Annual Report

UNeMed Corporation 2023

UNeMed Corporation

2023

UNeMed is the technology transfer and commercialization office for the University of Nebraska Medical Center and the University of Nebraska at Omaha, fostering innovation, advancing research, and engaging entrepreneurs and industry to commercialize novel technologies.

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greetings

Michael Dixon, PhD

We still have a lot of work to do, but as we exist to serve all faculty, staff and students at the University of Nebraska, I am quite proud to report another successful year in ushering Nebraska innovators through the invention process.

It is no coincidence that highlights of our last fiscal year span the spectrum of successful commercialization of university innovations. It should be noted that in our line of work, there is no such thing as an overnight success. Rather, each innovation is a long journey of dedication, tenacity, and devotion.

For example, it has been incredibly gratifying to watch one of our early startups, Virtual Incision Corporation, advance through decades of research and revision; amass more than $100 million in external funding; and now stand on the precipice of regulatory approval. The product of a UNL and UNMC collaboration, Virtual Incision is poised to disrupt traditional minimally invasive surgeries while dramatically improving accessibility to these kind of procedures. *(next page)*

When we talk about making the world a better place, this is exactly what we mean.

Of course, our successes and services hardly end there.

We are also extremely excited to see the completion of the Innovation Hub on Saddle Creek Road, which broke ground earlier this year. The Innovation Hub will serve as a nexus for inventors, entrepreneurs, investors, industry leaders and community members who can all work together, hopefully building more homeruns like Virtual Incision.

Or Vireo Resources.

Vireo is another startup company built on a UNMC innovation, and has so flourished in the market that it announced a massive expansion to its headquarters in Plattsmouth, Neb. *(page 6)*

On the other end of the technology continuum, we saw tremendous strides with Dr. Breanna Hetland. Her innovation in improving intensive care systems is turning heads everywhere she goes, earning well-deserved awards and accolades. Her startup, Family Room, is still in its infancy, but we will continue to work for Dr. Hetland, and all University innovators, to achieve ultimate success. *(page 7)*

As we look to the future, we can clearly see we won't lack for new ideas and discoveries to champion. For evidence, look no further than our remarkable numbers in patents issued, new inventions submitted and opportunities created. *(page 10)*

After all, it is going to be one of those new inventions that eventually becomes our next Virtual Incision; one of those patents that helps create the next Vireo.

And that is why we are here: To give every inventor, every invention, its best chance to get out there and make that big difference we all dream about.

MISSION FEATURES

fostering innovation

VIRTUAL INCISION:

Transforming surgery for the world...and beyond

UNeMed startup nears FDA clearance for surgical robotic platform that could transform traditional open surgeries into laparascopic procedures

A new surgical robotics system developed at the University of Nebraska will get a chance to prove its potential when NASA tests the device on the International Space Station in 2024.

Inventors Shane Farritor, an engineering professor at the University of Nebraska-Lincoln, and Dmitry Oleynikov, a surgeon formerly at the University of Nebraska Medical Center, created the MIRA Surgical System in a cross-campus collaboration that could redefine the scope of minimally invasive procedures.

Their device, MIRA, has already successfully completed its FDA Investigational Device Exemption clinical study for bowel resections. The study showed that MIRA can make what was once an open-surgery that required months of recovery can now be performed laparoscopically with recovery reduced to mere days.

Such a device, one operated by a remotely located surgeon, could come in handy in a place like low-Earth orbit or even the further reaches of our solar system.

"NASA has ambitious plans for long-duration space travel, and it's important to test the capabilities that may be beneficial during missions measured in months and years," Dr. Farritor said. "MIRA continues to push the boundaries of what's possible in RAS (Robotic-Assisted Surgery), and we are pleased with its performance so far during clinical trials. We're excited to take it a step further and help identify what could be possible as space travel is becoming a reality for humankind."

The advanced prototype is already in the final stages of a clinical trial under an Investigational Device Exemption to support U.S. Food and Drug Administration market authorization.

Virtual Incision is a UNeMed startup, and has raised more than $100 million in successive financing rounds. It is built upon a platform technology with more than 200 patents and pantent applications, dating back to the early 2000s.

Michael Dixon, PhD, President and CEO of UNeMed, was part of the licensing team that worked with Drs. Farritor and Oleynikov to help establish Virtual Incision as a startup back in 2008.

"It's good to remember that it's a marathon and not a sprint," Dr. Dixon said. "The continued collaboration of engineering and surgical expertise has led this team to continue to build on their innovative ideas. As a successful venture capitalist once told me, 'All my overnight successes took 10 years.' There have been a few bumps along the road, but the product that is in the clinic now is amazing."

Added Dr. Farritor: "UNeMed has always been open and willing to discuss options, and that flexibility to consider options is really important. UNeMed has been easy to work with, just a really good partner."

Photos: Virtual Incision Corporation

advancing research

INNOVATION HUB:

Project will facilitate growth of rese

The University of Nebraska Medical Center will build an innovation hub on its new Saddle Creek campus in Omaha.

The project will bring UNeMed together with UNeTech to facilitate the growth of research and innovation and allow entrepreneurs, investors and innovators to collaborate in the renovated 1906 Omaha Steel Castings industrial tract, located south of Farnam Street between 48th Street and Saddle Creek Road.

The Innovation Hub will be a UNMC-owned facility within the larger office development project known as Catalyst. Remaining space will be unfinished and leased to a wide spectrum of medtech and healthtech startups.

"The UNMC Innovation Hub at Catalyst is the next step to transform the Saddle Creek Campus from industry to innovation," said UNMC Chancellor Jeffrey P. Gold, MD. "The flexible lease space will support entrepreneurial businesses in a collaborative environment, will generate income for UNMC and spur regional economic development."

Within the building, the UNMC Innovation Hub at Catalyst will have access to shared conference rooms, amenities and collaboration zones. The project includes 40,834 gross square feet of designated condo space for UNMC, including 8,510 gross square feet for UNeMed, currently housed in Annex 14 at 4460 Farnam Street, and UNeTech, currently in Annex 32 at 3929 Harney Street.

"This innovation space will help us with our ultimate goal of seeing more university technologies developed into products that make the world a better place," said Michael Dixon, PhD, President and CEO of UNeMed Corporation, which works with UNMC and UNO faculty, staff and students to commercialize innovative ideas that have the potential to improve health for Nebraska residents and beyond. "In addition to the new building,

earch, collaboration

the associated entrepreneurship development programs will develop and attract more entrepreneurs and collaborators."

Rodney Markin, MD, PhD, agreed: "The Innovation Hub is critical to the development of a start-up and tech/biotech ecosystem and will be the center piece for our technology development initiatives." Dr. Markin is Associate Vice Chancellor for Business Development and Executive Director of the UNeTech Institute, which is Omaha's only university-supported startup incubator.

Construction work expects to complete in 2024.

The Innovation Hub at Catalyst is part of UNMC's larger Saddle Creek redevelopment project. In June, the Board of Regents approved the administrative facility at the corner of Saddle Creek Road and Farnam Street. Construction on the seven-floor office facility will begin this year with completion in late 2025.

> ***"This innovation space will help us with our ultimate goal of seeing more university technologies developed into products that make the world a better place."***
>
> ***–Michael Dixon, PhD***
> ***UNeMed President & CEO***

commercializing technologies

Vireo expansion continues

Vireo Resources celebrated the grand opening of the first creatine production facility in the United States, about 15 miles south of Omaha, in Plattsmouth, Nebraska. The Nebraska Department of Economic Development and the City of Plattsmouth supported the project with $1 million of funding through the Community Development Block Grant Program.

The entire project weighs in at a massive $16.6 million and adds to an industrial campus that will measure about 70,000 square feet. All told, Vireo said it plans to grow from its current roster of 50 employees to 200 and will create about $174 million in annual economic impact to the area.

Vireo makes health products such as holistic options for pain management, skin care, feminine care, overall wellness support, and sports nutrition supplements. The Tennessee-based company first came to the Good Life in 2008, attracted by Nebraska's business-friendly climate and outstanding academic institutions. Vireo has had great success partnering with Nebraska researchers, commercializing technologies developed with the University of Nebraska Medical Center in collaboration with UNeMed, the technology transfer office at UNMC.

Vireo's newly opened facility in Plattsmouth will produce Creatine HCl, which is used by athletes to increase strength, endurance, and recovery of muscles. Currently, the majority of creatine products available in the U.S. come from China. Vireo's new $16.6 million production facility will soon give customers the option to purchase domestically produced creatine.

"Nebraska has the world-class workforce, affordable energy, and welcoming communities that companies are looking for as they bring manufacturing jobs back to America," said Anthony L. Goins, Director of the Nebraska Department of Economic Development. "Vireo's growth also showcases our state's strength in research and development. The company has had tremendous success turning Nebraska brainpower into muscle-building powder and other nutritional supplements. Congratulations to Vireo and the community of Plattsmouth on the grand opening of this new facility!"

The Community Development Block Grant Program, administered by the Department of Economic Development, provides grants to local governments to support projects that expand the state's economic base and create quality jobs in Nebraska's communities. In Plattsmouth, the Community Development Block Grant helped Vireo purchase custom-made equipment for its new 32,000 square foot manufacturing facility. The grant has enabled Vireo to create more than 40 full-time jobs.

Vireo's growth in Plattsmouth has also been aided by the Economic Opportunity Program through the Nebraska Department of Transportation. The Economic Opportunity Program helps local communities attract jobs and private capital investment by providing grants to assist with first-mile/last-mile connections to Nebraska's statewide transportation system. The Nebraska Department of Transportation approved $322,586 to help the City of Plattsmouth fund construction of a roadway to Vireo's industrial campus.

UNeMed first secured a UNMC patent related to Creatine HCl, then licensed the intellectual property to Vireo. It's one of many patents developed at the University of Nebraska that has allowed partnering companies like Vireo to bring new products to market and create jobs in Nebraska. For six straight years, the University of Nebraska System has ranked among the top 100 academic institutions in the world for earning U.S. patents.

engaging entrepreneurs

Successes snowball for Breanna Hetland

Breanna Hetland, PhD, a UNMC nursing professor, spent most of 2023 gobbling up prestigious awards and accolades.

The year began with her acceptance into a competitive national entrepreneur-mentoring program; then she was awarded the Harriet H. Werley New Investigator Award by the Midwest Nursing Research Society; she then secured one of just 16 spots in a prestigious national fellowship program; and finally, she capped it all off with the Judges Award of a national pitch competition.

Dr. Hetland's avalanche of success was formed under the weight of her invention, Remote ICU. It is a software solution that fosters more robust patient and family engagement during acute hospitalizations. Remote ICU is also the basis of her startup company, The Family Room.

“As an ICU nurse, I’ve held many hands of patients and their families as they struggled to navigate the most traumatic experience of their lives...an ICU admission,” Dr. Hetland said. “Then I became the daughter of an ICU patient and it profoundly changed me. The Family Room App is the result of my experience: A passionate effort to vastly improve the ICU experience for patients and their families.”

Dr. Hetland's win in the pitch competition—the Judges Award in the Digital Tools category—was part of a national mentoring program out of Washington University in St. Louis. Called Equalize, the mentoring program was designed to increase the number of female academic inventors who develop startup companies to commercialize their inventions.

"I wish I could say I was surprised," said Tyler Scherr, PhD, a licensing specialist at UNeMed. "I think anyone who's been around Dr. Hetland for more than 10 minutes knows that her fire just burns brighter and hotter than the rest of us. Honestly, it would have been more surprising if she didn't win."

Prior to claiming the Judge's prize in the pitch competition, Dr. Hetland landed a Betty Irene Moore Fellowship for Nurse Leaders and Innovators. Sponsored by the University of California-Davis nursing school, the three-year fellowship includes a $450,000 grant, mentoring and professional support.

Finally, Dr. Hetland's New Investigator Award from the Midwest Nursing Research Society recognizes new contributions in nursing research that has the potential to enhance the science and practice of nursing. Dr. Hetland is the first Nebraska recipient of a Midwest Nursing Research Society award since 2009.

> *“I think anyone who's been around Dr. Hetland for more than 10 minutes knows that her fire just burns brighter and hotter than the rest of us.*
>
> *–Tyler Scherr, PhD*
> *UNeMed, Sr. Licensing Specialist*

Annual gala returns in 2022

In its return to an in-person event, the annual Innovation Awards represented a high-water mark for UNeMed in 2022.

The awards ceremony recognized all UNMC and UNO inventors who contributed to a new invention disclosure, had a U.S. patent issued or had a technology licensed.

UNeMed presented special awards to:

- *Emerging Inventor: Bin Duan, PhD*
- *Startup of the Year: Exavir, Co-founders Howard Gendelman, MD, and Benson Edagwa, PhD*
- *Most Promising New Invention: Song-young Park, PhD, and Cody Anderson*

Bin Duan, PhD, an associate professor in the Department of Internal Medicine, earned the 2022 Emerging Inventor award for his work in biomaterials and tissue engineering.

He was listed as an inventor on 13 new inventions submitted during the last five years, and has six pending patent applications.

UNeMed presented the Most Promising New Invention award to a pair of UNO researchers in the School of Health and Kinesiology: Doctoral research assistant Cody Anderson and his graduate mentor, Song-young Park, PhD.

Their invention—a system for measuring blood pressure in wearable electronic devices, such as smart watches—produces an accurate and reliable way for people to track their blood pressure, in real-time, without the need for specialized equipment or training.

UNeMed presented UNMC researchers Howard Gendelman, MD, and Benson Edagwa, PhD, with the 2022 Startup of the Year Award for the company they co-founded, Exavir Therapeutics.

Dr. Gendelman is Professor and Chair of the Department of Pharmacology and Experimental Neuroscience. Dr. Edagwa is an Associate Professor in the same department.

Exavir Therapeutics is currently developing ultra-long-acting antiretroviral nanomedicines. These nanomedicines enable long-acting slow effective release of antiretroviral therapy over time, potentially allowing for dosing once every six months or longer.

In May 2022, Exavir Therapeutics successfully closed on a $4 million seed-financing round that will help advance Exavir's lead formulation toward a clinical trial.

2022 innovation awards

AT RIGHT:
UNO researcher Song-young Park, PhD, hoists his award for developing the Most Promising New Invention of the year.

OPPOSITE:
UNeMed President & CEO Michael Dixon, PhD, (left) presents UNMC researchers Howard Gendelman, MD, (center) and Benson Edagwa, PhD, with the Startup of of the Year award in recognition of the recent success of Exavir Therapeutics.

Core Metrics

110 new inventions
173 unique inventors
97 new inventors

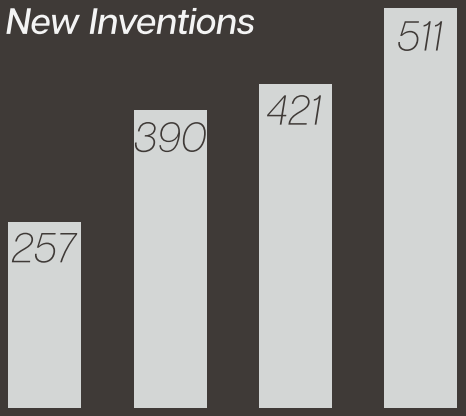
261 mta
96 cda
12 licenses
105 active licenses

135 patent applications filed
42 total patents issued
26 u.s. patents issued
17 foreign patents issued

37 products on market
2 new startups

$883,041 revenue
$177,594 sponsored research

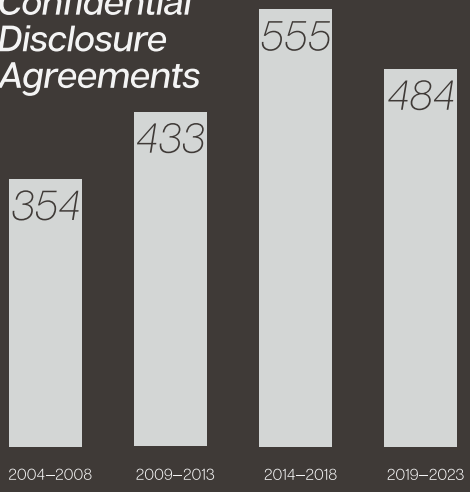
New Inventions



new inventions

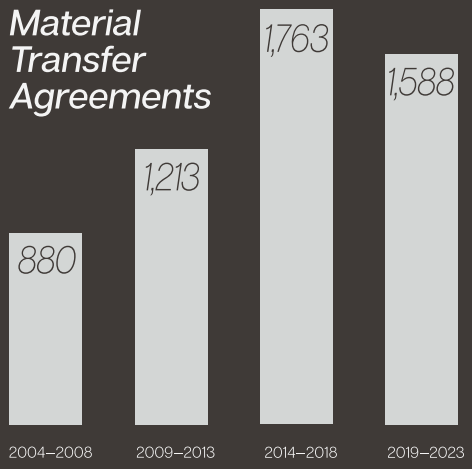
110
new invention notifications is the second most in company history, just one shy of the 111 inventions submitted in 2018; this marks the fifth time in six years that UNMC & UNO inventors have cracked the centurty mark

Confidential Disclosure Agreements

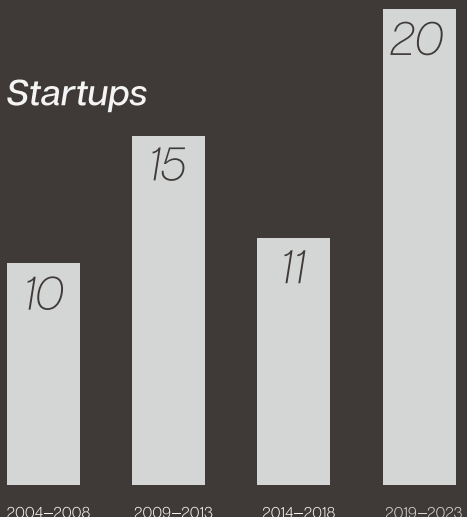


+22%
increase over the previous year in the number of new invention notifications processed

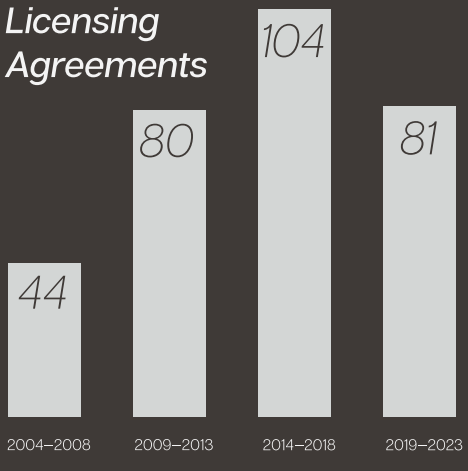
Material Transfer Agreements



Startups

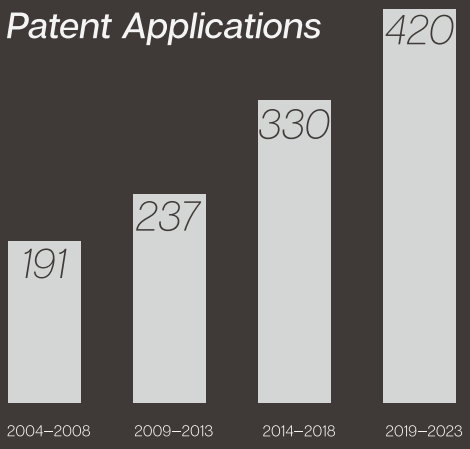


Licensing Agreements



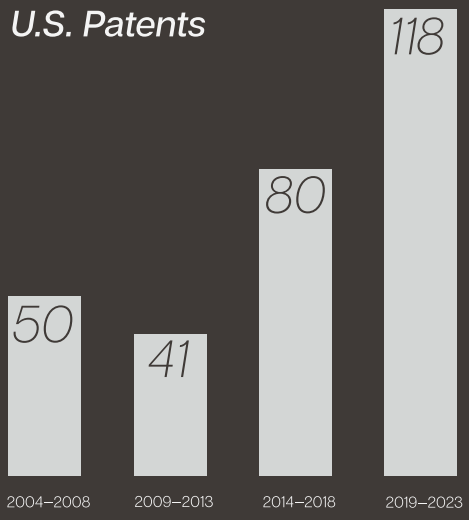
core metrics

Patent Applications

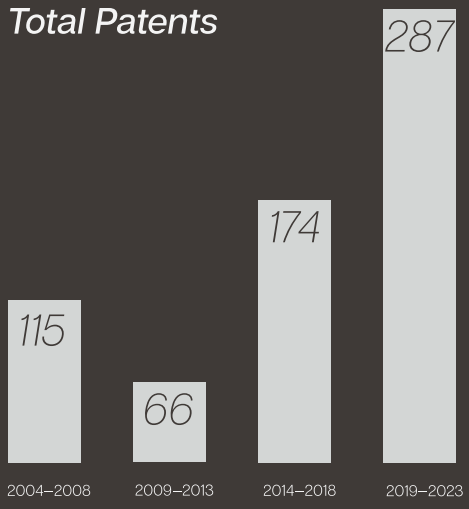


+62%
increase over the previous year in the total number of patent applications filed

U.S. Patents



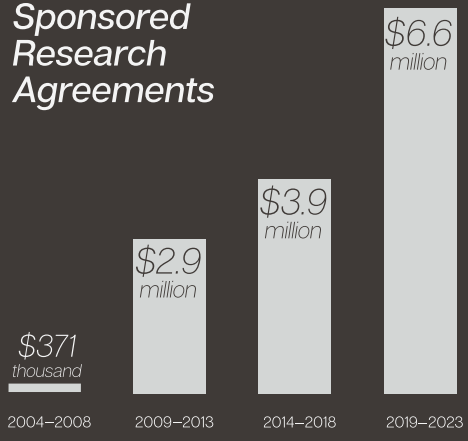
Total Patents



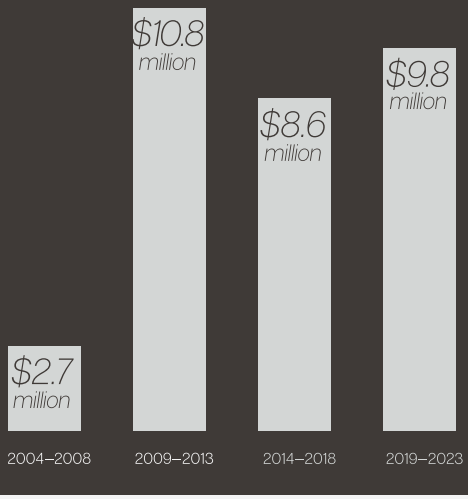
patents issued

26
U.S. patents issued is tied for the second-most in company history, matching the 26 issued in 2021, and is just two short of the record pace set last year

Sponsored Research Agreements



Total Revenue



UNeMed co-sponsors Innovate Nebraska

More than 100 attendees gathered at the University of Nebraska Medical Center in October 2022 to learn about Nebraska's contribution and leadership in the bioscience and medtech industries. The Innovate Conference, hosted by the Greater Omaha Chamber, Bio Nebraska, Omaha Public Power District and UNeMed, put a spotlight on the many Nebraska-based medical breakthroughs and unique opportunities that have propelled advancements in public health, patient outcomes and commercial patents.

"Nebraska is a global leader in medical technology and bioscience innovation," said Michael Dixon, PhD, president and CEO of UNeMed. "The research done here impacts the health and wellness of people across the world. We often think of Nebraska as an integral part of the agribusiness ecosystem, but our contributions to biotech cannot be overstated."

The Innovate Conference featured a keynote from Jim Linder, MD, CEO of Nebraska Medicine and founder of Linseed Capital. Several panel discussions covered medtech startup companies in Nebraska, opportunities for venture capital and economic development considerations for expansion and growth. There were also VIP tours of UNMC's Davis Global Center, iExcel and National Quarantine Center.

"These one-of-kind research and innovation centers are a crown jewel for the life science cluster we're building here in Omaha," said Mark Norman, Senior Director of Business Attraction and Expansion for the Greater Omaha Chamber. "The Innovate Nebraska conference was a great opportunity for us to connect the amazing breakthroughs being made in Nebraska with business leaders who can help bring those innovations to market and grow our local medtech ecosystem."

UNeMed identifies current biomed, pharma trends

UNeMed's team of licensing professionals set up 50 meetings with various representatives from a wide range of international biotech and pharmaceutical companies.

As a result, UNeMed learned a lot about key areas of industrial interest and how UNMC research and innovations might fit within that scope.

"We have no shortage of intriguing innovations, but I think there might be some major opportunities for us if we could further expand our reach into particular areas," UNeMed's Director of Licensing, Matt Boehm, PhD, said.

UNeMed secured the meetings during BIO, the world's largest international biomedical conference.

"There weren't too many surprises as some key areas of development have been a key focus for most pharmaceutical and biotech companies for a number of years now," Dr. Boehm said. "We want to make sure

engaging industry

UNMC researchers are aware of these key areas of interest as it could lead to significant opportunities for industry research collaborations and the development of cutting edge therapeutics. We really want to make a strong push to identify new inventions from UNMC that fit into these key areas of focus."

Key areas of interest that pharma and biotech companies identified to UNeMed:

- *New immuno-oncology-based therapeutics*
- *Cell therapies (CAR-T, TCR-T, technologies to boost CAR-T activity/longevity, novel CARs, NK-based therapies, macrophage-based therapies, etc.)*
- *Gene therapies (novel gene therapies, technologies for enhancing gene therapies, novel vectors, and novel non-viral delivery systems)*
- *New therapeutics for autoimmune diseases mRNA-based therapeutics*
- *Therapeutic antibodies (humanized antibodies, antibody fragments, bi-specific antibodies, antibody drug conjugates)*
- *Rare diseases*
- *Novel small molecules (preferably against novel targets, orally available molecules, low nanomolar IC50s)*

In the summer of 2023, UNeMed hosted its first-ever *Summer Chill*—an outdoor event of games, fun and refreshments—as a way to meet and connect with UNMC researchers, faculty and staff.

us patents

List of all U.S. patents issued to UNMC & UNO personnel during the fiscal year ending in 2023. Information includes patent numbers, patent titles, the date the patent was issued and the names of all co-inventors listed on the patent.

"Systems and Techniques for Estimating the Severity of Chronic Obstructive Pulmonary Disease in a Patient"
U.S. Patent No. 11,386,998 – July 12, 2022
- Amol Patil
- Stephen Rennard
- Nicholas Stergiou
- William Denton
- Jennifer Yentes

"Robotic Device with Compact Joint Design and Related Systems and Methods"
U.S. Patent No. 11,406,458 – August 9, 2022
- Shane Farritor
- Tom Frederick
- Eric Markvicka
- Dmitry Oleynikov

"Non-Human Animal Having Human IL-34 and Use Thereof"
U.S. Patent No. 11,419,317 – August 23, 2022
- Santhi Gorantla
- Larisa Poluektova
- Mamoru Ito
- Ikumi Katano

"Sheath"
U.S. Patent No. 11,420,027 – August 23, 2022
- Gregory Gordon

"Methods for Producing a Nanofiber or Microfiber Structure"
U.S. Patent No. 11,427,936 – August 30, 2022
- Jingwei Xie

"Distal Radius Plating System"
U.S. Patent No. 11,446,067 – September 20, 2022
- Daniel Firestone

"Antiviral Prodrugs and Formulations Thereof"
U.S. Patent No. 11,458,136 – October 4, 2022
- Benson Edagwa
- Howard Gendelman

"On-Board Tool Tracking System and Methods of Computer Assisted Surgery"
U.S. Patent No. 11,464,574 – October 11, 2022
- Hani Haider
- Osvaldo Andres Barrera
- Ibrahim Al-Shawi

"Local Control Robotic Surgical Devices and Related Methods"
U.S. Patent No. 11,484,374 – November 1, 2022
- Shane Farritor
- Eric Markvicka
- Tom Frederick
- Jack Mondry
- Joe Bartels

"Single-Arm Robotic Device with Compact Joint Design and Related Systems and Methods"
U.S. Patent No. 11,504,196 – November 22, 2022
- Shane Farritor
- Joseph Palmowski

"Single Site Robotic Device and Related Systems and Methods"
U.S. Patent No. 11,529,201 – December 20, 2022
- Shane Farritor
- Eric Markvicka
- Tom Frederick
- Jack Mondry
- Joe Bartels

"Kit for Detecting Coronary Artery Disease Comprising an MAA Protein Adduct and Reagents that Bind to Antibodies"
U.S. Patent No. 11,542,341 – January 3, 2023
- Daniel Anderson
- Michael Duryee
- Geoffrey Thiele

"Treatment Methods Using DNA Editing with Single-Stranded DNA"
U.S. Patent No. 11,549,126 – January 10, 2023
- Channabasavaiah Gurumurthy
- Hiromi Miura
- Masato Ohtsuka

"Precision Syringe Plunger"
U.S. Patent No. D975,274 – January 10, 2023
- Donny Suh
- Tyler Scherr
- Samantha Busch
- Phil Leopold
- Ronald Linke
- Chris Steadham
- Brian Walsh

"DNA Editing Using Relatively Long Single-Stranded DNA and CRISPR/Cas9 to Increase Success Rate in Methods for Preparing Transgenic Embryos and Animals"
U.S. Patent No. 11,555,208 – January 17, 2023
- Channabasavaiah Gurumurthy
- Hiromi Miura
- Masato Ohtsuka

"Healthcare Provider Interface for Treatment Option and Authorization"
U.S. Patent No. 11,557,386 – January 17, 2023
- Stephen Salzbrenner

"Method and Apparatus for Computer Aided Surgery"
U.S. Patent No. 11,564,745 – January 31, 2023
- Hani Haider
- Osvaldo Andres Barrera

"Method for Subtyping Lymphoma Types by Means of Expression Profiling"
U.S. Patent No. 11,574,704 – February 7, 2023
- Wing Chan
- Kai Fu
- Timothy Greiner
- Dennis Weisenburger

"Polyethylene Glycol-Conjugated Glucocorticoid Prodrugs and Compositions and Methods Thereof"
U.S. Patent No. 11,583,541 – February 21, 2023
- Dong Wang
- Zhenshan Jia
- Xiaobei Wang
- Fang Yuan

"Robotic Surgical Devices, Systems and Related Methods"
U.S. Patent No. 11,595,242 – February 28, 2023
- Shane Farritor
- Amy Lehman
- Eric Markvicka,
- Ryan McCormick
- Dmitry Oleynikov
- Kyle Strabala
- Tyler Wortman

"Apparatus for Assessing User Frailty"
U.S. Patent No. 11,602,278 – March 14, 2023
- Jason Johanning

"Compositions and Methods for the Treatment and Imaging of Cancer"
U.S. Patent No. 11,607,464 – March 21, 2023
- Janina Baranowska-Kortylewicz
- Zbigniew Kortylewicz

"Robotic Surgical Devices, Systems and Related Methods"
U.S. Patent No. 11,617,626 – April 4, 2023
- Shane Farritor
- Philip Chu
- Jason Dumpert
- Nishant Kumar
- Erik Mumm
- Yutaka Tsutano

"Method for Determining Lymphoma Type and Providing Treatment"
U.S. Patent No. 11,646,099 – May 9, 2023
- Wing Chan
- Kai Fu
- Timothy Greiner
- Dennis Weisenburger

"Quinoxaline Compounds and Uses Thereof"
U.S. Patent No. 11,661,411 – May 30, 2023
- Amarnath Natarajan

"Methods for Administration and Methods for Treating Cardiovascular Diseases with Resiniferatoxin"
U.S. Patent No. 11,679,075 – June 20, 2023
- Hanjun Wang
- Irving Zucker

featured technologies

CLAUDIN-1 INHIBITORS

Compounds fight cancer, other diseases

Researchers within the University of Nebraska Medical Center's Biochemistry and Pharmaceutical Sciences departments teamed up to develop new drugs that will help treat numerous cancers, such as colorectal, and other diseases like hepatitis and Crohn's.

The new drugs target a protein called Claudin-1, or CLDN1 for short.

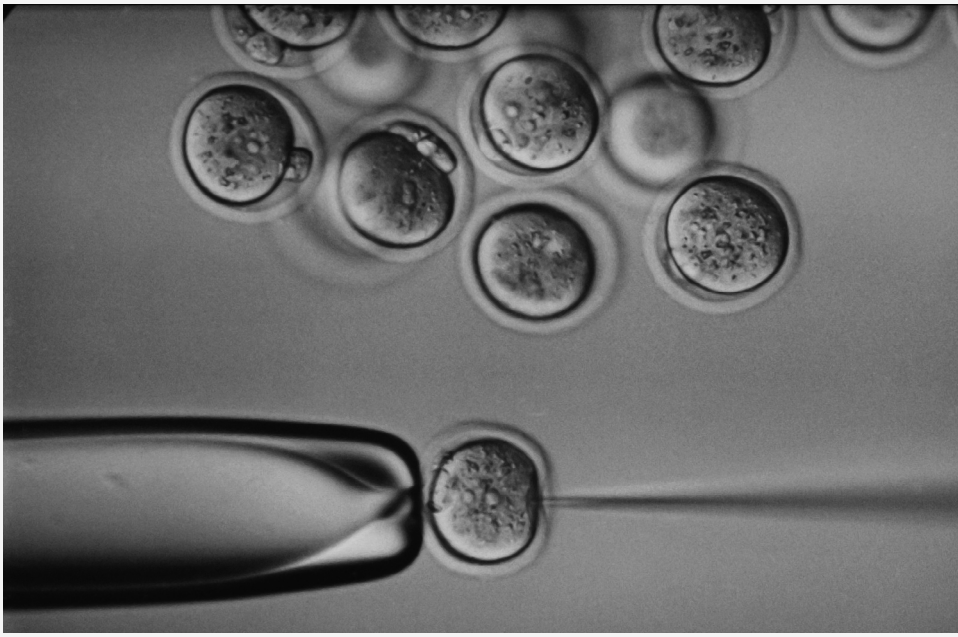
CLDN1 is a tight junction protein known to play a role in several human diseases, including multiple cancers. Critically, there are currently no approved methods of therapeutic intervention that can inhibit CLDN1-dependent disease progression.

The new CLDN1 inhibitors have micromolar potency demonstrated in vitro and in vivo efficacy in small animal models. They are under active investigation with RO1 funding to improve potency, improve pharmacokinetics, and identify precise molecular mechanisms of action.

- *Small molecule inhibitors of Claudin-1*
- *Potential treatment for classically chemoresistant cancers, hepatitis, Crohn's, & more*

EASI-CRISPR

Get more out of CRISPR with new insertion protocol



The discovery of the new gene editing technology, CRISPR, was a dream come true for scientists everywhere. Never before could DNA be cut so cleanly and precisely. But CRISPR only solves half the problem.

While CRISPR can delete a specific segment of mutated or faulty DNA, the process for replacing that piece has been unwieldly, imprecise and very inefficient. In short, CRISPR has the precision of a laser, while current DNA insertion methods are closer to bludgeons.

An international collaboration invented a better method to capitalize on CRISPR's strengths, while dramatically improving efficiency of inserting new material by as much as 400 percent. The University of Nebraska Medical Center's Dr. Channabasavaiah Gurumurthy and Drs. Masato Ohtsuka and Hiromi Miura at the Tokai University School of Medicine in Japan invented the protocol, which has a remarkably high rate of efficiency (up to 100 percent in some genetic loci).

- *Insert larger DNA fragments*
- *Improve efficiency up to 83%*
- *No special equipment needed*

As a research tool, the new protocol could have a profound impact in developing new genetically engineered model organisms, including animals, cells and plants, and other testing media that could lead to future cures of genetic conditions.

featured technologies

HEALTHCARE PAPR HELMET

New air purifying respirator helmet provides more comfort, convenience; improves physician performance

A team of clinicians and engineers, led by Elizabeth Beam, PhD, at the University of Nebraska Medical Center, have improved the traditional powered air purifying respirator (PAPR) helmet with a focus on physician performance and patient satisfaction.

Current PAPR designs are uncomfortable and burdensome to wear for extended periods. The combination of the loud fan motors that can drown a physician's voice and the mask itself blocking the physician's face also significantly hinder physician-patient communications.

The new PAPR helmet is comfortable, convenient to don and doff in a safe and sanitary manner, easily sterilized, modular, and facilitates communication. This novel design results in overall improved performance.

- *Comfortable for all-day wear use*
- *Convenient donning, doffing*
- *Improves physician performance*
- *Easier communication with patients*

BP MONITOR FOR WEARABLE DEVICES

New system more accurately measures blood pressure

- *Cuffless blood pressure monitoring*
- *Resistant to error*
- *Compatible with any device that measures ECG and PPG signals*

Doctoral research assistant Cody Anderson and his graduate mentor, Song-young Park, PhD, aim to revolutionize how people track their heart health with their new system that accurately and consistently measures a user's blood pressure in wearable devices.

The innovative approach measures the speed of a user's pulse wave, which spreads throughout the body with every heartbeat. Pulse wave velocity is a proven measure for finding blood pressure and blood vessel stiffness, important biomarkers for determining and predicting cardiovascular health.

Several wearable devices currently on the market claim to measure blood pressure and produce readings about pulse wave velocity. But those measures are often inaccurate and generally regarded as wholly unreliable.

Anderson and Dr. Park, vascular physiologists at the University of Nebraska at Omaha, overcame those reliability issues for modern devices that track heart health.

The new technology empowers individuals with minimal training to acquire high-quality measurements resistant to low-quality signal acquisition.

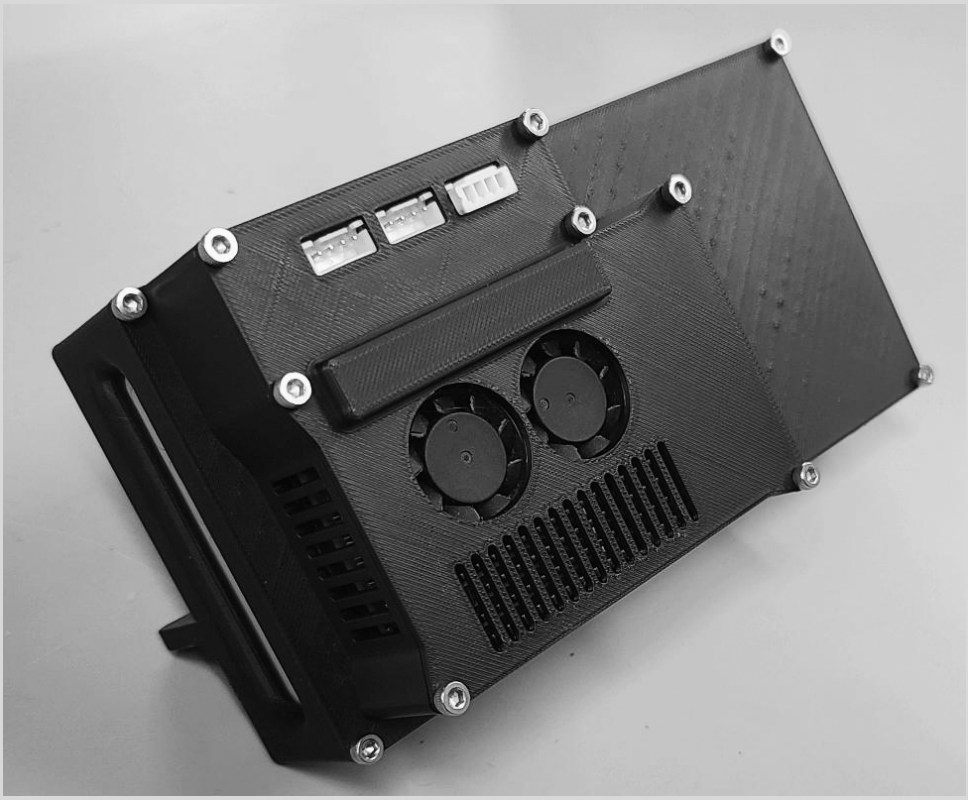
The innovation produces an accurate and reliable way for people to track blood pressure, in real-time, without the need for specialized equipment or training. The technology makes practical the tracking of blood pressure for public use, far beyond the limits of biomedical research laboratories and clinical settings.

This achievement could allow people to monitor and control their cardiovascular health virtually anywhere–while also helping reduce cardiovascular disease and associated costs.

featured technologies

JUMP TESTER

Single-laser device measures vertical, horizontal jump testing



A team of physical therapists, led by Michael Rosenthal, PT, DSc, at the University of Nebraska Medical Center, have developed a single-laser jump testing device for both vertical and horizontal jump assessments.

Current jump testing devices fall on either end of the technology spectrum, ranging from completely manual (e.g. sticks and rulers) to unnecessarily technical, which are bulky and expensive.

The new jump tester can perform a short list of the most essential athletic jump tests, is customizable, and easily portable for use inside or outdoors. This novel jump tester is perfect for deployment at all levels of athletics from grade school to college and even the pros.

- *Provides most critical athletic jump tests*
- *Customizable*
- *Light, collapsible for easy transport*

PI3K & BRD4 DUAL INHIBITOR

Dual-function inhibitor treats cancer, fibrosis

Researchers at UNMC have developed a novel inhibitor that targets two important proteins responsible for promoting fibrotic diseases and cancer development and resistance.

When a drug targets one cellular pathway, other pathways often activate, counteracting the treatment, which could make the cell drug-resistant. On the other hand, combining or mixing different drugs to target more than one pathway might limit the risk of resistance, but the combination could cause toxic side effects. Specifically targeting two pathways with a single drug could be a more effective treatment with minimal risks of increasing drug resistance and potential side effects for the patient.

- *Inhibit two cellular pathways*
- *Slow cancer growth, invasion and trigger cancer cell death*
- *Treat drug-resistant cancers*

Treating medulloblastoma cancer cells with the dual-inhibitor slowed cancer cell growth, reduced the cancer's ability to spread and triggered cancer cell death. Medulloblastoma cells treated with the dual inhibitor in mice slowed the cancer's growth or shrunk the cancer with no major side effects.

featured technologies

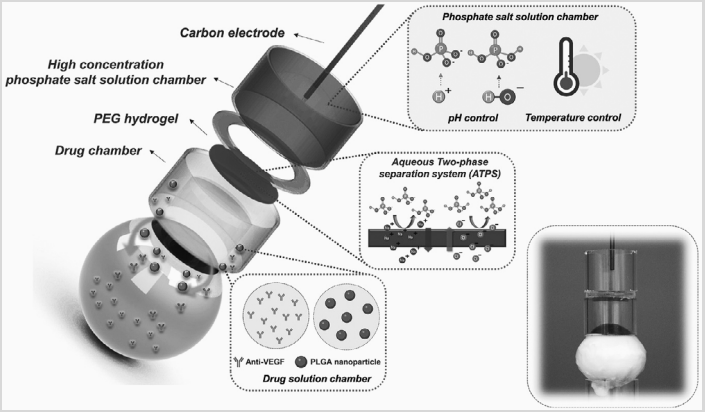
TRANSSCLERAL IONTOPHORESIS DEVICE

Deliver ophthalmic therapeutics safely, noninvasively

A team of researchers, led by Siwei Zhao, PhD, of the University of Nebraska Medical Center, has developed an improved transscleral iontophoresis device for ophthalmic drug delivery.

Historically, intraocular drug delivery has faced significant challenges associated with slow drug permeation, low bioavailability, and invasive and risky administration techniques.

This hydrogel ionic circuit-based device enables safer administration of macromolecule or nanoparticle based drugs in a clinically relevant time frame.



- *Ophthalmic delivery of macromolecule & nanoparticle drugs*
- *Decreased heat and buffered pH*
- *Safe application of high current intensities*

ANTIMICROBIAL WOUND DRESSING

Dressings treat, prevent infections

A new wound dressing with antimicrobial properties can improve the treatment of chronic wounds.

Patients with chronic open wounds, such as diabetic foot ulcers, have about a 78 percent incidence rate of serious infections known as biofilms.

- *slowly releases antimicrobial compounds*
- *penetrates biofilms, enhances animicrobial delivery*
- *may eliminate need for tissue removal*

Biofilms are cooperative infections that are often difficult to treat due to high rates of antibiotic resistance.

Current approaches to biofilm management heavily rely on the physical removal of infected tissue. This removal process can be uncomfortable for patients, and may not entirely remove the infection, requiring the painful procedure to be repeated.

UNMC's nanofiber-based dressing slowly releases antimicrobial compounds such as approved antibiotics or silver nitrate, into a wound to help prevent or treat an infection. The nanofiber dressings are specially designed to help penetrate biofilms and enhance delivery of antimicrobial agents. Additionally, these wound dressings may require fewer changes and may reduce or even eliminate the need for tissue removal.

These new nanofiber dressings should help decrease biofilm infections, reduce medical costs, and improve patient care.

DRUG DEPOT

On-demand, localized therapeutic delivery

- *Implantable, hydrogel-based scaffold*
- *Refillable drug-delivery system*
- *Decreased administration frequency*
- *Sustained, localized therapeutic release*

Researchers at the University of Nebraska Medical Center, led by Bin Duan, PhD, have invented a novel hydrogel scaffold for sustained, localized therapeutic release. This implantable drug-delivery system is refillable, thereby drastically reducing the frequency of drug administration.

Potential applications include therapeutic delivery at the site of an orthopedic surgical implant–such as a prosthetic knee–to promote healing and to prevent rejection and infection.

X-RAY OUTPUT SIMULATOR

Safely train next the generation of X-ray techs

Imagine taking an X-Ray... without taking an X-Ray.

Seems counterintuitive, but that is what innovators from UNMC sought to do. They developed an X-Ray Output Simulator that produces a unique, realistic simulated x-ray image that pairs with actual radiographic equipment. The simulator limits technologist error in patient positioning, which leads to repeated X-ray images of patients.

To learn radiographic positioning skills, radiology students work with each other manipulating actual radiographic equipment, but they cannot take X-Rays of each other to limit radiation exposure.

As a result, students can't see the results of their applied positioning skills until working with patients during clinical rotations. Students also can't evaluate their work or think through correcting errors without an X-Ray image.

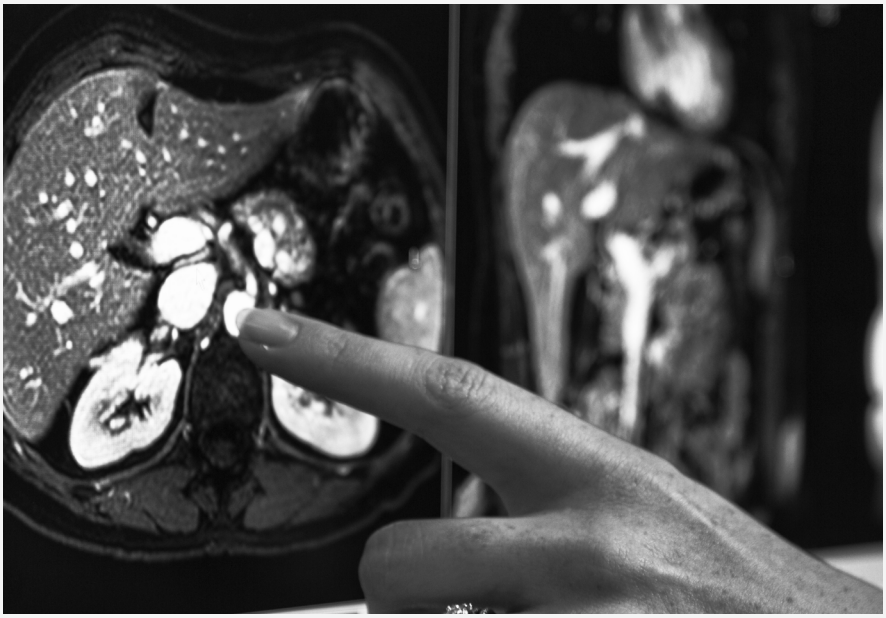
This new technology changes everything. Students manipulate actual radiographic equipment and take a simulated X-Ray image to test their skills without the danger of radiation.

Developed by UNMC radiology instructor Ellie Miller, and electrical engineer Eric Psota, PhD, the technology consists of cameras that capture information about the live human model's anatomic landmarks, and simulates an X-ray image using a deep machine learning algorithm.

Trainees can use this system to practice patient positioning skills on a live human model to critique applied radiographic positioning skills, critically think through positioning errors, and conceptualize relationships between anatomy and patient positioning. Because there isn't any radiation exposure, a licensed technologist does not need to be present, allowing for independent student practice.

- *Improve X-ray accuracy*
- *Inexpensive radiology training tool*
- *Limit radiation exposure*

featured technologies



MICROTUBULE TARGETED THERAPEUTICS, IMAGING AGENTS

New compounds allow cancer imaging, treatment

UNMC researchers have developed compounds that are capable of not only imaging and monitoring tumors, but treating them as well.

The new compounds specifically bind to protein-based structures called microtubules. Microtubules play a critical role in a number of cellular functions, and are a key target for treating a variety of cancers.

UNMC's compounds selectively target microtubules. The compounds can be safely labeled with various radioactive atoms that allow the compounds to be used for imaging (SPECT or PET) and therapy. When used without the radioactive isotopes, the compounds can help kill cancer cells and make them more susceptible to radiation therapy.

Microtubule-targeted compounds labeled with iodine-131 were tested in a mouse model of glioblastoma. Treatment with the compound significantly reduced tumor size and weight. Additional studies will look at the use of other radionuclides such as astatine-211.

- *Microtubule-targeted radiopharmaceuticals*
- *Images and treats cancer*
- *Non-radioactive forms of the drugs can induce cell death*
- *Can be labeled with a variety of radionuclides*

CATHETER PLACEMENT TROCAR

Safe, easy-to-use peritoneal access device

- *No electronic components*
- *Minimal training required*
- *Access peritoneal cavity for catheter placement, drug delivery, or other medical devices*
- *Designed for triage/battlefield use*

A team of engineers at the University of Nebraska-Lincoln and clinicians at the University of Nebraska Medical Center, have developed a mechanical, non-electronic, easy-to-use device for safe and reliable peritoneal access.

Most complications during laparoscopic surgery occur during initial entry into the peritoneal cavity, a procedure made even more difficult when performed on the battlefield.

The device is mechanically activated with a hand crank controlling a bellows system that provides optimal pressure for initial insufflation of the peritoneal cavity.

The device enables unskilled personnel to safely and quickly access an individuals peritoneal cavity for catheter placement, drug delivery, or other medical device access.

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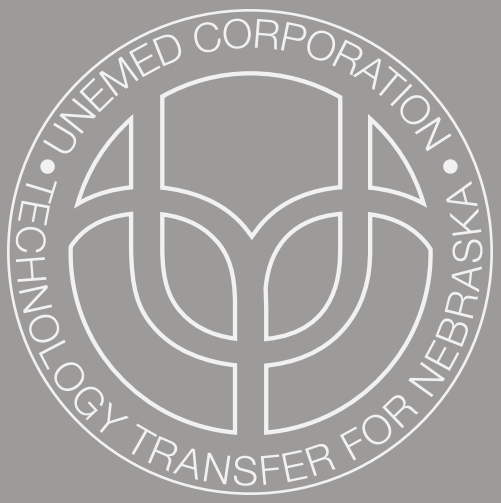
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