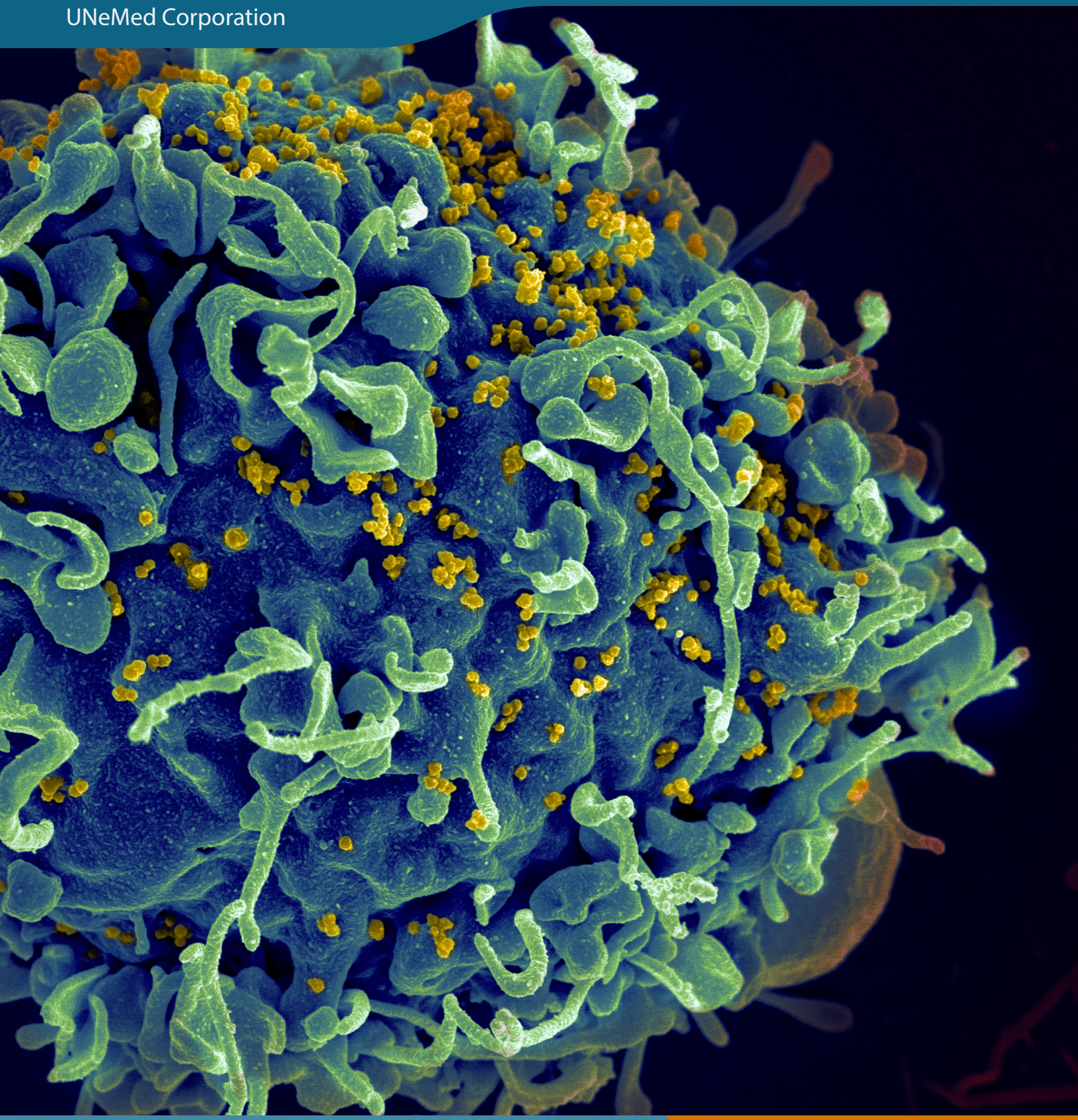
UNeMed Corporation



Annual Report

2022

unemed
tech transfer for nebraska

As the technology transfer and commercialization office for the University of Nebraska Medical Center and the University of Nebraska at Omaha, UNeMed fosters innovation, advances research, and engages entrepreneurs and industry to commercialize novel technologies.

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TECH TRANSFER

Updated Inventor Guides now available

In May, UNeMed released the print version of its updated Inventor's Guide to Technology Transfer.

The new guide is a comprehensive, 82-page handbook for all University of Nebraska Medical Center and University of Nebraska at Omaha faculty, staff and students who have or are planning to develop, discover or create new solutions and ideas that could benefit others.

It contains and explains all the essential elements of the technology transfer process and the successful commercialization of a new invention. The guide also dives into startup formation and other considerations important to researchers and inventors, such as conflict of interest matters, outside employment, external agreements and export controls.

The handbook also contains the latest University and campus policies related to innovation and technology transfer, and a complete glossary of relevant terms.

A digital version of the handbook can be viewed online (https://bit.ly/UNeMedGuide), but anyone on campus may request a physical copy of the handbook by submitting their name and campus address to unemed@unmc.edu.

Winners selected in first 'Napkin' contest

In September, UNeMed opened a new contest to all faculty, students and staff who have ideas for innovative medical devices.

The inaugural "Back-o-the-Napkin Contest" featured entry forms designed to resemble actual napkins for inventors to draw and describe their ideas.

Organizers selected three winning inventions to receive further development guidance and prototyping.

In no particular order, the three winning entries were a laser measurement device for jump testing; a design for a helmet that could replace face shields and respirators for healthcare workers; and a wearable ligation tool that could help improve a surgeon's ability to tie up arteries or other binding procedures.

The contest received entries from inventive faculty across clinical disciplines, including The Truhlsen Eye Institute, Department of Neurological Sciences, College of Allied Health Professions Division of Physical Therapy Education, Clinical Movement Analysis (CMOVA) Laboratory, College of Dentistry, College of Nursing, and the College of Medicine Department of Surgery.

The "Single Laser Measurement Device for Jump Testing" was submitted by Michael Rosenthal, Elizabeth Wellsandt and Michael Wellsandt. All three co-inventors are physical therapists in Allied Health. Their proposed device is a portable, single laser jump-testing device for repeatable, objective horizontal and vertical testing.

The "Beam Helmet" was submitted by Elizabeth Beam, PhD, a registered nurse in the College of Nursing. She designed a personalized, protective helmet for doctors that could replace filtering face piece respirators (FFR) and powered air-purifying respirators (PAPR).

Finally, the "Wearable Pinch Ligation Device – Python" was submitted by Quan Ly, MD, and Meghana Kashyap, MD, from the College of Medicine's Division of Surgery; and Larry Hart, a UNeTech prototyping fellow at Metropolitan Community College. Their invention is a wearable, electrosurgical ligation device that helps surgeons spare more tissue during procedures.

UNeMed sponsored the contest in collaboration with the James and Karen Linder Maker Studio at UNMC's McGoogan Library; UNO's Center for Innovation, Entrepreneurship, and Franchising; and UNeTech Institute.

SUCCESS STORY

Startup built on UNMC/UNO collaboration closes seed round

At the end of the calendar year, RespirAI Medical—a startup company built on an innovation developed at the University of Nebraska at Omaha's world-renowned biomechanics department—closed a seed investment round worth 3 million Israeli shekels, or about $960,000, according to exchange rates at the time.

Led by Israeli investment group, eHealth Ventures, the seed round will finance additional development and clinical trials for the startup, RespirAI Medical.

"The funds will help us to achieve some key development and clinical milestones," RespirAI CEO Nimrod Bin-Nun said in an email. "The main one is a multi-site clinical trial that will get us ready for a regulatory trial."

ResiprAI is one of 17 portfolio companies at eHealth Ventures, a multinational consortium that counts Mayo Clinic and Amgen among their partners.

"Home monitoring for lung diseases is an under-served area, and we are happy to invest in this innovative company, based on foreign IP, that will make full use of the funding and unique strategic support we provide," eHealth Ventures Vice President for Business Development, Ophir Shahaf, said in a press release.

The core technology is believed to be the first device that can accurately detect the earliest signs of what is known as a "COPD exacerbation."

COPD, short for or chronic obstructive pulmonary disease, is a condition that slowly destroys a patient's lungs, eventually forcing them to live in constant breathlessness.

On occasion, COPD symptoms can suddenly get much, much worse in a potentially fatal flare-up called an exacerbation.

COPD is the third-leading cause of death on the planet, and exacerbations are most often only treatable in intensive care units. Often, a patient's best chance at survival relies on how quickly they can get to a hospital.

The root cause of exacerbations remains a mystery, but RespirAI's wearable device could finally provide COPD sufferers some advance warning that an exacerbation may be imminent.

The device measures the relationship between the rhythms of a patient's pulse rate and their breathing and walking patterns. A subtle, measurable change in those patterns help determine the likelihood of an exacerbation.

It will likely take another year or more before the device is available to the public.

RespirAI was initially created through an intellectual property license deal brokered by UNeMed, the technology transfer and commercialization office for UNO and the University of Nebraska Medical Center. The original invention was a collaboration between UNMC's Stephen Rennard, MD, and UNO Biomechanics researcher, Jennifer Yentes, PhD.

UNeTech Instititue, the University of Nebraska's startup incubator in Omaha, played crucial role as well, funding a successful national study with an early prototype.

Pictured here is one of the earliest prototypes for the device that could detect imminent exacerbations of chronic obstructive pulmonary disease, before any obvious symptoms are present.

SUCCESS STORY

Virtual Incision to complete clinical study, FDA approval on the horizon

Virtual Incision Corporation, a UNeMed startup company pioneering the world's first miniaturized robotic-assisted surgery platform, announced in April that the U.S. Food and Drug Administration had approved an Investigational Device Exemption supplement to complete the final stage of its clinical study analyzing the MIRA® Platform in bowel resection procedures. The approval was supported by a favorable interim clinical study report on the safety profile of MIRA.

The Investigational Device Exemption supplement approval puts Virtual Incision on track to obtain the clinical evidence needed to bring innovation to the soft tissue surgical robotics industry, a market that has been historically dominated by a single player. Results of the completed study will support MIRA's upcoming FDA De Novo application for market authorization.

The first cases of the study were completed at Bryan Medical Center in Lincoln, Neb., by Dr. Michael Jobst and Dr. Kelly Krier, and at Lankenau Medical Center in Wynnewood, Penn., by Dr. John Marks and Dr. Henry Schoonyoung.

Photo: Virtual Incision

"Our clinical experience has been extremely positive so far," said Dr. Jobst, the first surgeon in the world to operate with the device. "I was able to perform 100 percent of the dissection with MIRA in all of my cases. We have also been pleased with its accessibility and efficiency. I operated on eight patients in five different operating rooms, and that's something that's just not possible with mainframe [robotic-assisted surgery] platforms. MIRA has the potential to bring the benefits of minimally invasive surgery to more patients, and that's truly exciting."

"MIRA was created to address the limitations of traditional robotic-assisted mainframe machines. We miniaturized and simplified MIRA to make it more accessible, easy to use, and easy to adopt," said John Murphy, president and chief executive officer of Virtual Incision. "These are the features that will allow surgeons to treat more patients each day. It is encouraging to see MIRA demonstrating the potential to help surgeons perform simplified robotic procedures safely and precisely. Completing the final stage of our clinical study will be a key milestone along MIRA's regulatory pathway, and we will continue to focus on clinical excellence to best support the innovation we provide to patients and surgeons."

A collaboration between a former UNMC surgeon and a UNL robotics engineer created Virtual Incision's MIRA Platform, the world's first miniaturized robotic-assisted surgery platform. Its small, sleek design is planned to offer the benefits of robotic-assisted surgery during abdominal procedures without the logistical inefficiencies of traditional mainframe robotics. The easily accessible device weighs only two pounds and can be used in any operating room – a dedicated mainframe room is unnecessary. With its drape- and dock- free design and portability, MIRA is quick to set up, clean up, and move in between cases, enabling an increased robotic-assisted surgery caseload. With MIRA, every operating room is robot-ready.

Virtual Incision is on a mission to simplify robotic-assisted surgery (RAS), so more patients and their surgeons can access its benefits every day. Headquartered in Lincoln, Nebraska, and holding over 200 patents and patent applications, the company is developing MIRA, the first-of-its-kind miniature, and highly accessible RAS platform. Virtual Incision's goal is to make every operating room RAS-ready.

In late November 2021, Virtual Incision announced the close of a $46 million Series C financing round. The successful funding round was led by Endeavour Vision and Baird Capital, with participation from returning investor Bluestem Capital and others, according to a Virtual Incision announcement.

Including this most recent raise, Virtual Incision has now attracted about $100 million in investments since its initial founding in 2006.

SUCCESS STORY

Exavir Therapeutics Completes $4M Seed Financing, led by AlleyCorp & Gilead Sciences

Exavir Therapeutics, a company dedicated to transforming the lives of people living with or at risk of acquiring HIV, announced in May that the company has closed on a $4 million seed financing led by AlleyCorp with participation from Gilead Sciences.

Exavir was co-founded by UNMC scientists, Howard Gendelman, MD, and Benson Edagwa, PhD, who invented the foundational technology: A platform for ultra-long acting therapies for HIV. Early testing shows the technology has potential to transform HIV treatments into a single dose given once or twice per year. Current treatment regimens often involve a strict schedule of daily doses.

"We are thrilled to have the support of AlleyCorp and Gilead Sciences, a pioneer and leader in antiviral drug development" said Alborz Yazdi, co-founder and President of Exavir. "With this financing, we are one step closer to our goal of bringing Exavir's broad portfolio of long-acting antivirals to communities around the world affected by some of the most challenging viruses."

"We could not be more excited to support Alborz and the Exavir team," said Brenton Fargnoli, MD, Managing Partner of the AlleyCorp Healthcare Fund. "HIV remains an important area of unmet need, and we are confident that long-acting treatment and prophylaxis options will be the future of HIV care and prevention."

Dr. Edagwa

Dr. Gendelman

Exavir Therapeutics is a preclinical stage biotechnology company dedicated to eliminating HIV and other viral infections with a broad modality-agnostic approach, beginning with long-acting antiviral therapeutics.

HIV is one of the world's most serious public health challenges. It is estimated that there are more than 37 million people living with HIV worldwide, and nearly 1.2 million people living with HIV in the United States alone. Over $30 billion is spent annually on antiretroviral HIV therapies worldwide.

STARTUP ECOSYSTEM

UNeTech lands $150,000 SBA award

The UNeTech Institute, a startup incubator affiliated with the University of Nebraska Omaha and the University of Nebraska Medical Center, landed $150,000 from the Small Business Administration (SBA) to fund the creation of a collaborative partnership of entrepreneurial support organizations aimed at supporting innovation-focused entrepreneurs from underserved communities. The eight winners of the 2021 Small Business Innovation Research (SBIR) Catalyst Prize competition were announced on Sept. 16.

The SBIR Catalyst competition is intended to expand access to the SBIR program, a highly competitive grant program that supports small businesses engaged in research and development with the potential for commercialization. Funding from the SBA will help UNeTech create the Heartland SBIR Catalyst Partnership, a collection of technology transfer offices at 11 midwestern universities aimed at linking university-owned intellectual property, SBIR funding and local entrepreneurs from underrepresented populations.

Jace Gatzemeyer, PhD, UNeTech's innovation development strategist, was responsible for landing the prize and will be leading the implementation of the new partnership. "UNeTech has an ambitious plan to build an inclusive R&D ecosystem in the heartland," Dr. Gatzemeyer said. "This funding will support the continued assembly of successful SBIR proposals."

"Jace has put together an amazing program," said Rod Markin, MD, PhD, executive director of UNeTech. "It is wonderful to see him get the national recognition he deserves."

Dr. Markin said the prize funding will help the incubator advance more ambitious projects.

Joe Runge, JD, associate director of UNeTech, expressed gratitude to the SBA.

"It is an honor for UNeTech to be mentioned alongside such experienced colleagues as BBC Entrepreneurial Training and OK Catalyst, who also were recognized from our region," he said.

STARTUP ECOSYSTEM

UNeMed joins Omaha cohort in MIT entrepreneurship program

UNeMed President and CEO Michael Dixon, PhD, is among a nine-person team on a prestigious initiative aimed at developing innovation and entrepreneurship in the area.

"I'm really excited to be a part of this team, and to have the opportunity to help grow our regional entrepreneurial ecosystem," Dr. Dixon said. "As one of the primary stakeholders of our local innovation economy this program will allow the university to continue to drive our technology and talent."

In early 2022, Omaha joined the MIT Regional Entrepreneurship Acceleration Program, or MIT REAP, as a part of its ninth cohort. Over the next two years, the Omaha team will learn and adapt the frameworks developed by MIT to accelerate innovation-driven entrepreneurship in the region.

"As this is one of the top global entrepreneurship programs in the world, the Omaha team will have access to research and tools that will allow us to continue to build on the momentum we already have," Dr. Dixon said. "The decision to participate in this program was a no brainer for UNeMed. This project will do more than lift Omaha and the immediate area: It gives all of us here at the University of Nebraska more options, more clout, more opportunity to get our inventors and their discoveries out the door."

MIT REAP is a global initiative that engages with communities around the world to supercharge innovation-driven entrepreneurship ecosystems and transform economies. The Global program employs an evidence-based "team" approach, translating MIT research and insights into a practical, actionable, and strategic framework that convenes and educates key stakeholders, and empowers regional leaders to drive meaningful, long-term economic and social change.

Kansas City, Des Moines and St. Louis will be in the same cohort as Omaha; and collaborators from Brazil, Australia, Dominican Republic and Hungary will add international flair.

Laurel Oetken, Director of Entrepreneurship and Innovation for the Greater Omaha Chamber, will lead the Omaha team, which includes highly influential regional leaders who represent five major stakeholder groups: government, university, corporate, risk capital, and entrepreneurs.

"The Greater Omaha Chamber has long recognized the importance of startup growth in regional economic development and we are constantly on the lookout to offer more support, awareness and resources for this crucial community," Oetken said in a press release. "Once we saw the opportunity to showcase the Omaha area's tremendous talent and ideas through MIT REAP, we jumped at the chance. I am thrilled at the diverse talent our team brings to the table and can't wait to start making real progress through these next two years and beyond."

Joining Oetken and Dr. Dixon on the team are:

- *Joe Petsick, Executive In Residence, University of Nebraska, College of Business*
- *Niki Ferguson, Entrepreneurial Development Manager, Advance Southwest Iowa Corporation*
- *Brian Ardinger, Director of Innovation, Nelnet*
- *Erica Wassinger, General Partner, Proven Ventures*
- *Adriana Cisneros Basulto, CEO, Maxwell*
- *Scott Bragg, Vice President, Chapman & Company*
- *Trevon Brooks, Business Development Manager for the Nebraska Department of Economic Development*

Goals for the Omaha cohort are:

- *Address research-identified challenges such as ensuring the entrepreneurship talent pipeline, risk aversion throughout the community, a lack of consistent goals and gaps in programming and resources.*
- *Build mutually beneficial partnerships and relationships with Cohort 9 representing the American heartland: Kansas City, Des Moines, and St. Louis.*
- *Make the Midwest a premiere place for startups to establish, grow, and scale their businesses by leveraging opportunities that Omaha's unique entrepreneurial ecosystem provides and discover how we can work with other nearby cities, such as Lincoln, Nebraska, and Council Bluffs, Iowa, to further its reach and connect the greater Nebraska ecosystem.*

MIT REAP Global teams participate in a two-year program focused on accelerating innovation-driven entrepreneurship (IDE) in their regional innovation ecosystems and are provided opportunities to collaborate with teams within and across their Cohort.

"We're thrilled to welcome leaders from such a diverse group of regions into Cohort 9," said Travis Hunter, Director of MIT REAP. "Now in our tenth year, we look forward to sharing the learnings and impact of our global alumni community with our incoming teams and seeing the momentum they will bring to their own regions' IDE ecosystems."

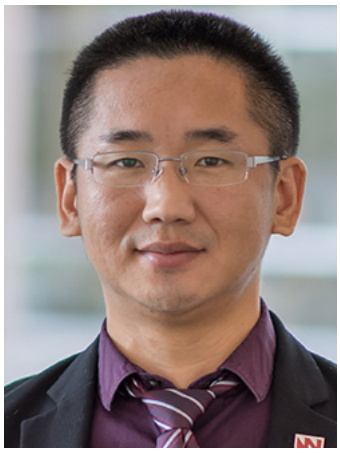
Regions from across the globe apply for admission to MIT REAP's Global program with a particular "urgency for change" or problem area in their region's overall system that they want to address. The MIT REAP faculty then work with each team to overcome the regional challenges that are hindering the growth of its IDE ecosystem by identifying the region's comparative advantages and the acceleration mechanisms required to promote IDE.

Hanjun Wang Innovator of 2021

For the second time in the event's 15-year history, the Innovation Awards was a virtual event in response to concerns related to the ongoing pandemic. Originally scheduled for October, the event was postponed until February 2022 with the hope that a delay would allow for an in-person ceremony.

Instead, UNeMed hosted the ceremony via Zoom.

A recording of the entire ceremony is available on UNeMed's YouTube channel at https://youtu.be/2TU55sKYNUs.


Hanjun Wang, MD

The ceremony featured remarks from Chancellor Jeffrey Gold, MD, and Vice Chancellor for Research, Jennifer Larsen, MD. UNeMed's CEO and President Michael Dixon also delivered a short presentation in review of the previous fiscal year.

Innovator of the Year

The highlight of the event was the awards ceremony, where UNeMed recognized all inventors who contributed to a new invention disclosure, received a U.S. patent or had a technology licensed. In addition, three special awards were presented, including Hanjun Wang, MD, as the 2021 Innovator of the Year.

An associate professor in the Department of Anesthesiology, Dr. Wang focuses on innovative work developing novel treatment strategies for a variety of diseases, including heart failure, acute respiratory distress syndrome and peripheral artery disease.

More specifically, his team is looking at the role spinal afferent neurons play in regulating disease onset and progression. He has identified a number of different approaches to target spinal afferent neurons. One of these approaches focuses on localized administration of resiniferatoxin, a potent neurotoxin that can ablate specific nerves. Dr. Wang is exploring resiniferatoxin as a possible treatment for hypertension, heart failure, acute respiratory distress syndrome and peripheral artery disease.

Some of those applications have been licensed by an undisclosed biotech company that is working on developing them for clinical use. As part of this relationship, Dr. Wang has helped bring in more than $1.1 million in sponsored research to develop this therapeutic approach.


From left are Brian Knarr, PhD, Travis Vanderheyden and Russell Buffum.

In addition, Dr. Wang has developed other approaches for targeting spinal afferent neurons. One of which has been licensed into a startup company, Inflaneurgo, which is working on finding a partner to help advance some of these ideas.

In total, Dr. Wang has submitted 13 inventions, including three in fiscal year 2021. These inventions have resulted in 21 active patents and patent applications, three license agreements, and two sponsored research agreements.

Most Promising New Invention

The Most Promising New Invention of 2021 was presented to a trio of innovators in the Department of Biomechanics at UNO: Brian Knarr, PhD, associate professor and Director of the Machining and Prototyping Core at UNO; Travis Vanderheyden, research and development engineer in the Machining and Prototyping Core; and Russell Buffum, research and development engineer in the Machining and Prototyping Core.

The "Improved Self-Pacing Treadmill" adjusts its speed to the runner—whether a user wants to run, walk or trot, the treadmill adjusts to the user's pace, without needing any other input. In speeding up or slowing down to match a runner's speed, the new treadmill will make home and gym workouts safer and more realistic.

Startup of the Year

Finally, UNeMed presented UNMC reearcher Dong Wang, PhD, with the 2021 Startup of the Year Award for his new company, Ensign Pharmaceutical.

Dr. Wang, a professor inthe Depratment of Pharmaceutical Sciences, created a thermosensitive hydrogel formulation called ProGel, a novel platform technology that can deliver a variety of therapeutics. ProGel has attracted wide interest as the cornerstone technology for his startup.


Dong Wang, PhD

Ensign Pharmaceutical recently secured nearly $2 million in federal research grant funding, which will support pre-clinical studies needed to approach regulatory approval. Ensign won the 2020 Business Innovation Live Pitch competition in Phoenix during the Orthopaedic Research Society's annual meeting.

Also, Ensign was selected to present at highly selective startup conferences, the Invest Midwest Venture Capital Forum and Destination Startup.

More information about Innovation Week and the Innovation Awards ceremony, including its history and awardees, can be found at https://www.unemed.com/innovation-week.

2022 U.S. PATENTS

List of all U.S. patents issued to UNMC & UNO personnel during the fiscal year ending in 2022. Information includes patent numbers, patent titles, the date the patent was issued and the names of all co-inventors listed on the patent.

"Robotic Surgical Devices, Systems, and Related Methods"
U.S. Patent No. 11,051,895 — issued July 6, 2021
- Shane Farritor
- Jason Dumpert
- Yutaka Tsutano
- Erik Mumm
- Philip Chu
- Nishant Kumar

"Methods, Systems, and Devices Relating to Surgical End Effectors"
U.S. Patent No. 11,065,050 — issued July 20, 2021
- Shane Farritor
- Tom Frederick
- Joe Bartels

"Dimers of Covalent NFKB Inhibitors"
U.S. Patent No. 11,104,684 — issued August 31, 2021
- Amarnath Natarajan
- Sandeep Rana

"Surgical Devices and Methods"
U.S. Patent No. 11,116,537 — issued September 14, 2021
- Jason MacTaggart
- Alexey Kamenskiy
- Paul Deegan

"Method and Apparatus for Computer Aided Surgery"
U.S. Patent No. 11,116,574 — issued September 14, 2021
- Hani Haider
- O. Andres Barrera

"Compositions and Methods for the Delivery of Therapeutics"
U.S. Patent No. 11,117,904 — issued September 14, 2021
- Howard Gendelman
- Benson Edagwa
- Brian Johns

"Antiviral Prodrugs and Nanoformulations Thereof"
U.S. Patent No. 11,154,557 — issued October 26, 2021
- Howard Gendelman
- Benson Edagwa

"Platform Device and Method of Use to Assist in Anastomosis Formation"
U.S. Patent No. 11,160,555 — issued November 2, 2021
- Marius Florescu

"Antiviral Prodrugs and Nanoformulations Thereof"
U.S. Patent No. 11,166,957 — issued November 9, 2021
- Howard Gendelman
- Benson Edagwa

"Precision Syringe"
U.S. Patent No. 11,167,091 — issued November 9, 2021
- Tyler Scherr
- R. Gabe Linke
- Donny Suh

"Quick-Release End Effector Tool Interface"
U.S. Patent No. 11,173,617 — issued November 16, 2021
- Shane Farritor
- Tom Frederick

"Phosphodiesterase Inhibitors"
U.S. Patent No. 11,180,499 — issued November 23, 2021
- Corey Hopkins

"User-Paced Exercise Equipment"
U.S. Patent No. 11,185,740 — issued November 30, 2021
- Casey Wiens
- William Denton
- Molly Schieber

"Method for Diagnosing and Treating Parkinson's Disease Via Measurement of Effector Memory T-Cells"
U.S. Patent No. 11,209,426 — issued December 28, 2021
- Howard Gendelman
- R. Lee Mosley
- Jessica Saunders

"Ozonides for Treating or Preventing Virus Infections"
U.S. Patent No. 11,246,854 — issued February 15, 2022
- Jonathan Vennerstrom
- Ravit Boger

"Transesophageal Echocardiography Simulator"
U.S. Patent No. 11,257,397 — issued February 22, 2022
- Nicholas Markin

"Modified Pigment Epithelium-Derived Factor (PEDF) Peptides and Uses Thereof For Treating Neovascular Diseases, Inflammatory Diseases, Cancer, and for Cytoprotection"
U.S. Patent No. 11,261,237 — issued March 1, 2022
- Jack Henkin
- Ignacio Melgar-Asensio
- Olga Volpert
- Serguei Vinogradov

"Methods and Compositions for Selective Generation of Dopaminergic Precursors"
U.S. Patent No. 11,261,461 — issued March 1, 2022
- Changhai Tian
- Jialin Zheng

"Compositions and Methods for the Delivery of Therapeutics"
U.S. Patent No. 11,311,545 — issued April 26, 2022
- Howard Gendelman
- Benson Edagwa
- Xinming Liu

"Antiviral Prodrugs and Nanoformulations Thereof"
U.S. Patent No. 11,311,547 — issued April 26, 2022
- Howard Gendelman
- Benson Edagwa

"Time-Varying Quantification of Capacitive and Resistive Arterial Blood Flow"
U.S. Patent No. 11,317,889 — issued May 3, 2022
- Irving Zucker
- Ioannis Chatzizisis
- Hanjun Wang
- Alicia Schiller
- Peter Pellegrino

"Nanofiber Structures and Methods of Use Thereof"
U.S. Patent No. 11,318,224 — issued May 3, 2022
- Jingwei Xie
- Shixuan Chen
- Mark Carlson

"Healthcare Provider Interface for Treatment Option and Authorization"
U.S. Patent No. 11,322,237 — issued May 3, 2022
- Stephen Salzbrenner

"Antimicrobial Compositions Containing a Synergistic Combination of Activated Creatinine and an Imidazole Antifungal Agent"
U.S. Patent No. 11,351,153 — issued June 7, 2022
- Thomas McDonald
- Steven Tracy

"Gross Positioning Device and Related Systems and Methods"
U.S. Patent No. 11,357,595 — issued June 14, 2022
- Shane Farritor
- Mark Reichenbach

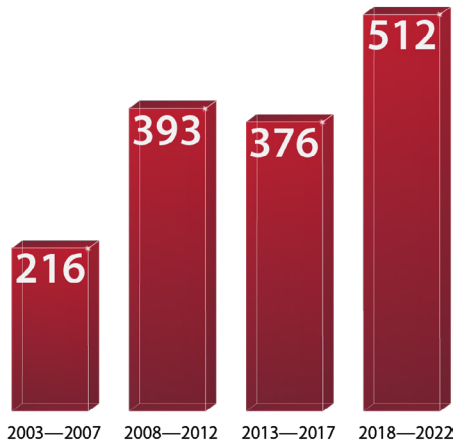
"Portable Camera Aided Simulator (PORTCAS) for Minimally Invasive Surgical Training"
U.S. Patent No. 11,361,678 — issued June 14, 2022
- Ka-Chun Siu
- Carl Nelson
- Mohsen Zahiri
- Dmitry Oleynikov

"Laparoscopic Devices and Methods of Using"
U.S. Patent No. 11,369,397 — issued June 28, 2022
- Jakeb Riggle
- Jake Kaufman
- Adam De Laveaga
- M. Susan Hallbeck

"TRPC5 Inhibitors and Methods of Using Same"
U.S. Patent No. 11,370,769 — issued June 28, 2022
- Corey Hopkins
- Anna Greka

CORE METRICS

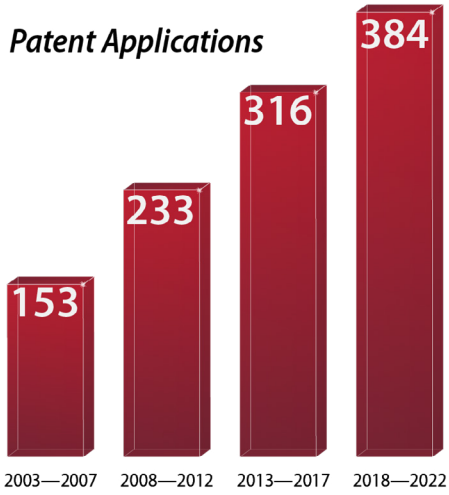
New Inventions



Core Metrics

90 New inventions
143 Unique inventors
72 New inventors

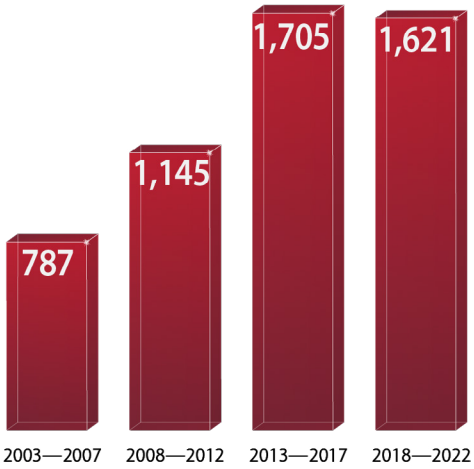
Patent Applications



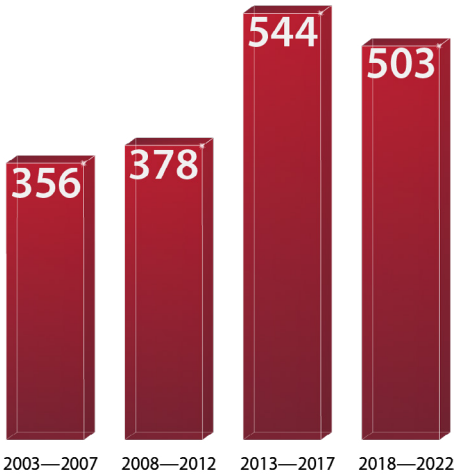
Core Metrics

321 MTAs
105 CDAs
105 Patent applications
63 Patents issued

Material Transfer Agreements



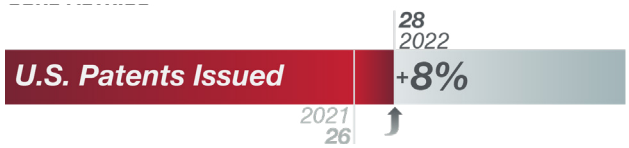
Confidential Disclosure Agreements



Peak Patent

28

U.S. Patents secured in 2022 breaks the company record of 26 set the previous year. It's just the fifth time in UNeMed's 32-year history with more than 17 patents.



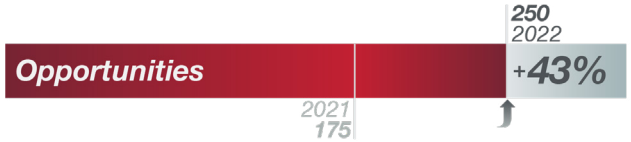
Patent Position

Total patents is second only to the 64 secured in 2019, when 16 U.S. and a record 48 foreign patents were issued to UNMC & UNO inventors.

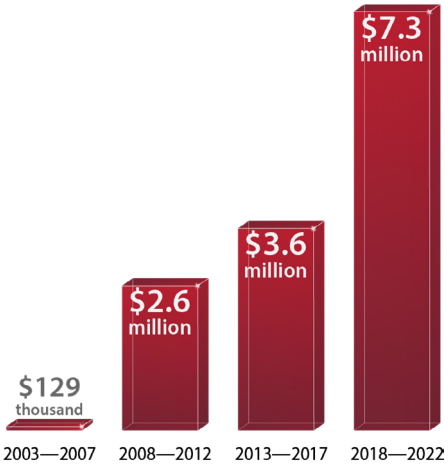
63

Core Metrics

105 Patent applications filed
63 Total patents issued
28 U.S. patents issued
35 Foreign patents issued



Sponsored Research Agreements



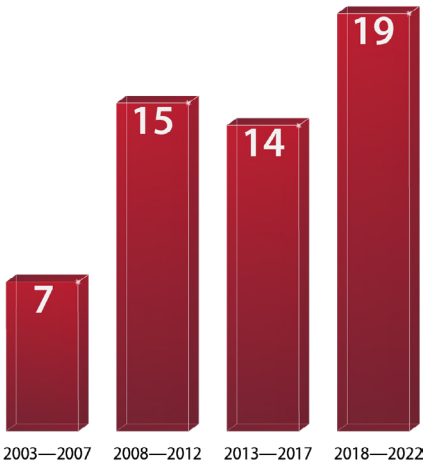
250 **Opportunities Knock**

Record number of opportunities, which reflect the amount of interactions that UNeMed generated with companies to review UNMC & UNO technologies.

Core Metrics

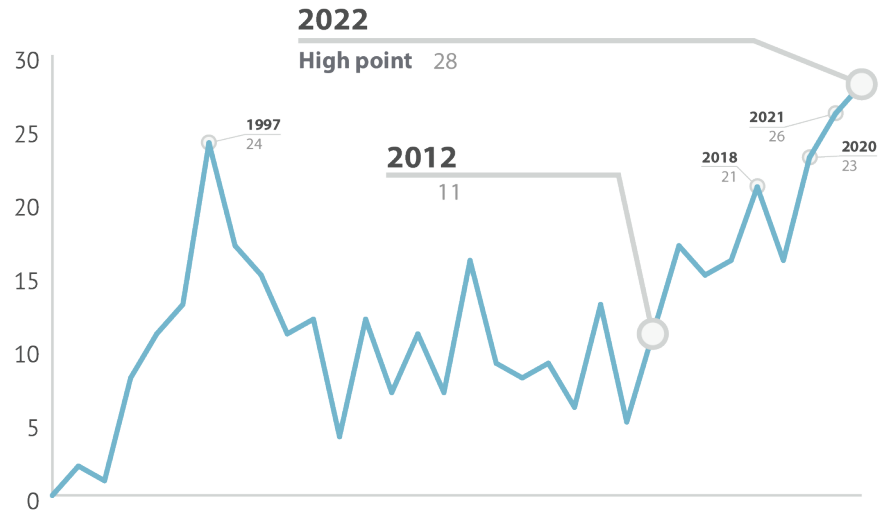
18 Licenses
117 Active licenses
39 Products on market
4 New startups

Startups



Twenty-something

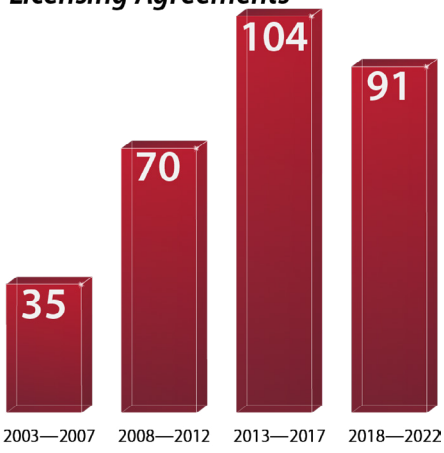
UNeMed's growth trend in securing **United States patents** for University of Nebraska inventors began in earnest 10 years ago. In 2012, UNeMed landed 11 patents, and never again dipped into single-digit territory. UNeMed continued to build on its success from there, securing 20-plus patents in four of the last five years, including last year's all-time high of 28.



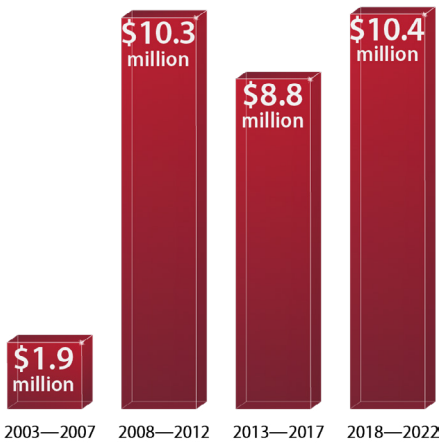
Core Metrics

$1.69 million Revenue
$0.83 million Sponsored research

Licensing Agreements



Total Revenue



Innovations & Libations networking event kicked off in July

UNeMed presented its first Innovations and Libations networking event in July, hosting a lively group of University innovators and key members of Omaha's entrepreneurial community.

Michael Dixon, PhD, president and CEO of UNeMed, the technology transfer and commercialization office for UNMC and UNO, was pleased with the robust turnout.

"We had no idea what to expect, especially with it being the first time for this event, so seeing all of the attendees interacting and engaging was really encouraging," he said. "We enjoy hanging out with innovators and entrepreneurs, and that's one thing we've really been missing these last few years. So we wanted to bring everyone together. I saw a lot of folks getting together with people they might not normally come into contact with, and that's exactly what we were trying to do."

Co-sponsored with UNeTech and the Great Plains IDeA-CTR, the informal event was created as a way to help University inventors build new connections and potential collaborations. Attendance included inventors from both UNMC and UNO, in addition to several people from the private and governmental sectors, which included local manufacturing, engineering and funding organizations.

"This is great," said James Hermsen, a local entrepreneur with an engineering background. "I'm talking to some biologists and it's really cool to talk to people in different fields. We're kind of the same in a way, because we all want to solve problems and help people."

Hermsen and his startup SH Strap, is the product of an unlikely collaboration with former UNMC pediatric ophthalmologist, Donny Suh, MD. Now at UC Irvine, Dr. Suh and Hermsen created a company that makes, among other

things, special eyeglasses for children who can't physically wear traditional eyeglasses.

Planners hope the overall success of the event could kindle more fruitful collaborations for University innovators. The success ensured that the event will return before the end of 2022.

"Our attitude is, 'Get out and meet new people, learn new things and make the world a better place,'" Dixon said. "If this kind of event is enough to get just two new collaborators bouncing ideas off each other, then this is well worth the effort."

Innovations and Libations was hosted at the Ratherskeller Bier Haus located near the intersection of Saddle Creek and Farnam Streets, and all guests received a complimentary drink during the event.

Based at UNMC, the Great Plains IDeA-CTR—short for Institutional Development Award for Clinical and Translational Research—is a UNMC-based collaborative for nine major research organizations in Nebraska, Kansas, North Dakota and South Dakota.

UNeTech is the University of Nebraska's startup incubator in Omaha, helping build new companies derived from innovations and discoveries that emanate from UNMC and UNO.

FEATURED TECHS

HEIGHT ADJUSTABLE RADIAL PLATFORM

Improve catheter stability, patient comfort during interventional procedures

UNMC physicians have finally solved an ongoing problem facing interventional radiologists everywhere: How to access the patient vascular system through the radial artery in the arm or wrist.

A major challenge to adoption of the radial approach is adjusting to changes in room set-up. This new device tackles the problem.

Interventional radiology procedures involve a physician threading a wire or catheter through the patient's veins or arteries. The minimally invasive procedures have a wide range of uses that include diagnosis, treatment and collecting tissue samples.

It's well-established that radial access leads to far greater chances of success and better patient outcomes. Yet, due to awkward patient positioning, quirks of vascular anatomy and the cumbersome set-up for a radial approach, radial access remains a significant challenge for most interventional radiologists.

Traditionally, interventionists have avoided those challenges by using the femoral artery in the leg. But femoral access carries with it a significantly increased risk of complications.

This new medical device removes nearly all the challenges associated with radial access.

The innovative design comfortably positions a patient's wrist while stabilizing the catheter. The wrist and catheter platform are independently adjustable for optimal tilt, length, and height to accommodate any patient size. The device also works for both left- or right-arm access.

- *Comfortably position patient wrists*
- *Prevents catheter instability, falling*
- *Adjusts to any-sized patient*
- *Works for right- and left-arm interventions*

Interventions through the radial artery carry more advantages compared to the traditional femoral artery approach, which include:

- *lower risk of bleeding complications*
- *improved patient recovery time*
- *no requirements to hold pressure, or use closure devices at the catheter site*
- *increased patient comfort*

DRUG DEPOT

On-demand, localized therapeutic delivery

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.

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

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.

FEATURED TECHS

X-RAY OUTPUT SIMULATOR

Safely train next 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.

- *Improve X-ray accuracy*
- *Inexpensive radiology training tool*
- *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.

METFORMIN NANOFORMULATION

New nanoformulation treats cancer, immunological diseases

New nanoformulation treats cancer, immunological diseases

Researchers at the University of Nebraska Medical Center have developed a novel nanoformulation of metformin for the treatment of cancer.

Physicians commonly prescribe metformin to reduce the liver's production of glucose as a way to manage type II diabetes and help regulate a patient's blood sugar. Because cancers typically demand very high levels of sugar, metformin has been a drug of interest for cancer researchers.

- *Increases concentration of drug in target tissues*
- *Sensitizes cancer tissue to radiation*
- *May enhance current treatment strategies*

A team of researchers at UNMC, under the direction of Chi Zhang, MD, developed a novel nanoformulation of metformin that enhances delivery to the tumor and increases cancer cell uptake of the drug.

Research shows that the metformin nanoformulation enhances survival in a mouse model of glioblastoma. When given as a combination with radiation therapy, survival was further enhanced with around 60 percent of the mice surviving beyond 40 days. Mice treated with radiation and regular metformin only, however, survived beyond 40 days in just 20 percent of cases.

Due to its ability to modulate the activity of macrophages, the nanoformulated metformin can also treat inflammatory diseases.

FEATURED TECHS

CATHETER PLACEMENT TROCAR

Safe, easy-to-use peritoneal access device

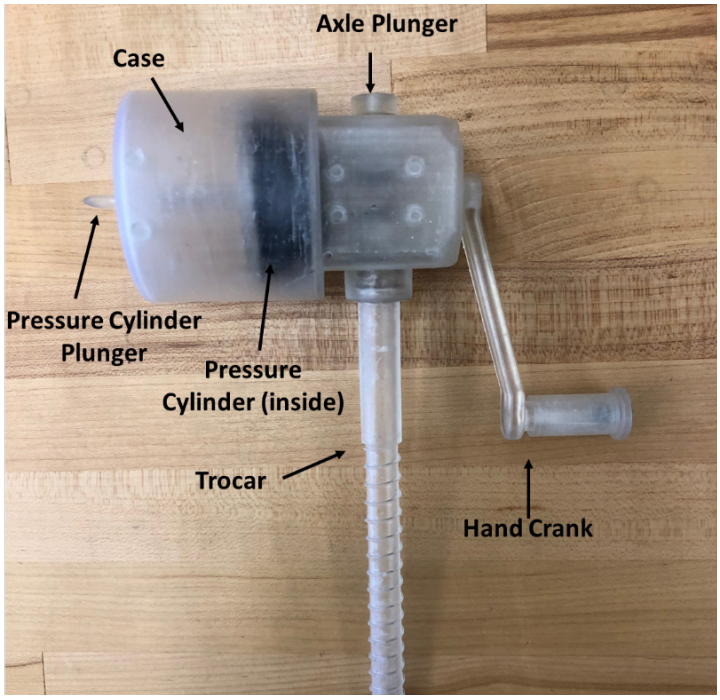
A team of engineers led by Ben Terry, PhD, at the University of Nebraska-Lincoln and clinicians led by Mark Carlson, MD, at the University of Nebraska Medical Center, have developed a mechanical, non-electronic, easy-to-use device for safe and reliable peritoneal access.

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.

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



GGDPS INHIBITORS

Small molecule inhibitors of GGDPS provide new treatment approach for cancer

Researchers at the University of Nebraska Medical Center and the University of Iowa have teamed up to develop new drugs to help treat multiple myeloma and other types of cancer.

The new drugs target a protein called geranylgeranyl diphosphate synthase, also known as GGDPS.

GGDPS is involved in the regulation of the Rab family of small but important proteins that are also often linked to cancer: GTPases. Targeting GGDPS may provide a way to inhibit Rab family proteins, providing a unique way to treat various forms of cancer.

The new GGDPS inhibitors have nanomolar potency and are being assessed in vivo to determine pharmacokinetics properties and efficacy.

- *Small molecule inhibitors of GGDPS*
- *Nanomolar potency*
- *Novel treatment approach for multiple myeloma and other cancers*

FEATURED TECHS

PASSIVE HIP EXOSKELETON

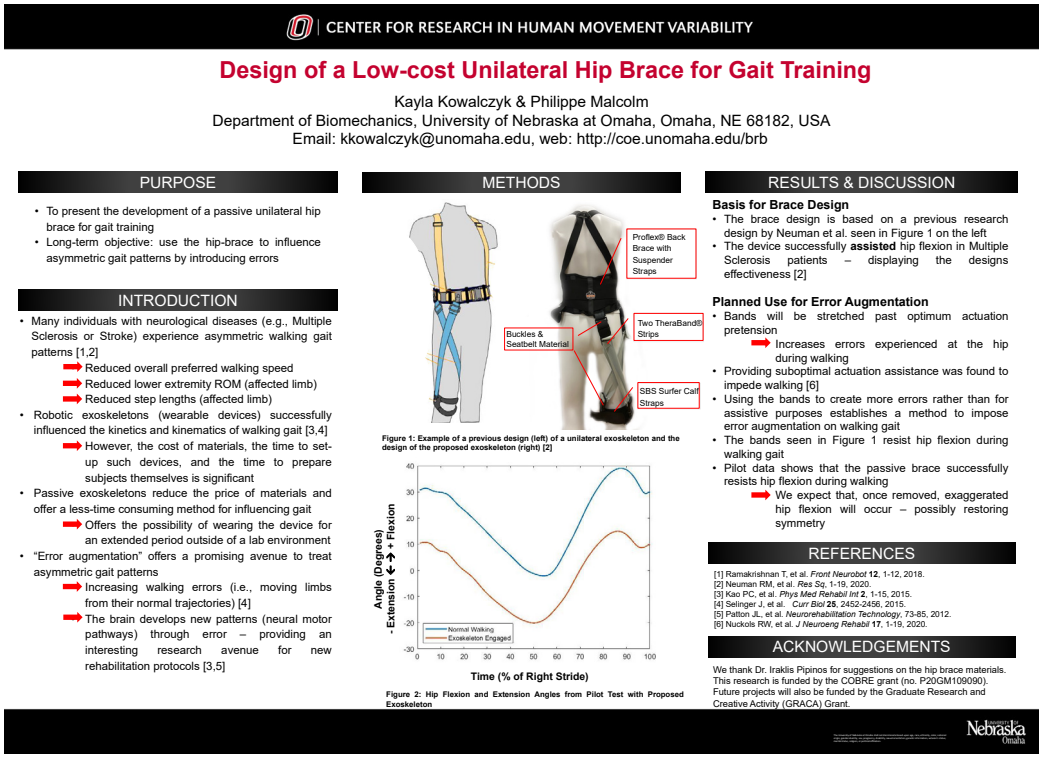
Provide walking support to one or both legs with single device

Biomechanics researchers at the University of Nebraska at Omaha, led by Philippe Malcolm, PhD, have developed a passive hip exoskeleton for rehabilitation and walking assistance.

The brace is easy to use, can be worn underneath clothing, and provides walking assistance to one or both legs at the same time.

The device stores and returns elastic energy in parallel with the wearer's hip flexors and extensors.

Patient populations that would benefit from the passive hip exoskeleton include those suffering from stroke, multiple sclerosis, peripheral arterial disease, or any other population suffering from asymmetric gait patterns.



CENTER FOR RESEARCH IN HUMAN MOVEMENT VARIABILITY

Design of a Low-cost Unilateral Hip Brace for Gait Training

Kayla Kowalczyk & Philippe Malcolm
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PURPOSE

- To present the development of a passive unilateral hip brace for gait training
- Long-term objective: use the hip-brace to influence asymmetric gait patterns by introducing errors

INTRODUCTION

- Many individuals with neurological diseases (e.g., Multiple Sclerosis or Stroke) experience asymmetric walking gait patterns [1,2]
  - ➡ Reduced overall preferred walking speed
  - ➡ Reduced lower extremity ROM (affected limb)
  - ➡ Reduced step lengths (affected limb)
- Robotic exoskeletons (wearable devices) successfully influenced the kinetics and kinematics of walking gait [3,4]
  - ➡ However, the cost of materials, the time to set-up such devices, and the time to prepare subjects themselves is significant
- Passive exoskeletons reduce the price of materials and offer a less-time consuming method for influencing gait
  - ➡ Offers the possibility of wearing the device for an extended period outside of a lab environment
- "Error augmentation" offers a promising avenue to treat asymmetric gait patterns
  - ➡ Increasing walking errors (i.e., moving limbs from their normal trajectories) [4]
  - ➡ The brain develops new patterns (neural motor pathways) through error – providing an interesting research avenue for new rehabilitation protocols [3,5]

METHODS

Figure 1: Example of a previous design (left) of a unilateral exoskeleton and the design of the proposed exoskeleton (right) [2]

Figure 2: Hip Flexion and Extension Angles from Pilot Test with Proposed Exoskeleton

RESULTS & DISCUSSION

Basis for Brace Design

- The brace design is based on a previous research design by Neuman et al. seen in Figure 1 on the left
- The device successfully **assisted** hip flexion in Multiple Sclerosis patients – displaying the designs effectiveness [2]

Planned Use for Error Augmentation

- Bands will be stretched past optimum actuation pretension
  - ➡ Increases errors experienced at the hip during walking
- Providing suboptimal actuation assistance was found to impede walking [6]
- Using the bands to create more errors rather than for assistive purposes establishes a method to impose error augmentation on walking gait
- The bands seen in Figure 1 resist hip flexion during walking gait
- Pilot data shows that the passive brace successfully resists hip flexion during walking
  - ➡ We expect that, once removed, exaggerated hip flexion will occur – possibly restoring symmetry

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[4] Selinger J, et al. *Curr Biol* **25**, 2452-2456, 2015.
[5] Patton JL, et al. *Neurorehabilitation Technology*, 73-85, 2012.
[6] Nuckols RW, et al. *J Neuroeng Rehabil* **17**, 1-19, 2020.

ACKNOWLEDGEMENTS

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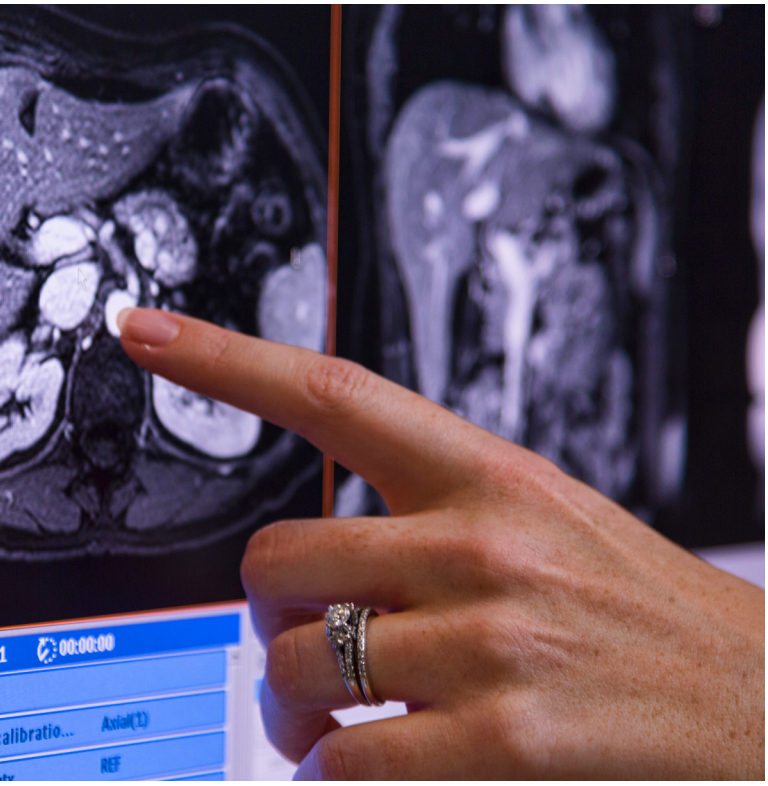
MICROTUBULE TARGETED THERAPEUTICS, IMAGING AGENTS

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.

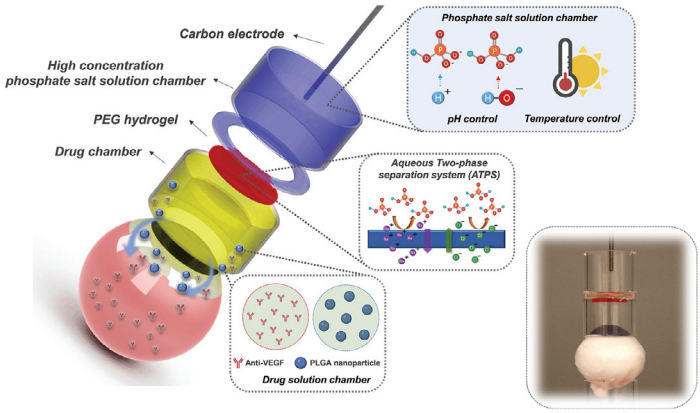
Microtubule-targeted compounds labeled with iodine-131 were tested in a mouse model of glioblastoma. Treatment with the compound significantly reduced tumor size and weight. Additional studies will look at the use of other radionuclides such as astatine-211.

- *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*

FEATURED TECHS

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 and nanoparticle drugs*
- *Decreased heat and buffered pH*
- *Safe application of high current intensities*

SYNTHETIC BYPASS GRAFT

Innovative graft material flexes, improves blood flow for patients with peripheral artery disease

Researchers at UNMC developed a highly flexible vascular bypass graft for the treatment of peripheral artery disease.

Peripheral artery disease is a common circulatory condition for the elderly, with more than 3 million new cases per year. As the body ages, the vessels carrying vital oxygen and nutrients throughout the bloodstream begin to weaken and narrow, reducing blood flow to the limbs.

To reinforce the vessels, and support improved blood flow, physicians can surgically implant grafts that protect the vessel integrity. However, traditional grafts tend to be rigid and risk severe bending and kinking during normal limb use. Grafts placed over major joints like knees and elbows have particularly high fail rates.

- *Reinforces vessels, supports improved blood flow*
- *More flexible, prevents severe bending and kinking*
- *Ideal for use in major joints like knees, elbows*

A team of researchers at UNMC, led by vascular surgeon Jason MacTaggart, MD, developed a synthetic graft material that is more flexible and prevents severe bending and kinking during normal limb use. Their tests indicate that such a graft may improve blood flow patterns and reduce vascular torsion in patients with peripheral artery disease.

This new graft design may improve options for patients suffering from peripheral artery disease and offer a higher quality of life.

FEATURED TECHS

NANOFIBER SWABS

Design outperforms traditional swabs in collecting pathogens, including SARS-CoV-2

Researchers at the University of Nebraska Medical Center have developed highly absorbent nanofiber swabs that perform better than traditional cotton or flocked swabs.

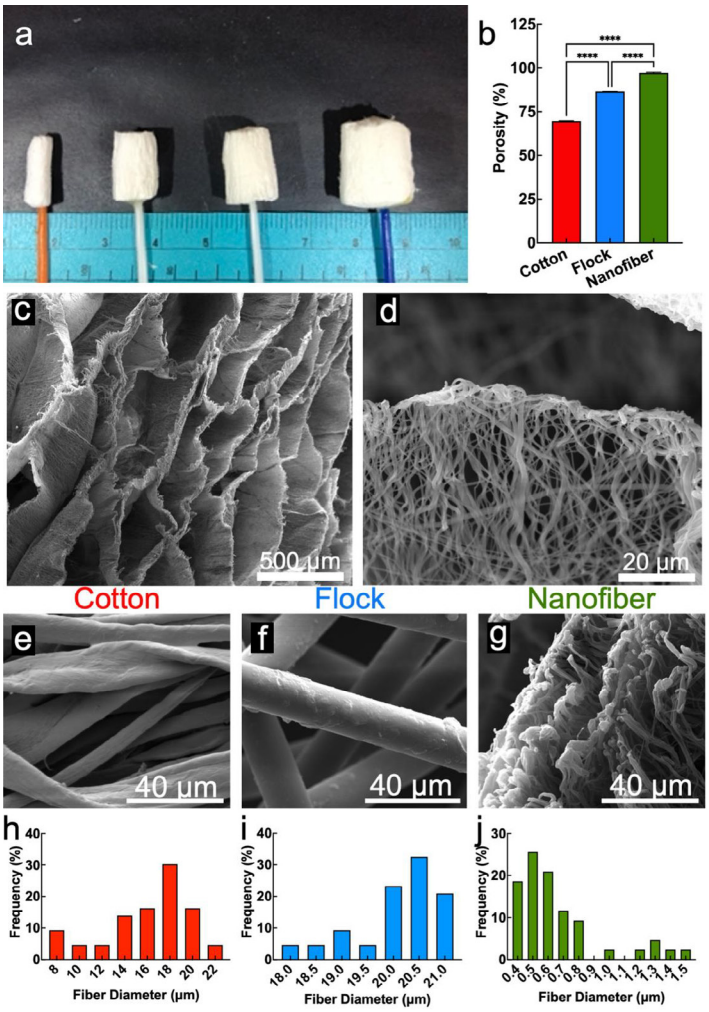
In head-to-head tests, the nanofiber swabs showed improved absorption and release of a variety of samples including cells, bacteria, and viruses.

Unlike traditional swabs, nanofiber swabs were able to collect SARS-CoV-2 virus from diluted samples.

The enhanced properties of the nanofiber swabs may help improve the overall accuracy of diagnostic tests.

Additional applications include use in forensic sciences, where obtaining small molecules such as DNA can be exceptionally challenging.

- *Improves both sample absorption AND release from swab*
- *Can reduce false-negative results*
- *May improve early detection diagnostics*



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

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

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).

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.

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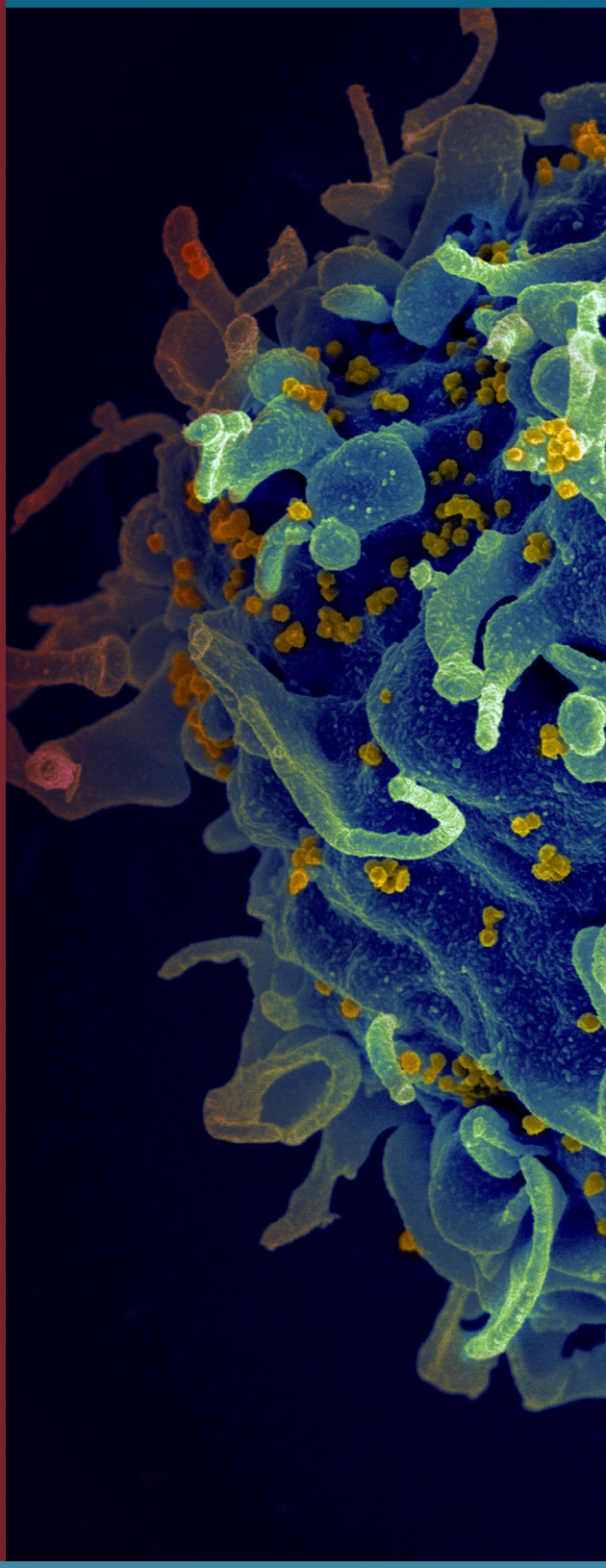

COVER: A human T cell (blue) is under attack by HIV (yellow), the virus that causes AIDS. The virus specifically targets T cells, which play a critical role in the body's immune response against invaders like bacteria and viruses.

Credit: *Seth Pincus, Elizabeth Fischer and Austin Athman, National Institute of Allergy and Infectious Diseases, National Institutes of Health*