selected From Random Mutagenesis Libraries

Peptide Inhibitors of CIB1

Synthesis and Anticancer Activity of Quinolone Derivatives

Hydrophilic Derivatives of Quinolones as Anti-Cancer Agents

N-Aryl Unsaturated Fused Ring Tertiary Amine Compounds, Preparation Method and Anti-Tumor Applications

Polysubstituted Pyridine Compounds as Inhibitors of Non-Nucleoside HIV Reverse Transcriptase, Preparation Methods and Uses Thereof

Raav Gene Therapy Vector Expressing Codon-Optimized Hsgsh for Treating MPS IIIA

Raav Gene Therapy Vector Expressing Codon-Optimized Hnaglu for Treating MPS IIIB

Multi-Substituted Diarylanilines as Non-Nucleoside HIV Reverse Transcriptase Inhibitors

AAV ITR Promoters

Gene Therapy Using Genomic DNA Locus

Methods to Improve and Maintain the Barrier Integrity of the Gingival Tissue and Enhance the Health of the Oral Tissues Using Curcuminoid Oral Care Compositions

Breast Milk and Human Cognitive Performances

Small Molecule Reactivation of Mecp2 and Other X-Linked Genes

Targeted Nanotherapy for Pulmonary Hypertension

Glycosaminoglycan/Growth Factor Complexes Regulating Organoids of Stem/Progenitors

Retargeted Lentiviral Vectors Via Bispecific Antibodies

Novel Affinity Molecules That Direct the Metabolism and Polarization of Macrophages and Synergize the Immune Checkpoint Blockade Therapy

Transdifferentiated Cell Compositions and Methods for Use in Therapeutic Methods

Method to Improve the Efficacy of Chemotherapy by Activating the Innate Immune Response

MERTK and TYRO3 Inhibitors for Cancer Treatment

Oligosaccharides and Their Effect in Liver Injury

Ovarian Cancer Therapy

Molecules Augmenting CAR-T Cell Function in Solid Tumors

Antipsychotic Use of an Antifibrotic Drug

Computational Stabilization of T Cell Receptors

Optimized FKRP Gene Expression Cassettes in AAV Vectors and Their Use

Cross-Genotype Chimeric Human Norovirus Vaccine Candidates

Sesquiterpene Derivatives and Their Use in Cancer Treatment

Use of Deferoxamine to Improve Tendon Healing

CD30 Chimeric Antigen Receptor

Multivalent Nanoengagers for Epidermal Growth Factor Receptor-Targeted Natural Killer Cell-Mediated Chemoimmunotherapy

RNA Binding Heterocyclic Compounds

Novel Selective Ligands for the Melatonin Receptors MT1 and MT2

Nutrient Cocktails to Mitigate, or Enhance, the Biological Impact of Exposures

Amino Acid Mutations for Stabilizing the E Protein Dimer From Dengue Virus

Host-Directed Therapies for Salmonella and Francisella Infection

Surface Functionalization of Probiotics to Prevent Attachment of Pathogenic/Infectious Bacteria

Delivery Formulations for Therapeutic Bacteria That Improve Storage, Mucoadhesion, and Control Their Local Concentration Via Sustained Release

Hepatocellular Carcinoma Therapy Based on Immunogenic Cell Death

Nano FOLFOX for Cancer Therapy

Lu177 Labeled NOTA-TATE for Cancer Therapy

The Use of Highly Soluble Nanoparticle for Immunotherapy Applications

Method of Treating Cancer With Anti-Folates

Use of Prodrugs of Fumarates to Treat or Prevent Psychotic Disorders

Bacterial Species Mitigates Radiation-Induced Hematopoietic/Gastrointestinal Injury and Death, and Promotes Cancer Control By Radiation

SMAC Mimetics for HIV Latency Reversal

Polymorphs With Betta

High Avidity T Cell Receptor Redirects Natural Killer T Cell Specificity and Outcompetes the Endogenous Invariant Chain T Cell Receptor

LCK and SHP1 Engineering in Car-T Cells

SHP1 Engineering in Car-T Cells

Il23 Cytokine T Cell Engineering for Cancer Immunotherapy

T Cell Receptor Targeting the Leukemia Associate Minor Histocompatibility Antigen UNC-GRK4-V

UNC-GRK4 Specific T Cell Receptor Sequence

In Situ Recruitment, Reprogramming and Release of Car-T Cells

KOH-5-Fluorouracil Compound

Nitric Oxide-Releasing Compositions

Know-How Related to RNA Degrader Technology

CLN7 Gene Therapy

Regulated Gene Editing System

Cornea Stroma Restricted Promoter

GALC Vector Design for Krabbe Gene Therapy

Single Chain Immune Modulators

Codon-Optimized SUMF1 Expression Cassette

Novel Strategy to Block AAV Neutralizing Antibodies

Enhance AAV Transduction With Cell Membrane Fusion Proteins

Gene Transfer of UBE3A to Treat Angelman Syndrome

Optimized ArsB for MPS VI Ocular Disease

AAV-CTNS for Corneal Cystinosis

Dengue 3/1 Chimera Vaccine Sequences

AAV-IDO-1 for Immune Modulation

Use of Thy-1 as a Therapy for Fibrosis

High-Performance Therapy to Overcome Resistance to Chemotherapy and Radiation in Non-Hodgkin Lymphoma

A CD4-Based Chimeric Antigen Receptor to Target HIV-Infected Cells

Novel Ube3a Unsilencers for the Potential Treatment of Angelman Syndrome

Inhibition of Reactive Oxygen Species (ROS) Generation Increases Antibiotic Efficacy During Staphylococcus Aureus Infection

Compound Reduces ROS and Increases Antibiotic Susceptibility During S. Aureus Infection

Synthetic Peptide Mimetic Inhibitor of NuRD

Synthetic Peptide Mimetic Inhibitor of NuRD

Long Acting HIV Drugs Emtricitabine and Elvitegravir

Compounds and Compositions for Inhibition and Elimination of Zika Infection and Uses for Same

Composition of Leptin in Extracellular Vesicles

Novel LPS Neutralizing Protein Molecules With Trivalency

Scalable Synthesis of Novel Antibiotics

Nano Co-Delivery of Quercetin and Alantolactone Promotes Anti-Tumor Response Through Synergistic Immunogenic Cell Death for Microsatellite-Stable Colorectal Cancer

Nano-Puerarin Regulates Tumor Microenvironment and Facilitates Chemo- And Immunotherapy

Highly Modular Biepitopic and Bispecific Car-T Cells for Cancer Immunotherapy

Methods to Dilate Tumor Vessels

Selective D3 Dopamine Receptor Agonists and Methods of Their Use

Novel Activators of the Mitochondrial Peptidase CLPP; A New Strategy for Anti-Cancer Drug Development

Novel Activators of the Bacterial Peptidase CLPP; A New Strategy for Anti-Bacterial Drug Development

Gnidimacrin Derivatives as Potent HIV-1 Inhibitors and Latency Reversing Agents

Leptin Extracellular Vesicle Formulations

Targeted Delivery of Thrombolytics

Drug Discovery for Treatment of Leishmania Infection

Inhibitors of RNA-Binding Proteins, Compositions Thereof, and Therapeutic Uses

Eutectic-Based Emulsions Containing Multiple Anesthetics for Treating Dry Sockets Following Tooth Extractions

Synergy of Tolerizing Agents

Novel Biologics Highly Specifically Targeting Mutated GNAQ for the Treatment of Uveal Melanoma

Combination of Chemical Analogs With Chemical Inhibitors of CDK4/6 as a Novel Approach to Treat Cancer

Delivery of Therapeutic Proteins to the Brain by Means of Extracellular Vesicles (EVs) and Methods Thereof

Combination of Peptide-Morpholino Oligonucleotide Conjugate With Small Enhancing Compound

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