University of Nebraska

TECHNOLOGY PORTFOLIO 2025

cancer
cardiovascular
drug delivery
infectious diseases
medical devices
metabolic
miscellaneous
neurologic
research tools
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startups

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Revised: March 1, 2025

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University of Nebraska

TECHNOLOGY PORTFOLIO 2025

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ProGel

Versatile platform for localized & long acting drug delivery

ProGel is a platform technology that can be used with a diverse spectrum of drug payloads, such as steroids, statins, antioxidants, opioids, chemotherapeutics, and hormones. A liquid at lower temperatures, ProGel transforms into a gel-like substance as it reaches body temperature. The gel is then more likely to linger in the affected area, concentrating the pharmaceutical payload exactly where it needs to be.

The initial focus of ProGel is on managing osteoarthritis pain, incorporating a potent steroid, dexamethasone, into the formulation.

When injected into a joint, dexamethasone provides temporary relief of debilitating pain and swelling caused by osteoarthritis, a chronic condition that slowly erodes the protective cartilage at the end of bones.

While effective for pain relief, the benefit of dexamethasone is unfortunately short-lived, usually lasting only a few days. However, when formulated with ProGel, dexamethasone remains active much longer, providing relief for months. In addition to providing a more sustained and stable local release of medication, the hydrogel also has the benefit of limiting potential harmful side effects typically seen with systemic dexamethasone, including weight gain, increased blood sugar, insomnia and osteoporosis.

Any number of pharmaceuticals can combine with ProGel for localized and sustained delivery. For example, ProGel could help treat other musculoskeletal disorders such as chronic back pain, tendonitis, bursitis, fracture repair, spinal fusion, and periodontal bone regeneration.

It may also serve as a depot for sustained drug delivery in a broad spectrum of disorders, including hormone therapy for high-risk pregnancy, and localized chemotherapy.

Rundown

- Platform technology can deliver a wide range of drugs
- Liquid at room temperature, thickens to gel at body temp
- Limits negative side effects of therapeutics

Inventor

- Don Wang, PhD

Cancer

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Cancer

Anti-INHBA siRNA

Targeted RNAi intervention treats several indications

So-Youn Kim, PhD, and Seok-Yeong Yu, PhD of the University of Nebraska Medical Center have developed an RNAi intervention to treat cachexia: a complex syndrome resulting in the progressive loss of muscle and fat. Cachexia is often observed with cancer, heart failure, diabetes and other chronic diseases.

Cancer patient data and animal studies show that cachexia is associated with elevated levels of a certain molecule in the blood called activin A. This molecule, specifically expressed by the INHBA gene, is normally involved in a number of cellular processes, including the creation of blood cells and connective tissue.

Targeting anti-INHBA siRNA constructs in a pancreatic ductal adenocarcinoma mouse study, yielded a decrease in activin A. This approach also prevented the rapid loss of body weight, slowed tumor growth and improved survival rates in pancreatic cancer-driven cachexia.

This intervention could treat a variety of diseases that exhibit increased levels of activin A in the blood, including cancer, autoimmune diseases, fibrotic disorders, blood disorders, allergies, heart failure, neurodegenerative diseases and inflammatory diseases.

To learn more about this technology, contact Amanda Hawley, PhD, at ahawley@unmc.edu or 402-310-5602

Rundown

- Treat cancer and fibrosis
- Targeted gene therapy
- Reduce the impacts of disease-driven cachexia
- Available for licensing

Inventors

- So-Youn Kim, PhD
- Seok-Yeong Yu, PhD

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MIBG Analogs
New compounds shrink tumors

Promising new compounds shrink brain cancer tumors without any noticeable side effects, according to early research tests at the University of Nebraska Medical Center.

Most cancer therapies are toxic, which is why treatment often includes sometimes debilitating side effects. UNMC's innovative approach specifically targets the cancers cells in tumors, unlike more traditional chemo- or radiation therapies, which can indiscriminately affect both cancerous and healthy cells alike.

The compound focuses on cancer cells that produce an overabundance of norepinephrine transporter protein. Researchers created the molecule by combining a norepinephrine-targeting agent with another agent that damages DNA. The targeting agent helps the molecule get inside a cancer cell. Once inside, the DNA-damaging agent kills the cell by breaking apart its DNA.

As an effective delivery platform, the compound could also be adapted for other therapeutic uses such as labeling norepinephrine cancer cells, which would allow physicians to better diagnose and track the disease.

Rundown

- Useful for imaging and as a therapeutic
- Useful for the treatment of a variety of cancers
- Decreased toxicity to normal tissue
- Increased specificity for cancer cells

INVENTORS

- Janina Baranowska-Kortylewicz, PhD
- Zbigniew Kortylewicz, PhD

Cancer

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Cancer

Metformin nanoformulation

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.

A team of researchers at UNMC, under the direction of Chi Zhang, M.D., developed a novel nanoformulation of metformin that enhances delivery to the tumor and increases the cancer cells' 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.

RUNDOWN

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

INVENTORS

- Chi Zhang
- Fei Wang
- Svetlana Romanova
- Tatiana Bronich

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COVID-19

Cancer

Extracellular Vesicle Diagnostic Testing Kit

Tissue specific signatures could improve future diagnostics

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Exosomes are cellular excretions that are useful as biomarkers and diagnostics because they contain diverse tissue specific cargo, including any products of the cell like fats, proteins, DNAs and RNAs. UNMC researchers have identified tissue specific markers on exosomes that help identify their origin. Exosome markers for brain, heart, kidney, lung, and liver tissues have been identified. These unique signatures help identify tissue-specific biomarkers, and potentially aid in the development of new diagnostics.

Signatures have been validated in animal and human cadaver specimens, and will enable future diagnostic tests.

Rundown

- Simple blood test
- Biomarkers of brain, heart, kidney, lung and liver
- May yield early strategies for early diagnosis

INVENTORS

- Gurudutt Pendyala
- Sowmya Yelamanchili

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Cancer

Nanogel cancer treatment

Nanogel delivers cancer treatment with fewer side effects

A new nanogel under development at the University of Nebraska Medical Center may dramatically reduce the multitude of adverse side effects often associated with modern cancer treatments.

Most cancer treatments require a strategy that incorporates a combination of therapies, which can be detrimental to the patient's health. Until now there haven't been many effective ways to specifically target cancerous cells.

A nanogel developed by former UNMC researcher Alexander Kabanov, M.D., makes possible a simultaneous delivery of multiple drugs to specific cancer sites. By "tagging" the nanogel with a tumor-recognizing antibody, physicians gain the ability to target cancer sites with smaller effective doses and a significant reduction in potential side effects.

Proof of principle studies show the nanogel can effectively deliver multiple chemotherapy drugs, and can also be used with a wide range of drugs and drug classes, including peptides, proteins and gene therapy agents.

Target cancer sites

- Novel nanogel formulation
- Allows for targeted delivery of multiple drugs
- Allows for a lowered effective dose
- Minimizes side effects
- Targets cancer cells

INVENTORS
- Tatiana Bronich, Ph.D.
- Alexander Kabanov, Ph.D.

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Claudin-1 Inhibitors

New 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.

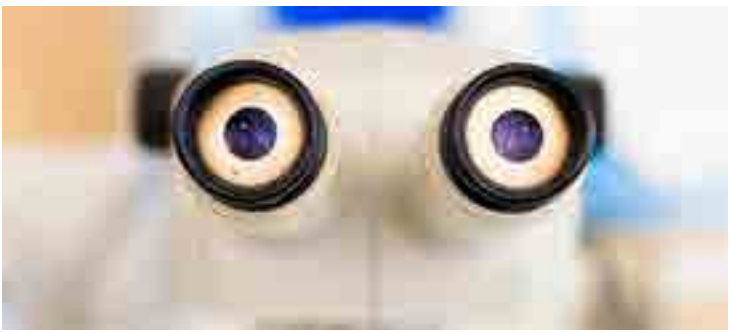
CLDN1 is a tight junction protein known to play a role in several human diseases, including multiple cancers. Critically, there are currently no approved methods of therapeutic intervention that can inhibit CLDN1-dependent disease progression.

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.

Rundown

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

INVENTORS
- Amar Singh
- Corey Hopkins
- Iram Fatima
- Punita Dhawan



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Cancer

NF-kB Pathway Inhibitors

Wage war against pancreatic cancer with minimal side effects

There may finally be an answer to pancreatic cancer.

Every year, roughly 45,000 people are diagnosed with pancreatic cancer, the most lethal form of cancerous disease. With current treatment options, almost 43,000 of them will die within five years of diagnosis.

The few treatments that exist are too soon rendered impotent as patients quickly develop resistance to the drugs.

But researchers at the University of Nebraska Medical Center may be able to increase the odds for those who receive the grim news. Researchers at UNMC are working on a novel drug called "13-197" that has shown promise in mouse models with relatively few side effects.

"13-197" is still in preclinical development for pancreatic cancer, and may be useful in the treatment of other forms of cancer and other diseases such as diabetes.

UNMC is interested in partnering with a pharmaceutical company to further develop "13-197" and future analogs for clinical use.

Novel Inhibitors of the NF-kB Pathway

- Novel drug
- Orally Available
- Few side effects
- Potent inhibitor of cancer cell proliferation
- Effective in pancreatic cancer animal model
- Treat other forms of cancer
- Treat diabetes, other diseases

INVENTORS

- Amarnath Natarajan, Ph.D.
- Qian Chen, Ph.D.
- Vashti Bryant, Ph.D.
- Rajkumar Rajule

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Microtubule targeting

New compounds allow imaging, treatment of cancer

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.

New Compounds to treat, image cancer

- 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

INVENTORS
- Janina Baranowska-Kortylewicz, Ph.D.
- Zbigniew Kortylewicz, Ph.D.

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.

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Cancer

New approach for myeloma, other cancers

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.

GGDPS Inhibitors

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

INVENTORS

- David Weimer, Ph.D.
- Sarah Holstein, Ph.D.

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NF-κB Pathway Inhibitor

UNMC scientists invent new compounds to treat cancer

Researchers at the University of Nebraska Medical Center created a molecule capable of specifically inhibiting the NF-κB pathway, a key target involved in a variety of cancers and other diseases.

The NF-κB pathway is often overactive in a number of cancers. Therefore, new ways to shut off this pathway could yield important new cancer treatments.

Amarnath Natarajan, Ph.D., and his team developed a small molecule called 36-252 that destroys key members of the NF-κB pathway—specifically the proteins IKKβ and IKKα. In ovarian cancer cell studies, 36-252 effectively inhibited cell growth at nanomolar concentrations, stimulated cell death (apoptosis), and effectively inhibited NF-κB activity. 36-252 was also effective at destroying ovarian cancer stem-like cells.

New Compounds to treat cancer

- Inhibits the NF-κB pathway
- Causes degradation of IKKβ and IKKα
- Nanomolar potency in cell-based studies

INVENTORS
- Amarnath Natarajan, Ph.D.
- Sandeep Rana, Ph.D.

UNeMed is interested in forming collaborations with industry to further explore the potential of 36-252 as a novel therapy of the treatment of cancer and other diseases associated with overactive NF-κB.

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Cancer

CDK9 PROTACs

Cutting edge anti-cancer approach targets CDK9

University of Nebraska Medical Center researchers created an inhibitor that targets cyclin-dependent kinase 9 (CDK9), a protein that regulates several oncogenes, which are often responsible for tumor growth.

This new CDK9 inhibitor is a PROTAC, or Proteolysis targeting chimera, which is a class of inhibitors that harness the body's own protein degradation machinery to eliminate cancer-related proteins.

This new CDK9 PROTAC degrades CDK9 at nanomolar concentrations without degrading other CDKs or CDK9-binding partners in pancreatic cancer cells.

The CDK9 PROTAC can also sensitize pancreatic cancer cells to an FDA approved Bcl2 inhibitor Venetoclax, a cancer treatment patients commonly develop resistance to.

RUNDOWN

- Targeted degradation of CDK9
- Nanomolar potency
- Sensitizes pancreatic cancer cells to Bcl2 inhibitor

INVENTORS

- Amarnath Natarajan
- Sandeep Rana

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Cardiovascular

Measuring BP in Wearable Devices

New system more accurately monitors blood pressure

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.

Rundown

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

INVENTORS
- Cody Anderson
- Song-young Park, PhD

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.

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Cardiovascular

Hypertension Detection, Treatment Algorithm

Uncovers hypertension for asymptomatic patients

A new process for identifying and treating hypertension can identify the deadly condition in patients years earlier than with traditional diagnostic tools.

This new process, developed with UNMC's in-house supercomputer, analyzes various measurements and lab values and compares them to 2,000,000to 2,000,000 previous patients. During this comparison, numerous mathematical calculations determine the most probable outcome. The final calculation provides a suggested diagnosis and treatment plan for the physician.

Rundown

- Early diagnosis of previously undetected hypertension
- Patient record analytics produces a diagnosis and treatment plan
- Allows for more personalized patient care, higher precision

This outcome, combined with the physician's clinical acumen, allows for earlier treatment of hypertension and supports real-time symptom management. This means that patients can adjust their treatments more frequently than the typical once- or twice-per-year follow-up appointments, enabling more responsive and personalized care.

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Cardiovascular

Cardiac vascular access graft
Better care for children with heart defects

Many babies born with congenital defects of the heart now live to become adults. Pediatric congenital heart disease and the heart defects that it produces used to be completely lethal. Surgery for congenital heart defects can now correct the majority of these heart defects in infants.

Treatment of heart defects in infants came from tireless innovation for congenital heart defect surgery and the combined expertise of teams of medical experts. Pediatric cardiologist Jeffrey Delaney MD and pediatric thoracic surgeon James Hammel MD embody that innovation.

Managing congenital heart disease

- No deviation from current correction of congenital heart defects
- Improved access for better management
- Easier to use, more efficient

INVENTOR
- Jeff Delaney, M.D.

Dr. Hammel surgically corrects birth defects of the heart and Dr. Delaney manages children living with congenital defects of the heart. Their collaboration is the kind of care that has produced the first generation of adults with congenital heart disease.

Together, they have invented a new pediatric medical device to correct heart defects. The device, utilized in the final stages of a Fontan procedure, will help facilitate management of the patient's congenital heart defects. A novel shunt, the device replaces traditional tubes that redirect blood flow away from defective parts of the hearth.

The improved device has permeable membranes to help the cardiologist regulate pressure in the tube. A radio opaque ring wreaths the membrane, making it easy to locate utilizing radiography.

Doctors Hammel and Delaney are prepared to conduct an animal study that will further validate the device. Contact UNeMed to discuss how to bring this vital new device to market and give children with life threatening heart defects more options in their care.

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COVID-19

Cardiovascular

Extracellular Vesicle Diagnostic Testing Kit

Tissue specific signatures could improve future diagnostics

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- Simple blood test
- Biomarkers of brain, heart, kidney, lung and liver
- May yield early strategies for early diagnosis

INVENTORS

- Gurudutt Pendyala
- Sowmya Yelamanchili

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Cardiovascular

Sympathetic vasomotion monitoring

New device will improve outcomes in renal denervation procedures

Researchers at UNMC developed a device capable of making high blood pressure more treatable by accurately measuring the rhythmic constriction and relaxation of blood vessels, known as sympathetic vasomotion.

The sympathetic nervous system controls the body's automated functions such as digestion, heart rate and the vasomotion of blood vessels. Disruption of the sympathetic nervous system can contribute to a variety of chronic diseases, including high blood pressure.

Rundown

- Detects small changes
- Measures success of renal denervation
- Increase success rate
- Can screen for blood pressure-related fainting
- non-invasive hemodynamic monitoring

INVENTORS
- Irving Zucker, PhD
- Alicia Schiller
- Peter Pellegrino

One potentially effective way to treat high blood pressure is to destroy, or ablate, all or parts of the sympathetic nerves of the kidneys. The problem, however, is until now there has not been an accurate tool that helps clinicians in real-time determine if the procedure is targeting the proper areas of the kidneys.

UNMC's detection system non-invasively monitors sympathetic nerve activity in real time and determines if a renal denervation procedure was successful. This technology will help significantly increase the success rate of renal denervation procedures.

UNMC researchers have shown that the sympathetic vasomotion detection system can accurately detect renal denervation in rat and rabbit models. A current study in pigs is expected to further validate the system's ability and accuracy.

The sympathetic vasomotion detection system is a versatile tool that can also monitor and detect other diseases or conditions associated with the sympathetic nervous system.

In addition to their work with renal denervation, UNMC researchers are also investigating the device's use as a screening tool for blood pressure-related fainting and non-invasive hemodynamic monitoring.

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Drug Delivery

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Rundown

- Platform technology can deliver a wide range of drugs
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Inventor

- Don Wang, PhD

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UNeMed Corporation is the technology transfer office for the University of Nebraska Medical Center and the University of Nebraska at Omaha, serving researchers, faculty and staff who develop new technologies and inventions. UNeMed strives to help bring those innovations to the marketplace.

COVID-19

Drug Delivery

3-in-1 Oxygen Mask Modification

Decrease aerosolized germ spread, improve drug delivery

A simple yet innovative attachment for simple oxygen masks could revolutionize patient care and reduce the spread of contagious diseases. Designed for use with patients hospitalized with influenza, COVID-19, and other aerosolized diseases, the attachment delivers oxygen and medication more effectively.

Traditionally, hospitals relied on costly negative pressure protocols to contain pathogens, which placed a heavy burden on healthcare workers while consuming significant energy. Using 3D printing technology this innovative approach creates a positive pressure mask that prevents germs from escaping the patient's mouth or nose.

Unlike standard oxygen masks, this modified version allows real-time sampling and testing of the patient's breath, enabling immediate analysis of contagiousness, diagnosis, and pathogen clearance. Additionally, the positive pressure mask improves medication delivery. Medications for aerosolized infections, typically administered in nebulized form, can be fully delivered to the patient without escaping into the surrounding air.

Rundown

- Innovation modifies standard oxygen mask
- Small change that increases mask's utility, safety, & effectiveness
- Decreases burden of aerosolized diseases in hospitals
- Improves treatment for infected patients
- Test aerosolized bacteria inhaled through the mask

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Drug Delivery

Nanofiber rings
Implant, customize drug delivery device

Researchers at the University of Nebraska Medical Center have developed a new implantable drug delivery device made out of nanofibers.

This new device is a nanofiber-based ring that is biodegradable, versatile and customizable.

The nanofiber rings can be loaded with a variety of different types of drugs including small molecules and biologics. The devices can also be loaded with multiple drugs at one time, allowing for the delivery of a combination therapy.

Another unique property of this device is that the nanofiber rings can be customized to allow for different release properties of each drug loaded into the ring. This includes delayed release of drugs, sequential release of multiple drugs, and parallel release of multiple drugs.

Rundown

- Capable of delivering, variety of drugs, including small molecules and biologics
- Biodegradable
- Can be loaded with more than one drug at a time
- Release kinetics of each drug can be tailored

INVENTOR
- Jingwei Xie, Ph.D.

The unique properties of the nanofiber ring structure make it ideal for use as an implantable drug delivery device.

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Drug Delivery

Drug Depot
On-demand, localized therapeutic delivery with engineered drug depot

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.

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

INVENTORS
- Bin Duan
- Lee Korshoj
- Tammy Kielian
- Wen Shi

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Drug Delivery

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.

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

INVENTOR
- Siwei Zhao

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Nanogel cancer treatment

Nanogel delivers cancer treatment with fewer side effects

A new nanogel under development at the University of Nebraska Medical Center may dramatically reduce the multitude of adverse side effects often associated with modern cancer treatments.

Most cancer treatments require a strategy that incorporates a combination of therapies, which can be detrimental to the patient's health. Until now there haven't been many effective ways to specifically target cancerous cells.

A nanogel developed by former UNMC researcher Alexander Kabanov, M.D., makes possible a simultaneous delivery of multiple drugs to specific cancer sites. By "tagging" the nanogel with a tumor-recognizing antibody, physicians gain the ability to target cancer sites with smaller effective doses and a significant reduction in potential side effects.

Target cancer sites

- Novel nanogel formulation
- Allows for targeted delivery of multiple drugs
- Allows for a lowered effective dose
- Minimizes side effects
- Targets cancer cells

INVENTORS
- Tatiana Bronich, Ph.D.
- Alexander Kabanov, Ph.D.

Proof of principle studies show the nanogel can effectively deliver multiple chemotherapy drugs, and can also be used with a wide range of drugs and drug classes, including peptides, proteins and gene therapy agents.

Drug Delivery

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Drug Delivery

Bone Allograft Coating
Shows significant increases bone growth and healing

Researchers at the University of Nebraska Medical Center and the University of Rochester developed a novel coating for structural bone allografts.

Structural allografts are the top choice to repair large bone defects that require immediate support. However, traditional allografts have a 60 percent failure rate within 10 years of implantation.

Rundown

- Versatile, can be tailored to specific needs
- Can be used to package therapeutic agents
- Coating with BMP-2 peptides enhances bone growth

INVENTORS

- Jingwei Xie
- Xinping Zhang

The team designed the new allograft coating technology to help enhance the properties of bone allografts, and improve their overall performance and success rates.

The new coating technology consists of a polymer coating applied to the allograft via electrospraying. This allows for a uniform coating of polymer that can be easily tailored to achieve the desired thicknesses.

The polymer coating can also be loaded with therapeutics such as biological factors that help enhance bone growth and healing, like bone morphogenic 2 peptides.

Researchers have tested the coating containing bone morphogenic 2 peptides and have shown that this coating significantly increased bone growth and healing while also decreasing fibrosis.

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COVID-19

Drug Delivery

Z-filter Device

Captures infectious aerosol particles during treatments

Clinicians from the University of Nebraska Medical Center have developed the Z-filter, a device that mitigates the release of infectious aerosolized particles during nebulizing treatments.

Asthmatic patients or patients experiencing difficulty breathing or shortness of breath, require breathing treatments delivered via a nebulizer, which aerosolizes a liquid medication. The nebulizer allows for faster and less invasive uptake by the patient via their respiratory system. However, in scenarios where the patient may have a highly infectious disease, there is a potential to spread of infectious pathogens as the patient's breath is dispersed

into the air via the nebulizer's high airflow. Many health-care facilities have stopped all nebulized treatments in fear of contaminating rooms with SARS-CoV-2, the coronavirus responsible for COVID-19.

The Z-filter is an add-on attachment designed for universal fit with standard oxygen masks that are required for nebulizing treatments. Its construction prevents the release of exhaled infectious particles into the air.

Considering the many upcoming changes in healthcare practices and procedures, the Z-filter could become a standard practice in the future.

Rundown

- Allows nebulized treatment in patients with infectious diseases
- Prevents environmental contamination
- Preliminary testing exhibits excellent recapture of aerosolized saline

INVENTORS
- Heather Nichold
- Michael Wadman
- Thang Nguyen
- Wesley Zeger

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Photo: National Institute of Allergy and Infectious Diseases

COVID-19

Infectious Diseases

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Rundown

- Innovation modifies standard oxygen mask
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Healthcare PAPR Helmet

Design improves safety, comfort and communication

Rundown
- Lightweight
- Comfortable
- Reduced fan noise
- Full face visibility

Powered air purifying respirators (PAPRs)—and related personal protective equipment—are manufactured with astronauts and miners in mind, not healthcare workers. Regardless, protective gear such as PAPRs have been adopted in healthcare to protect clinicians from highly infectious respiratory pathogens. The bulky and sometimes awkward devices might be great at protecting its wearer from the vacuum of space or meeting the intense physical demands of protecting a miner from coal dust. But a healthcare worker in a clinical setting has different needs.

A UNMC team led by Elizabeth Beam, PhD, RN, and Bethany Lowndes, PhD, MPH, contracted with UNO's Brian Knarr, PhD, and Andrew Walski in the Machine and Prototyping Core to design and prototype a PAPR with the healthcare worker in mind. The result was a lightweight PAPR helmet that is all at once convenient to don and doff properly and easy to sanitize. With reduced fan noise and full-face visibility, the design goes far beyond improving user comfort and convenience to enhance performance and communication.

The significant impact on clinician comfort and communication, as well as interest from large companies and the military, made this invention UNeMed's Most Promising New Invention of 2024.

The Healthcare PAPR Helmet Team has secured two grants to perform usability testing and create a ruggedized version for military use in austere environments.

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Infectious Diseases

Novel Short Lipopeptides

Peptides effective against MRSA biofilms

UNMC researchers, led by Gus Wang, Ph.D., have developed novel antimicrobial lipopeptides with efficacy against MRSA biofilms.

The engineered short lipopeptides are derivatives of human LL-37 (Cathelicidin) and demonstrate improved functionality in vivo in part due to greatly reduced serum protein binding.

Such peptides could be used in combination with traditional antibiotics to treat skin and soft-tissue infections (SSTIs). They could also be used to prevent MRSA biofilm formation on catheters and implanted prosthetics.

Rundown

- Human LL-37 derivative short lipopeptides
- Selectivity, stability and antimicrobial activity in vivo
- Little to no serum binding
- Inhibits S. aureus biofilm formation in a catheter mouse model

INVENTORS

- Gus Wang
- Jayaram Lakshmaiah Narayana
- Radha Golla

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Infectious Diseases

PAPR Adapter

3D print file creates adapter for previously incompatible systems

Clinicians at the University of Nebraska Medical Center and its clinical partner, Nebraska Medicine, developed a new solution to chronic shortages caused by the COVID-19 pandemic. In this case, they created a simple adapter that can be 3D-printed and used to maximize a hospital's Powered Air Purifying Respirator fleet, or PAPR for short.

The adapter enables hospitals and other clinical setting to connect a 3M Versaflow air handling unit with a Dover brand Hood.

Rundown

- Simple adapter can be 3D-printed
- Maximize a hospital's Powered Air Purifying Respirator fleet
- Adapter connects 3M Versa-flow air handling unit with a Dover brand Hood
- Print file available on request

INVENTORS

- Jerald Farke
- Nicholas Markin
- Tyler Scherr

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COVID-19

Infectious Diseases

SARS-CoV-2 antigens & serological assay

Novel antigens could help detect, fight coronavirus

Researchers at the University of Nebraska Medical Center have identified SARS-CoV-2 protein antigens to help develop therapeutics and diagnostics for COVID-19.

The researchers have generated custom-designed viral protein sequences and expression constructs to serve as antigens in serological assays. Initial testing has shown the antigens can be used to differentiate between COVID-19 positive and COVID-19 negative patient samples. The proof-of-concept serological assay using the antigens demonstrated sensitivity and specificity for SARS-CoV-2 antibodies in serum and plasma.

The antigens can also be used in the design of therapeutics for the treatment of COVID-19 including antibody-based therapeutics as well as vaccines.

Rundown

- Custom antigens can be used to develop diagnostics and therapeutics for COVID-19
- Antigens show specificity and selectivity for SARS-CoV-2 antibodies
- Serologic assay shows high sensitivity and low background

INVENTORS
- Andrew Schnaubelt
- Chittibabu Guda
- Gloria Borgstahl
- Ken Bayles
- Mara Jana Broadhurst
- Siddappa Byareddy
- St Patrick Reid

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Infectious Diseases

Drug Depot

On-demand, localized therapeutic delivery with engineered drug depot

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.

Drug Depot

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

INVENTORS
- Bin Duan
- Lee Korshoj
- Tammy Kielian
- Wen Shi

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Infectious Diseases

Debridement Iontophoresis Device

New device treats biofilms

UNMC researchers have developed a system that treats bacterial biofilms and enhances the delivery and penetration of drugs delivered through iontophoresis—a process that uses an electric current to drive the ions of a chemical or drug through the skin and into deeper tissues.

Biofilms—a slimy, layered community of microbes that can form on wounds, medical devices and implants—are notoriously difficult to treat. Biofilms are typically resistant to most antibiotics and quickly regrow if improperly treated. Infected devices, such as implants, often need to be replaced with highly invasive and risky surgical procedures. For infected wounds, successfully treating a biofilm could mean removing the infected tissue.

UNMC's new device improves the current standard treatments of washing wounds, absorption of topical therapeutics through the skin, or surgically removing the biofilm from the surrounding tissue. These current remedies—with therapeutics that are unable to target all of the microbes in the biofilm community—could cause the biofilm bacteria to spread further into the wound, damage surrounding healthy tissue. Failing to fully remove or kill all of the biofilm microbes could result in the biofilm reforming.

When operated at high electrical currents, iontophoresis devices allows for faster transport and penetration of a chemical or drug into the skin. Unfortunately, the higher currents also cause burns, discoloration or rashes on patients' skin. But treating a biofilm-infected wound with UNMC's water-stable, hydrogel-based ionic circuit system could minimize the burns and discomfort associated with current iontophoresis devices while more rapidly and effectively delivering therapeutics to the afflicted tissues.

To learn more about this technology, contact Amanda Hawley, PhD, at ahawley@unmc.edu or 402-310-5602.

Rundown

- Treat biofilm-infected wounds
- Improved drug delivery, penetration through tissues
- Reduce regrowth of drug-resistant biofilm bacteria
- Available for licensing

Inventors

- Siwei Zhao, PhD
- Fan Zhao, PhD

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COVID-19

Infectious Diseases

Nanofiber Swabs

Design outperforms traditional cotton and flocked swabs

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.

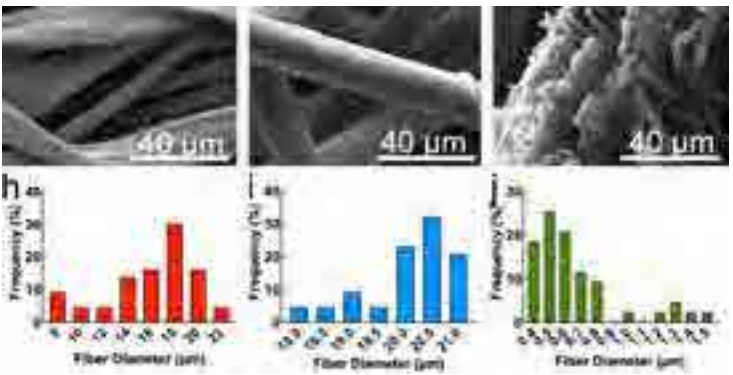
Additional applications include use in forensic sciences, where obtaining small molecules such as DNA can be exceptionally challenging.

Rundown

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

INVENTORS

- Jingwei Xie, PhD
- Mark Carlson, MD
- Shixuan Chen, PhD
- Alec McCarthy



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COVID-19

Infectious Diseases

Vaccine Platform

New strategy to prevent viral infections, including coronavirus

Researchers at the University of Nebraska Medical Center have developed a modular vaccine system that can be used to generate vaccines against known and emerging viral pathogens. The system can rapidly generate vaccine candidates and allows for the incorporation of multiple peptide-based antigens from a virus of interest or from multiple viruses. Since multiple antigens can be combined in one vaccine, it can help increase the efficacy of vaccines against emerging viral diseases.

Researchers are exploring the use of this new vaccine system for emerging viral diseases such as COVID-19 (SARS-CoV-2), SARS (SARS-CoV-1), MERS and Ebola, as well as for the production of vaccines against well-known viral pathogens such as Influenzas A and B.

Rundown

- System rapidly generates vaccine candidates
- Incorporates multiple peptide-based antigens
- Increases vaccine efficacy against emerging viral diseases
- Potential use for COVID-19 (SARS-CoV-2), SARS (SARS-CoV-1), MERS, Ebola, Influenza A and Influenza B

INVENTORS
- Karen Zagorski
- Yuri Lyubchenko

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Infectious Diseases

Long Acting Formulations for Hepatitis B

New formulation improves treatment of Hepatitis B

Researchers at the University of Nebraska Medical Center are developing promising new treatment strategies for Hepatitis B.

The innovation features injectable, long acting-slow release prodrug-based formulations of a class of antiviral drugs called thiazolides. The new formulation can be effectively packaged into nanoparticles that slowly release the active drug in a patient's body.

The goal of this strategy is to create a once-a-month injectable formulation, or even a once every three- or six-month injectable formulation.

Currently, the researchers are developing prodrug formulations of nitazoxanide for testing in animal models of Hepatitis B infection.

They are also developing prodrug formulations of other anti-viral drugs such as nucleoside reverse transcriptase inhibitors, which can also treats Hepatitis B.

To discuss licensing opportunities contact Matt Boehm, Ph.D., at mboehm@unmc.edu or 402-536-9881.

Rundown

- Sustained delivery of antiviral agents
- Decreased dosing
- Increased patient compliance

INVENTORS

- Howard Gendelman, MD
- Benson Edagwa, PhD

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Infectious Diseases

Macrophage targeted nanoparticles
Empower macrophages to treat biofilm infections

Bacterial biofilm infections are notoriously difficult to treat, but scientists at UNMC have developed a new option that could change that.

Rundown
- Treatment for clearance of biofilm infection
- Enhances macrophage targeting of biofilms
- May prevent need for surgical removal of infected implants

INVENTORS
- Kelsey Yamada
- Tammy Kielian
- Tatiana Bronich
- Xinyuan Xi

Biofilm infections are colonies of bacteria that bond together, creating a nearly impenetrable barrier to traditional antibiotic therapies. These challenging infections occurred in more than 20,000 patients who underwent total knee- or hip-replacement surgeries in 2020. If the biofilm infection is unresponsive to traditional antibiotics, then surgeons often need to remove the orthopedic implant, significantly prolonging patient recovery.

Tammy Kielian, Ph.D., and her laboratory have demonstrated that biofilms actually reprogram macrophages to become less active, decreasing their ability to attack the biofilm. One way that biofilms target macrophages is to reprogram their metabolic profile. Dr. Kielian's team has shown that reversing this metabolic reprograming makes macrophages more effective at attacking biofilm infections.

Dr. Kielian's group has developed a nanoparticle system capable of targeting and reprograming macrophages' metabolic profiles to increase their ability to attack and destroy biofilms. Combining these specialized nanoparticles with standard antibiotics can effectively clear established biofilm infections.

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COVID-19

Infectious Diseases

Naso/Oropharyngeal Swab Specimen Trainer

Training tool improves deft of clinical skill, patient comfort

The UNMC iEXCEL team, in collaboration with the Chamberlain Group, has created a novel oral/nasopharyngeal training model. This anatomically accurate model, created from a CT scan, is the most sophisticated and life-like trainer currently on the market.

Christie Barnes, MD, assistant professor and rhinologist in the UNMC Department of Otolaryngology-Head and Neck Surgery, simulates doing a nasal pharyngeal swab for COVID on the Oral Nasal Pharyngeal Anatomy Clinical Education trainer.

Nasopharyngeal swabbing has become a household term during the COVID pandemic. The technique is both critical for sampling potentially infected tissue and notorious for its discomfort on patients. The fact is that millions of front-line healthcare workers had never performed the technique, and far too few had even practiced the technique.

Enter the Oral Nasal Pharyngeal Anatomy Clinical Education trainers, or ONPACE. The portable trainers provide visual feedback of proper overall technique for the trainee, and contain a clear side view for real-time instructor observation and more precise feedback.

ONPACE trainers are available for purchase via The Chamberlain Group at https://www.thecgroup.com/product/onpace-training-system-9046/.

Rundown

- Correct oral, nasal pharyngeal swabbing training system
- Interchangeable normal and deviated septa
- Visual feedback of proper technique
- Clear side view for real-time instructor observation and evaluation
- Available for purchase or licensing

INVENTORS

- Benjamin Stobbe
- Christie Barnes
- Jayme Dowdall
- Samuel Pate

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Antischistosomal aryl hydatoins

New drug prevents, treats tropical parasite disease

UNMC researchers have developed a new strategy for treating one of the world's most prolific parasitic infections, schistomiasis.

Rundown

- Next generation drugs for schistosomiasis
- Fewer side effects than Praziquantel
- Effective against both juvenile and adult forms of schistosome parasites

INVENTORS

- Derek Leas
- Jonathon Vennerstrom

Parasitic worms cause schistosomiasis, a world-wide disease most common in the tropical regions of Africa, Asia and South America. Schistosoma, also known as bilharzia, affects as many as 200 million worldwide, with 779 million living at risk of infection. The disease can lead to inflammation and scarring in the intestine, liver or bladder, but children with chronic infections often suffer from anemia, malnutrition and learning difficulties, according to the Centers for Disease Control and Prevention.

The best option available today is a "preventive chemotherapy" program that treats millions of school-age children with praziquantel, or PZQ for short. PZQ is the only drug available for treatment of this disease, but it is rapidly metabolized, rarely curative, and has little activity against juvenile schistosomula, the young developmental stage of the parasite (Utzinger et al., 2011; Olliaro et al., 2014; Bergquist et al., 2017).

Should serious PZQ drug resistance arise, there are no viable alternatives to this drug.

The innovation at UNMC is a series of aryl hydantoins that have superior pharmacokinetic profiles compared to PZQ. Unlike PZQ, these new compounds have high efficacy against both juvenile and adult forms of the schistosome parasite. They have potential applications for both prevention and treatment, and could perhaps even help eradicate schistosomiasis.

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COVID-19

Infectious Diseases

Infectious aerosol filter housing

Reusable housing allows replacement filters

Virus filters are commonly used to prevent patients from dispersing virus-containing droplets when receiving oxygen therapy, or during intubation procedures that use ventilators to help the patients breathe. But during a pandemic like the COVID-19 outbreak, supplies of the typically disposable single-use filters become scarce.

Innovators at the University of Nebraska Medical Center developed a replacement filter housing that can be cleaned and opened so that replacement filter paper can be inserted.

The filter housing can also be fitted to any tube system, including ventilators. It also comes in various sizes and shapes to accommodate virtually any need for in-line filtered tubing systems.

Rundown

- Overcomes filter scarcity during pandemics like COVID-19
- Can be cleaned and reused
- Can accommodate any tubing system
- Several sizes and shapes are also available

INVENTORS
- Greg Pugh
- James Linder
- Max Kaeter
- Nicholas Markin
- Steven Lisco

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GEMs for COVID-19

Find answers with genetically engineered mice for SARS-CoV-2

Mouse models could create answers to several lingering unanswered questions about the COVID-19 outbreak and the virus that created it, SARS-CoV-2. Geneneticlly engineered mice will help scientists understand the molecular mechanisms of the virus, repurpose currently available antiviral drugs, and provide an opportunity to develop new therapies and vaccines against COVID-19. One major challenge in achieving these goals is the lack of suitable preclinical animal models.

Unfortunately, SARS-CoV-2 only infects mice if they express human ACE2. This feature, combined with a wealth of genetic tools available only in mice, offers a unique opportunity for creating a versatile set of genetically engineered mouse models useful for COVID-19 and SARS-CoV-2 research.

UNMC researcher, Channabasaviah Gurumurthy, PhD, has developed three broad categories of genetically engineered mouse models, and about 30 different model designs for SARS-CoV-2 research:

1. *Knocking-in expression cassettes, or point mutations, into the endogenous mouse ACE2 locus.*
2. *Knocking-in CRE-activatable- or tetracycline inducible-hACE2 expression cassettes into safe-harbor loci, by re-engineering the existing reporter or inducer lines.*
3. *Knocking-in CRE-activatable cassettes into the mouse ACE2 locus.*

The natural non-permissiveness of mice to SARS-CoV-2 infection in combination with a wide variety of available genetic tools and molecular switches offers a unique opportunity to make this species useful for COVID-19 research.

Rundown

- Preclinical mouse models directed towards a variety of members in the SARS-CoV-2 transmission process
- Models are generated under different mouse backgrounds
- Research use only

INVENTORS
- Channabasavaiah Gurumurthy
- Masato Ohtsukan
- Rolen Quadros

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Infectious Diseases

Automated Antibiogram

Automated, real-time antimicrobial stewardship solution

A UNMC Public Health Informatics team led by W. Scott Campbell, MBA, Ph.D., has developed an automated, real-time antibiogram.

All hospitals and clinics are federally required to report antibiotic usage as part of their antimicrobial stewardship. This software application can easily connect with any hospital system to generate real-time, automated reports.

On top of fulfilling a mandated requirement, these reports can also help clinicians make more intelligent antibiotic selections.

Rundown

- Automated software application
- Generates hospital-specific antibiograms
- Uses patient data and controlled medical terminologies
- Could inform antibiotic usage

INVENTORS

- Caitlin Murphy
- James Campbell
- Nicholas Staffend
- Trevor VanSchooneveld
- W. Scott Campbell

The software application is currently in-use at the University of Nebraska Medical Center.

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COVID-19

Infectious Diseases

Infectious Aerosol Capture Mask

New device protects caregivers from viral exposure

A new protective device can help protect healthcare workers everywhere, preventing infected patients from spraying or exhaling viral agents and potentially infecting others in the room.

Aerosol capture maskDeveloped by the chair of UNMC's Department of Anesthesiology, Steven Lisco, M.D., the Infectious Aerosol Capture Mask is a face tent that covers the patient's mouth and nose, and is then coupled with a viral filter and a special adapter that connects the unit to standard vacuum supplies in most clinical settings.

The Nebraska Medicine Innovation Committee has approved the device for use in its facilities, and has already deployed them in operating rooms and elsewhere in the hospital.

Hospitals risk wider contamination from COVID-19 patients when they cough or even just breathe. They produce microscopic particles that float through the air of their rooms, and potentially beyond. Even patients that have no symptoms may still unwittingly spread the virus in the same way, particularly when wearing supplemental oxygen or undergoing the procedures that insert or remove breathing tubes.

Dr. Lisco said in a recent announcement the device performed well in early tests, "catching more than 90 percent of airborne particles expelled in the mask, ultimately preventing the aerosol from entering the patient environment." He added: "Even when the vacuum wasn't turned on, the mask was still 85 percent effective as a barrier."

At this initial stage, the special adapter for the Infectious Aerosol Capture Mask is available for purchase through Omaha Custom Manufacturing at info@omahacustommfg.com or 800-228-5021. All other components are commonly accessible in most clinical settings and readily found through various medical equipment suppliers.

A future version of the technology will incorporate all components into one contiguous device, but that will not be available for purchase until later this year.

Rundown

- Limits caregiver exposure to aerosolized viral agents
- Covers the patient's mouth and nose
- Assembled from commonly available products in clinical settings
- Universal adapter connects to standard vacuum line found in most clinical settings

INVENTORS
- Nicholas Markin
- Steven Lisco

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Infectious Diseases

Antimicrobial bone scaffold
Improve healing, prevent infection with 3D bioprinted scaffold

Researchers at the University of Nebraska Medical Center have invented a novel bone scaffold that supports healing while simultaneously preventing infections. With the help of the latest 3D bioprinting technology, they created a device that is equal parts regenerative and antimicrobial in one biocompatible package.

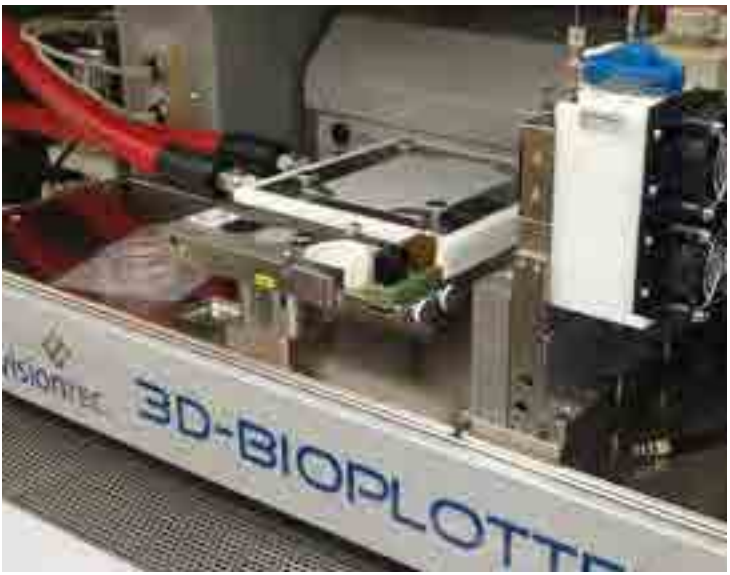
An initial prototype demonstrated tremendous efficacy in a mouse craniotomy model of biofilm infection. Final product embodiments include off-the-shelf and patient-specific products.

Regrow bone tissue

- Biocompatible
- Supports bone healing
- Applications include craniotomies
- Trimmable off-the-shelf or patient-specific
- Prevents/manages infections including biofilms

INVENTORS

- Bin Duan, Ph.D.
- Amy Aldrich, Ph.D.
- Mitchell Kuss, Ph.D.
- Tammy Kielian, Ph.D.



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Targeted biofilm prevention

Prevent, treat biofilms by targeting the immune system

More than a million cases of hospital-acquired infections can be traced to biofilm, a slimy coating of microbes that can form on medical devices and implants.

Biofilm infections are notoriously difficult to treat without removing or replacing the infected medical device. Treatment is further hindered by the development of antibacterial resistant strains of microbes.

But researchers at the University of Nebraska Medical Center have discovered a new way to combat device-related infections. Rather than pursue traditional routes of treatment with antibiotics, Dr. Tammy Kielian has discovered a method to prevent, treat and destroy biofilms that adhere to implanted medical devices.

Dr. Tammy Kielian has discovered that the inhibition of a certain population of cells known as myeloid-derived suppressor cells, enhances the ability of the body's immune system to attack and clear biofilms.

By targeting a patient's own cells, rather than using antibiotics, this approach may also help decrease the likelihood of developing antibiotic-resistant bacteria.

Rundown

- Minimizes biofilm infections
- Proof of concept in animal models

Inventor

- Tammy Kielian, Ph.D.

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Infectious Diseases

COVID-19

Z-filter Device

Captures infectious aerosol particles during treatments

Clinicians from the University of Nebraska Medical Center have developed the Z-filter, a device that mitigates the release of infectious aerosolized particles during nebulizing treatments.

Asthmatic patients or patients experiencing difficulty breathing or shortness of breath, require breathing treatments delivered via a nebulizer, which aerosolizes a liquid medication. The nebulizer allows for faster and less invasive uptake by the patient via their respiratory system. However, in scenarios where the patient may have a highly infectious disease, there is a potential to spread of infectious pathogens as the patient's breath is dispersed

into the air via the nebulizer's high airflow. Many health-care facilities have stopped all nebulized treatments in fear of contaminating rooms with SARS-CoV-2, the coronavirus responsible for COVID-19.

The Z-filter is an add-on attachment designed for universal fit with standard oxygen masks that are required for nebulizing treatments. Its construction prevents the release of exhaled infectious particles into the air.

Considering the many upcoming changes in healthcare practices and procedures, the Z-filter could become a standard practice in the future.

Rundown

- Allows nebulized treatment in patients with infectious diseases
- Prevents environmental contamination
- Preliminary testing exhibits excellent recapture of aerosolized saline

INVENTORS
- Heather Nichold
- Michael Wadman
- Thang Nguyen
- Wesley Zeger

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Antimicrobial peptides

Imbue orthopedic implants with primary immunity

All orthopedic implants, such as hip or knee replacements, eventually fail. But if an implant gets infected it fails much more rapidly and can even lead to death. Researchers at the University of Nebraska Medical Center discovered a new way to prevent implant-associated biofilm infections. Guangshun Wang, Ph.D., designed antimicrobial peptides to coat the surface of metallic orthopedic implants and specifically target antibiotic resistant infections known as MRSA or methicillin-resistant Staphylococcus aureus. Not only do the novel proteins prevent MRSA biofilm formation, but they also recruit host immune cells to help clear any opportunistic bacteria.

Dr. Wang's technology effectively imbues the medical device with its own innate immunity. In humans, innate immunity represents the front line defense against pathogens. Implants, however, have no such basic protections against infections, including MRSA, which accounts for two-thirds of all orthopedic implant infections. Implants can become unchecked breeding grounds for biofilm infections and ultimately lead to total device replacement—at best.

Rundown

- Highly effective against leading causes of orthopedic infections including MRSA
- Ability to prevent bacterial biofilm formation; Formulated for immobilization unto metal surfaces
- Evidence of innate immune cell recruitment

INVENTOR

- Guangshun Wang, Ph.D.

More than one million Americans receive hip or knee replacements each year. While about 90 percent of those procedures are still effective 10 years later, about 100,000 patients will undergo a repeat procedure to alleviate pain associated with prosthetic loosening or bacterial infection.

As an opportunistic pathogen, MRSA has evolved numerous strategies for evading the human immune system. MRSA has a particularly notorious ability to find, attach to, and create bacterial biofilms on orthopedic implants. Once a MRSA biofilm is fully formed, the only effective treatment involves total removal of the orthopedic implant. Even then, the patient is at a permanently increased risk for repeat infection.

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COVID-19

Infectious Diseases

Two-part Face Shield

New design improves PPE adherence

Donning and doffing personal protective equipment can be cumbersome, and carries with it the risk of potential exposure. During the on-going COVID-19 pandemic, clinicians are expected to have a face shield on at all times. They are expected to change the face shield between each patient visit or in case of a shortage, decontaminate the shield between visits.

The present face shields are attached to the clinician's head by an elastic band. Taking the shield off between each visit is cumbersome as it could get caught in hair or clothing and thus increase the risk of infection. To avoid this, clinicians at the University of Nebraska Medical Center have developed a two-part face shield that can be easily removed between each patient visit. In times of shortage, it can be easily decontaminated according to hospital protocols. This lowers risk because the elastic band stays on throughout the day, so there is minimal need to touch the head.

Rundown

- User protected from exposure to disease conditions
- Shield can be re-used under shortage conditions
- Can be easily de-contaminated

INVENTORS

- Michael Wadman
- Thang Nguyen
- Wesley Zeger

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COVID-19

Infectious Diseases

Modular Electronic Decision Support Builder

Pediatric interactive screening tool adapts to institutional needs

Physicians from Omaha's Children's Hospital and Medical Center have developed a pediatric-specific COVID-19 screener. This application can be accessed by a one-time download as an offline app or directly on the web.

This tool can be used by a variety of clinical and non-clinical end-users to access information step-by-step. The software also provides tracking to connect user behavior with access of tagged content within the tool. The customization nature of the tool allows for institutional-level branding and adjustment of content to fit the local context.

Commercial applications include user data analytics and observation, branding and delivery of content to target populations, use in public health, and dissemination or implementation of projects to improve healthcare processes or outcomes. The combination of customizable content, user analytics, and interactive surveys combines multiple distinct features into a single software tool.

Rundown

- COVID-19 screener specifically for pediatric patients
- Available as a web-based or native app
- Allows for institutional-level branding

INVENTORS
- Ellen Kerns
- Russell McCulloh

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Infectious Diseases

Peptides Targeting Ebola

Engineered peptides can treat Ebola

UNMC researchers, led by Steven Hinrichs, M.D., Chair of the Department of Pathology and Microbiology, have developed antimicrobial peptides with efficacy against the Ebola virus.

The engineered peptides are derivatives of human LL-37 (Cathelicidin) and function by impairing the CatB-mediated cleavage of the viral glycoprotein; the process necessary for the virus to enter a host cell.

Such peptides could be used prophylactically to prevent Ebola, or therapeutically to treat the infection at a very early stage.

Rundown

- Human LL-37 antimicrobial peptide variants
- Can inhibit Ebola infection
- Impair CatB-mediated cleavage of Ebola virus glycoprotein
- Prophylactic or early therapeutic potential

INVENTORS
- Gus Wang
- Kaihong Su
- St Patrick Reid
- Steven Hinrichs
- Yangsheng Yu

Produced by the National Institute of Allergy and Infectious Diseases, under a magnification of 25,000X, this digitally-colorized scanning electron micrograph depicts numerous filamentous Ebola virus particles (green) budding from a chronically-infected VERO E6 cell (orange).

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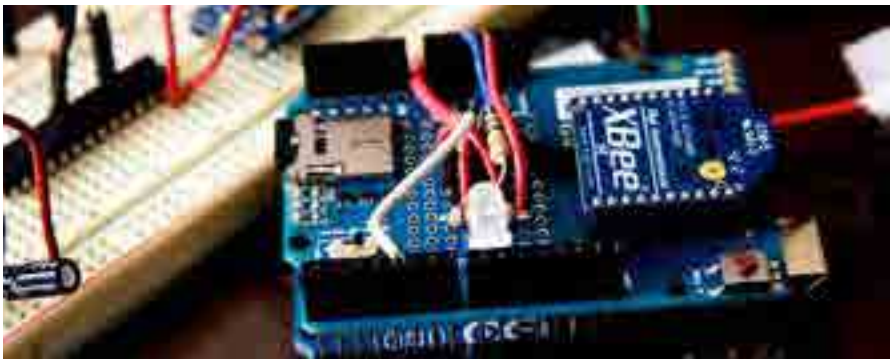
University of Nebraska

TECHNOLOGY PORTFOLIO

2025

cancer
cardiovascular
drug delivery
infectious diseases
medical devices
metabolic
miscellaneous
neurologic
research tools
software
startups



Medical Devices

Adhesion Preventing Hydrogel

Novel hydrogel helps prevent dangerous surgery complications

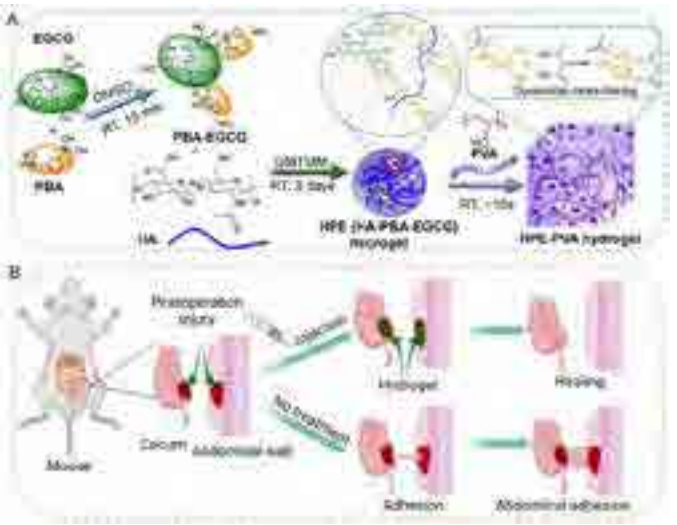
Internal scarring after abdominal surgeries often leads to severe complications, including pain, infertility, and even death. Despite ongoing research, many preventative treatments fall short due to incomplete coverage and the complex shape of the affected area.

Bin Duan, PhD, a researcher at UNMC, developed a groundbreaking hydrogel that molds perfectly around the impacted area, effectively preventing scar tissue from damaging the abdominal organs. The hydrogel eliminates the need for other treatments and provides longer therapeutic coverage, while minimizing inflammation and scarring during critical stages of healing.

Preliminary animal studies have shown promising results in safety and efficacy.

Rundown

- Prevents post-operative adhesions in the abdomen
- Holds anti-inflammatory, antioxidative, & self-healing properties
- Clinical grade effectiveness in mouse models



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Wearable Hydrogels

Print biosensors with hydrogel 'ink'

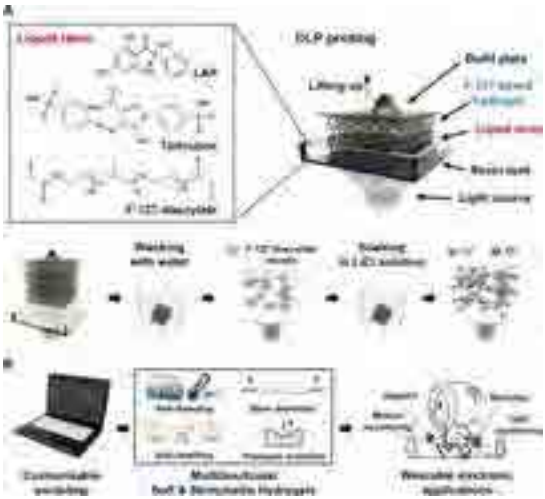
In the past, 3D printing with hydrogel materials lacked the necessary strength and durability to withstand extreme environments and forceful movements.

Now, Bin Duan, PhD, a researcher at UNMC, has developed a novel hydrogel structure that uses digital light processing (DLP) 3D printing technology to produce durable biosensors.

The hydrogel is the ink used to produce a biosensor. Companies that produce these biosensors could use the material in many different applications, ranging from motion detection to pressure sensing. This advancement in 3D printing materials paves the way for the creation of custom biosensors that offer superior integration and deliver precise patient data, regardless of environmental conditions. This hydrogel formulation also has outstanding biocompatibility, making it safe for use in human applications.

Rundown

- Has promise for biosensor applications
- Biocompatible & safe for human use
- Platform for custom biosensors
- Can survive extreme cold and destructive forces



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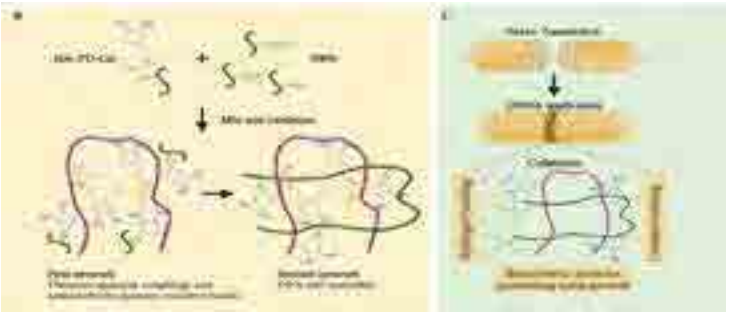
Medical Devices

Nerve Adhesive

Could replace standard treatment of severed nerves



When a nerve is cut or divided, the transection can lead to pain, numbness, and loss of mobility. Current treatments for transected nerves often result in poor recovery for 33 percent of patients post-surgery.

However, Bin Duan, PhD, at the University of Nebraska Medical Center, has developed a groundbreaking nerve adhesive that could heal patients more effectively. This new adhesive, designed as an alternative to traditional nerve sutures, significantly reduces scarring and enhances nerve regeneration. Faster nerve regeneration can minimize long-term damage, such as muscle atrophy, permanent weakness, and chronic pain.

Using glue structures modeled after the same chemical that mussels use for underwater adhesion, the biomaterial forms bonds strong enough to withstand forces that might otherwise disrupt the repair. The direct nerve to nerve connection promotes faster nerve regrowth and debris clearance. The new nerve glue also promotes stronger nerve reconnection and reduces secondary damage normally caused by nerve sutures.

Preliminary testing has shown it is safe and effective in mice and rabbit models.

Rundown

- Can reconnect nerves
- Better than sutures & fibrin glue
- Mimics chemical formula found in underwater mussels
- Quick curing properties make it useful in surgery

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COVID-19

Medical Devices

3-in-1 Oxygen Mask Modification

Decrease aerosolized germ spread, improve drug delivery

A simple yet innovative attachment for simple oxygen masks could revolutionize patient care and reduce the spread of contagious diseases. Designed for use with patients hospitalized with influenza, COVID-19, and other aerosolized diseases, the attachment delivers oxygen and medication more effectively.

Traditionally, hospitals relied on costly negative pressure protocols to contain pathogens, which placed a heavy burden on healthcare workers while consuming significant energy. Using 3D printing technology this innovative approach creates a positive pressure mask that prevents germs from escaping the patient's mouth or nose.

Unlike standard oxygen masks, this modified version allows real-time sampling and testing of the patient's breath, enabling immediate analysis of contagiousness, diagnosis, and pathogen clearance. Additionally, the positive pressure mask improves medication delivery. Medications for aerosolized infections, typically administered in nebulized form, can be fully delivered to the patient without escaping into the surrounding air.

Rundown

- Innovation modifies standard oxygen mask
- Small change that increases mask's utility, safety, & effectiveness
- Decreases burden of aerosolized diseases in hospitals
- Improves treatment for infected patients
- Test aerosolized bacteria inhaled through the mask

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Research Tools

Healthcare PAPR Helmet

Design improves safety, comfort and communication

Powered air purifying respirators (PAPRs)—and related personal protective equipment—are manufactured with astronauts and miners in mind, not healthcare workers. Regardless, protective gear such as PAPRs have been adopted in healthcare to protect clinicians from highly infectious respiratory pathogens. The bulky and sometimes awkward devices might be great at protecting its wearer from the vacuum of space or meeting the intense physical demands of protecting a miner from coal dust. But a healthcare worker in a clinical setting has different needs.

A UNMC team led by Elizabeth Beam, PhD, RN, and Bethany Lowndes, PhD, MPH, contracted with UNO's Brian Knarr, PhD, and Andrew Walski in the Machine and Prototyping Core to design and prototype a PAPR with the healthcare worker in mind. The result was a lightweight PAPR helmet that is all at once convenient to don and doff properly and easy to sanitize. With reduced fan noise and full-face visibility, the design goes far beyond improving user comfort and convenience to enhance performance and communication.

Rundown
- Lightweight
- Comfortable
- Reduced fan noise
- Full face visibility

The significant impact on clinician comfort and communication, as well as interest from large companies and the military, made this invention UNeMed's Most Promising New Invention of 2024.

The Healthcare PAPR Helmet Team has secured two grants to perform usability testing and create a ruggedized version for military use in austere environments.

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Medical Devices

Guided Endodontic System

Perform easy, precise endodontics…every time

Guided dental implant surgery has become routine, but there are no commercial products for guided endodontics.

Greg Bennett, DMD, has developed a novel, complete system for endodontics.

The system includes drills, hollow channel posts, and guided sleeves. With this system, any dentist can easily and precisely initiate the endodontic access for treatment, create post space for the corresponding endodontic post, and remove the post via in situ obliteration.

Every dental office uses guided implant surgery. Soon, every dental office will use guided endodontics too.

To discuss licensing opportunities, contact Tyler Scherr, Ph.D., at tyler.scherr@unmc.edu or 402-559-2468.

Rundown

- System includes drills, hollow channel posts, and guided sleeves
- Improved precision during both implantation and removal
- Optimized for guided endodontic access, post-space preparation, and post removal
- Designed to match the cutting end diameter of commonly used endodontic files

Inventor
- Greg Bennett

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Medical Devices

Debridement Iontophoresis Device

New device treats biofilms

UNMC researchers have developed a system that treats bacterial biofilms and enhances the delivery and penetration of drugs delivered through iontophoresis—a process that uses an electric current to drive the ions of a chemical or drug through the skin and into deeper tissues.

Biofilms—a slimy, layered community of microbes that can form on wounds, medical devices and implants—are notoriously difficult to treat. Biofilms are typically resistant to most antibiotics and quickly regrow if improperly treated. Infected devices, such as implants, often need to be replaced with highly invasive and risky surgical procedures. For infected wounds, successfully treating a biofilm could mean removing the infected tissue.

UNMC's new device improves the current standard treatments of washing wounds, absorption of topical therapeutics through the skin, or surgically removing the biofilm from the surrounding tissue. These current remedies—with therapeutics that are unable to target all of the microbes in the biofilm community—could cause the biofilm bacteria to spread further into the wound, damage surrounding healthy tissue. Failing to fully remove or kill all of the biofilm microbes could result in the biofilm reforming.

When operated at high electrical currents, iontophoresis devices allows for faster transport and penetration of a chemical or drug into the skin. Unfortunately, the higher currents also cause burns, discoloration or rashes on patients' skin. But treating a biofilm-infected wound with UNMC's water-stable, hydrogel-based ionic circuit system could minimize the burns and discomfort associated with current iontophoresis devices while more rapidly and effectively delivering therapeutics to the afflicted tissues.

To learn more about this technology, contact Amanda Hawley, PhD, at ahawley@unmc.edu or 402-310-5602.

Rundown

- Treat biofilm-infected wounds
- Improved drug delivery, penetration through tissues
- Reduce regrowth of drug-resistant biofilm bacteria
- Available for licensing

Inventors

- Siwei Zhao, PhD
- Fan Zhao, PhD

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Medical Devices

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.

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

INVENTORS
- Benjamin Stobbe
- Benjamin Wankum
- Keely Buesing
- Mark Carlson
- Riley Reynolds
- Sean Crimmins

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Medical Devices

Hybrid arm

One device combines best of body-powered, motor-driven prostheses

A new cyborg prosthetic arm design brings prosthetics one step closer to replicating anatomy.

Traditional electronically-powered prostheses have two common downfalls: weight and a lack of manual, body-powered control.

To solve these issues, a research team at UNO Biomechanics designed a novel prosthetic arm that incorporates the best of both worlds: It has both the lightweight feel of a body-powered prosthetic and the improved functionality of an electronically-powered device.

Using a body-powered prosthetic base, the hybrid arm still provides manual control.

Manual motor control is an important feature because it permits the development of healthy and strong muscles in children who would normally abandon the use of their affected limb. That leads to long-term weakness and even postural problems such as scoliosis.

To reduce weight and enhance ease of use, fewer (and lighter-weight) motors are used.

Rather than developing all of the force needed to grip objects, the motors in this hybrid design are intended to augment the user's strength to make using the prosthetic easier and to encourage them to use the strength they have.

Rundown

- Strategically combines body-powered and motor-driven actuation
- Lightweight
- Ergonomic
- Decreased muscle fatigue

INVENTORS

- James Pierce
- Jean Peck
- Jorge Zuniga
- Rakesh Srivastava
- Walker Arce

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Modular arm
Prosthetic adapts to user's lifestyle

A modular prosthetic arm, invented at UNO Biomechanics, is body-powered, lightweight and made to accommodate a smorgasbord of task-specific end-effector attachments. The end-effectors are specially engineered to perform specific, challenging tasks such as playing a stringed instrument, swimming, riding a bike, and participating in team sports like basketball and baseball.

The end-effectors can be easily removed and replaced as needed so active users can easily move from one task to the next.

Rundown
- Body-powered prostheses
- Task-specific end-effectors
- Unique end-effectors for: playing stringed instruments, swimming, bike riding, team sports, etc.
- End-effectors can be easily replaced

INVENTORS
- James Pierce
- Jean Peck
- Jorge Zuniga
- Keaton Young

Medical Devices

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Medical Devices

Nanofiber for hemostasis

Sponges rapidly absorb fluids

A new technology to stop severe bleeding injuries has been developed by researchers at the University of Nebraska Medical Center.

The technology is a nanofiber-based sponge capable of rapidly absorbing blood and other fluids while still retaining its overall shape and size.

The nanofiber sponge absorbs more fluid, more quickly than traditional gauze products and gelatin sponges currently on the market.

The nanofiber sponges were tested in a large animal liver injury model. In the tests, the nanofiber sponges effectively stopped the catastrophic bleeding, and greatly reduced overall blood loss.

The new nanofiber sponge will be a useful addition to surgical suites, emergency rooms and the battlefield.

Rundown

- Rapidly absorb blood and other fluids
- Retain shape when wet
- Capable of retaining more fluid than gelatin sponges and other products
- Effective in large animal study

INVENTORS

- Jingwei Xie
- Mark Carlson
- Shixuan Chen

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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.

Rundown

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

INVENTOR
- Siwei Zhao

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Medical Devices

Height Adjustable Radial Platform

Medical device improves 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.

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

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Medical Devices

Nanofiber microspheres

Enhance cell delivery for improved healing

University of Nebraska researchers have designed a new nanofiber-based microsphere can deliver cell therapies for wound healing and tissue regeneration.

The nanofiber microspheres are manufactured using electrospraying and are highly customizable. Invented and developed at the University of Nebraska, the nanofiber microspheres can be made in a wide variety of shapes and designs, including hollow spheres and spheres with various sized pores. The nanofiber microspheres have a large surface-area-to-volume ratio, which helps cellular infiltration from the surface into the microsphere.

The nanofiber microspheres also allow for improved viability and maintenance of stem cells, making the microspheres an ideal tool for cell therapy approaches.

Rundown

- Novel method of microsphere formation via electrospinning and electrospraying
- Delivery of cell therapies for wound healing
- Noninvasive alternative to surgical scaffold placement

INVENTOR
- Jingwei Xie

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Medical Devices

Cervical Spine Disc Retractor

New device improves spinal access during neck surgeries

UNMC neurosurgeons have re-engineered c-spine retractors, a tool that enables neurosurgeons to spread the vertebra of the neck in order to perform spinal surgeries.

Current devices are bulky and can severely limit the amount of working space available to the surgeon, but UNMC's new cervical disc spreader has a much smaller profile and detachable components.

Functional prototypes built with surgical-grade stainless steel, have shown great promise in cadaver studies. The studies show that the device significantly improves the surgical working space during cervical spine surgeries, allowing superior physician access during complicated neurosurgical procedures.

Rundown

- Superior physician access to surgical site
- Particularly beneficial for bariatric patients
- Surgical-grade steel that can be sterilized and reused
- Available in various sizes, shapes

INVENTORS
- Daniel Surdell
- Joseph McMordie

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Medical Devices

Nanofiber rings
Implant, customize drug delivery device

Researchers at the University of Nebraska Medical Center have developed a new implantable drug delivery device made out of nanofibers.

This new device is a nanofiber-based ring that is biodegradable, versatile and customizable.

The nanofiber rings can be loaded with a variety of different types of drugs including small molecules and biologics. The devices can also be loaded with multiple drugs at one time, allowing for the delivery of a combination therapy.

Another unique property of this device is that the nanofiber rings can be customized to allow for different release properties of each drug loaded into the ring. This includes delayed release of drugs, sequential release of multiple drugs, and parallel release of multiple drugs.

Rundown

- Capable of delivering, variety of drugs, including small molecules and biologics
- Biodegradable
- Can be loaded with more than one drug at a time
- Release kinetics of each drug can be tailored

INVENTOR
- Jingwei Xie, Ph.D.

The unique properties of the nanofiber ring structure make it ideal for use as an implantable drug delivery device.

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Medical Devices

Safety Electric Cautery

Prevent accidental cuts, burns and fires in ORs

A newly designed protective sleeve could nearly eliminate accidental cuts, burns and fires in operating rooms.

Current Electric cauteries are invaluable surgical tools, used daily to cut through soft tissue and stop bleeding. But they also carry with them the potential for accidental harm.

Developed by Jason Johanning, M.D., the Safety Electric Cautery features an easily extendable protective sleeve. The sleeve not only covers the hot cautery tip between uses, but the device also automatically turns off when the sleeve is fully extended.

Rundown

- Designed for safety
- Easily extendable protective sleeve
- Fail-safe kill switch when sleeve is extended over tip
- Prevent accidental operating room cuts, burns, fires

INVENTOR
- Jason Johanning

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COVID-19

Medical Devices

Nanofiber Swabs
Design outperforms traditional cotton and flocked swabs

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.

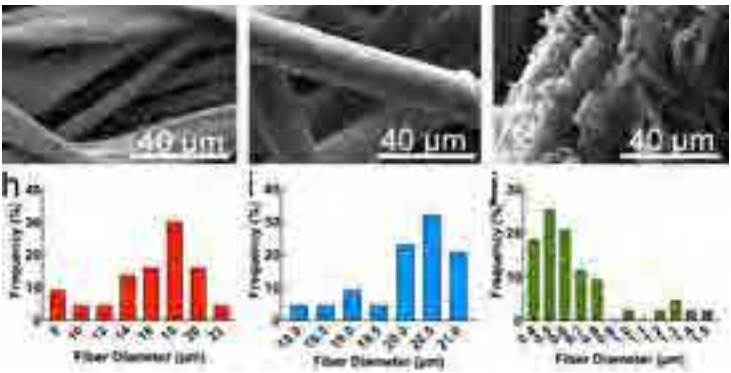
Unlike traditional swabs, nanofiber swabs were able to collect SARS-CoV-2 virus from diluted samples.

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

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

INVENTORS
- Jingwei Xie, PhD
- Mark Carlson, MD
- Shixuan Chen, PhD
- Alec McCarthy

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



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Medical Devices

Bone Allograft Coating
Shows significant increases bone growth and healing

Researchers at the University of Nebraska Medical Center and the University of Rochester developed a novel coating for structural bone allografts.

Rundown
- Versatile, can be tailored to specific needs
- Can be used to package therapeutic agents
- Coating with BMP-2 peptides enhances bone growth

INVENTORS
- Jingwei Xie
- Xinping Zhang

Structural allografts are the top choice to repair large bone defects that require immediate support. However, traditional allografts have a 60 percent failure rate within 10 years of implantation.

The team designed the new allograft coating technology to help enhance the properties of bone allografts, and improve their overall performance and success rates.

The new coating technology consists of a polymer coating applied to the allograft via electrospraying. This allows for a uniform coating of polymer that can be easily tailored to achieve the desired thicknesses.

The polymer coating can also be loaded with therapeutics such as biological factors that help enhance bone growth and healing, like bone morphogenic 2 peptides.

Researchers have tested the coating containing bone morphogenic 2 peptides and have shown that this coating significantly increased bone growth and healing while also decreasing fibrosis.

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Rapid hands-free airway management

New device allows hands-free, rapid intubation with improved visability, continuous suction

A team of emergency healthcare workers at UNMC created a small, hands-free airway management device that should make intubation procedures faster and safer.

Rundown

- Hands-free visualization of the airway in emergencies
- Rapid intubation possible; constant suctioning
- Working prototype available

INVENTORS
- Hani Haider
- Michael Wadman
- Thang Nguyen

Currently, clinical staff often maintain a patient's airway through a non-invasive technique called the jaw-thrust maneuver. In this technique, medical staff forcefully push forward the patient's jaw to establish a clear airway. Though this technique is effective in most instances, it does require constant, hands-on attention to maintain proper position of the jaw.

UNMC's solution to this problem is a small device that—when properly placed between a patient's teeth—facilitates the opening of the mouth while mechanically thrusting the jaw forward. The device is structured to use the patient's teeth as landmarks for proper insertion. The same structure also serves as a mechanical aid that helps clinicians perform the jaw-thrust maneuver.

Use of the device frees medical personnel to perform other critical tasks, which can include wound care or preparations for more advanced airway management.

Safeguards incorporated into the device displace the patient's cheek and lips, which protects the soft tissue from injury while allowing full visibility to the back of the patient's throat.

Increased visibility allows for advanced airway techniques such as endotracheal intubation without needing to remove the device. An integral retention holder also allows for hands-free placement of a suction catheter to help keep the airway clear of fluids during the intubation process.

This device is portable, requires minimal training, and has manufacturing costs equivalent to current devices on the market. A working prototype is available for use.

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COVID-19

Medical Devices

Infectious aerosol filter housing

Reusable housing allows replacement filters

Virus filters are commonly used to prevent patients from dispersing virus-containing droplets when receiving oxygen therapy, or during intubation procedures that use ventilators to help the patients breathe. But during a pandemic like the COVID-19 outbreak, supplies of the typically disposable single-use filters become scarce.

Innovators at the University of Nebraska Medical Center developed a replacement filter housing that can be cleaned and opened so that replacement filter paper can be inserted.

The filter housing can also be fitted to any tube system, including ventilators. It also comes in various sizes and shapes to accommodate virtually any need for in-line filtered tubing systems.

Rundown

- Overcomes filter scarcity during pandemics like COVID-19
- Can be cleaned and reused
- Can accommodate any tubing system
- Several sizes and shapes are also available

INVENTORS
- Greg Pugh
- James Linder
- Max Kaeter
- Nicholas Markin
- Steven Lisco

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Medical Devices

Cardiac vascular access graft

Better care for children with heart defects

Many babies born with congenital defects of the heart now live to become adults. Pediatric congenital heart disease and the heart defects that it produces used to be completely lethal. Surgery for congenital heart defects can now correct the majority of these heart defects in infants.

Treatment of heart defects in infants came from tireless innovation for congenital heart defect surgery and the combined expertise of teams of medical experts. Pediatric cardiologist Jeffrey Delaney, M.D., and pediatric thoracic surgeon James Hammel, M.D., embody that innovation.

Dr. Hammel surgically corrects birth defects of the heart and Dr. Delaney manages children living with congenital defects of the heart. Their collaboration is the kind of care that has produced the first generation of adults with congenital heart disease.

Rundown

- No deviation from current correction of congenital heart defects
- Improved access for better management
- Easier to use, more efficient

INVENTOR
- Jeff Delaney, M.D.

Together, they have invented a new pediatric medical device to correct heart defects. The device, utilized in the final stages of a Fontan procedure, will help facilitate management of the patient's congenital heart defects. A novel shunt, the device replaces traditional tubes that redirect blood flow away from defective parts of the hearth.

The improved device has permeable membranes to help the cardiologist regulate pressure in the tube. A radio opaque ring wreaths the membrane, making it easy to locate utilizing radiography.

Doctors Hammel and Delaney are prepared to conduct an animal study that will further validate the device. Contact UNeMed to discuss how to bring this vital new device to market and give children with life threatening heart defects more options in their care.

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Medical Devices

X-Ray Output Simulator

Train next generation of X-ray technologists, safely

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.

Rundown

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

INVENTORS

- Ellie Miller
- Eric Psota

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.

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COVID-19

Medical Devices

Infectious Aerosol Capture Mask

New device protects caregivers from viral exposure

A new protective device can help protect healthcare workers everywhere, preventing infected patients from spraying or exhaling viral agents and potentially infecting others in the room.

Aerosol capture maskDeveloped by the chair of UNMC's Department of Anesthesiology, Steven Lisco, M.D., the Infectious Aerosol Capture Mask is a face tent that covers the patient's mouth and nose, and is then coupled with a viral filter and a special adapter that connects the unit to standard vacuum supplies in most clinical settings.

The Nebraska Medicine Innovation Committee has approved the device for use in its facilities, and has already deployed them in operating rooms and elsewhere in the hospital.

Hospitals risk wider contamination from COVID-19 patients when they cough or even just breathe. They produce microscopic particles that float through the air of their rooms, and potentially beyond. Even patients that have no symptoms may still unwittingly spread the virus in the same way, particularly when wearing supplemental oxygen or undergoing the procedures that insert or remove breathing tubes.

Dr. Lisco said in a recent announcement the device performed well in early tests, "catching more than 90 percent of airborne particles expelled in the mask, ultimately preventing the aerosol from entering the patient environment." He added: "Even when the vacuum wasn't turned on, the mask was still 85 percent effective as a barrier."

At this initial stage, the special adapter for the Infectious Aerosol Capture Mask is available for purchase through Omaha Custom Manufacturing at info@omahacustommfg.com or 800-228-5021. All other components are commonly accessible in most clinical settings and readily found through various medical equipment suppliers.

A future version of the technology will incorporate all components into one contiguous device, but that will not be available for purchase until later this year.

Rundown

- Limits caregiver exposure to aerosolized viral agents
- Covers the patient's mouth and nose
- Assembled from commonly available products in clinical settings
- Universal adapter connects to standard vacuum line found in most clinical settings

INVENTORS
- Nicholas Markin
- Steven Lisco

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COVID-19

Medical Devices

Two-part Face Shield

New design improves PPE adherence

Donning and doffing personal protective equipment can be cumbersome, and carries with it the risk of potential exposure. During the on-going COVID-19 pandemic, clinicians are expected to have a face shield on at all times. They are expected to change the face shield between each patient visit or in case of a shortage, decontaminate the shield between visits.

The present face shields are attached to the clinician's head by an elastic band. Taking the shield off between each visit is cumbersome as it could get caught in hair or clothing and thus increase the risk of infection. To avoid this, clinicians at the University of Nebraska Medical Center have developed a two-part face shield that can be easily removed between each patient visit. In times of shortage, it can be easily decontaminated according to hospital protocols. This lowers risk because the elastic band stays on throughout the day, so there is minimal need to touch the head.

Rundown

- User protected from exposure to disease conditions
- Shield can be re-used under shortage conditions
- Can be easily de-contaminated

INVENTORS
- Michael Wadman
- Thang Nguyen
- Wesley Zeger

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Medical Devices

3D nanofiber scaffolds

New 3D scaffolds enhance bone growth, regeneration

Researchers at the University of Nebraska Medical Center have developed a new class of three-dimensional nanofiber scaffolds capable of stimulating rapid endogenous bone growth and regeneration.

These 3D nanofiber scaffolds are extremely versatile and customizable. The 3D scaffolds can be manufactured in a variety of shapes and sizes including cylinders, rectangles, discs and spheres. The manufacturing process also allows for customization of the internal structure of the scaffolds. The porosity of the scaffold and the internal alignment of the nanofibers can all be modified.

Rundown

- Versatile 3D scaffolds
- Customize shape, size and internal structure
- Enhance bone regeneration
- No need for therapeutics or other biologically active agents

Inventors

- Jingwei Xie
- Shixuan Chen

The 3D scaffolds stimulate bone growth without the addition or use of any drugs or biologically active agents.

UNMC researchers have tested the new 3D scaffolds in animal models and have shown that the 3D scaffolds significantly enhanced bone regeneration. The new bone that is formed is of high quality both internally and externally.

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Medical Devices

Enhance nanofiber mat properties

Better bandages make better scaffolds for repairing tissue

A new technique developed at the University of Nebraska Medical Center creates better nanofiber mats that could impact a wide range of health care applications, and could even improve elements of the environmental, energy, defense and security industries.

In the healthcare industry, better nanofiber mats would make more absorptive bandages and wound dressings; more effective scaffolds for tissue engineering and repair; and more efficient drug delivery materials. More broadly, the technique could also be used to make better filters, and chemical and biological detection sensors.

The new method enhances the properties of nanofiber mats produced by a technique known as "electrospinning."

Electrospinning produces nanometer-sized fibers that, in medical applications, are arranged and layered into bandage-sized mats. The nanofiber mats can then be used as wound dressings and scaffolds for tissue regeneration and cell-growth.

Method increases 3rd dimension

- Increases porosity
- Creates more absorptive materials
- Maintains nanoscale surface features
- Allows for robust cellular infiltration and proliferation in nanofiber mats

INVENTORS
- Jingwei Xie, Ph.D.
- Jiang Jiang, Ph.D.

Traditional electrospinning typically produces uncontrolled and densely packed fibers resulting in compact and thin nanofiber mats. Tightly packed fibers have limited use because they tend to prevent cells from migrating and growing.

UNMC researchers developed the solution with a new method that expands electrospun nanofiber mats in the third dimension. The result is a thicker and deeper mesh that more resembles a sponge.

The method uses a modified gas-foaming technique that essentially enhances the thickness of the nanofiber mats. The resulting mats are significantly more porous, making them more absorbent than traditional nanofiber membranes. Preliminary studies demonstrate robust cellular infiltration and proliferation within the expanded nanofiber mats compared to the limited number of cells that are seen on the surface of traditional nanofiber mats.

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COVID-19

Medical Devices

PAPR Adapter

3D print file creates adapter for previously incompatible systems

Clinicians at the University of Nebraska Medical Center and its clinical partner, Nebraska Medicine, developed a new solution to chronic shortages caused by the COVID-19 pandemic. In this case, they created a simple adapter that can be 3D-printed and used to maximize a hospital's Powered Air Purifying Respirator fleet, or PAPR for short.

The adapter enables hospitals and other clinical setting to connect a 3M Versaflow air handling unit with a Dover brand Hood.

Rundown

- Simple adapter can be 3D-printed
- Maximize a hospital's Powered Air Purifying Respirator fleet
- Adapter connects 3M Versa-flow air handling unit with a Dover brand Hood
- Print file available on request

INVENTORS

- Jerald Farke
- Nicholas Markin
- Tyler Scherr

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Medical Devices

Antimicrobial bone scaffold
Improve healing, prevent infection with 3D bioprinted scaffold

Researchers at the University of Nebraska Medical Center have invented a novel bone scaffold that supports healing while simultaneously preventing infections. With the help of the latest 3D bioprinting technology, they created a device that is equal parts regenerative and antimicrobial in one biocompatible package.

An initial prototype demonstrated tremendous efficacy in a mouse craniotomy model of biofilm infection. Final product embodiments include off-the-shelf and patient-specific products.

Regrow bone tissue

- Biocompatible
- Supports bone healing
- Applications include craniotomies
- Trimmable off-the-shelf or patient-specific
- Prevents/manages infections including biofilms

INVENTORS

- Bin Duan, Ph.D.
- Amy Aldrich, Ph.D.
- Mitchell Kuss, Ph.D.
- Tammy Kielian, Ph.D.

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COVID-19

Medical Devices

Z-filter Device

Captures infectious aerosol particles during treatments

Clinicians from the University of Nebraska Medical Center have developed the Z-filter, a device that mitigates the release of infectious aerosolized particles during nebulizing treatments.

Asthmatic patients or patients experiencing difficulty breathing or shortness of breath, require breathing treatments delivered via a nebulizer, which aerosolizes a liquid medication. The nebulizer allows for faster and less invasive uptake by the patient via their respiratory system. However, in scenarios where the patient may have a highly infectious disease, there is a potential to spread of infectious pathogens as the patient's breath is dispersed into the air via the nebulizer's high airflow. Many health-care facilities have stopped all nebulized treatments in fear of contaminating rooms with SARS-CoV-2, the coronavirus responsible for COVID-19.

The Z-filter is an add-on attachment designed for universal fit with standard oxygen masks that are required for nebulizing treatments. Its construction prevents the release of exhaled infectious particles into the air.

Considering the many upcoming changes in healthcare practices and procedures, the Z-filter could become a standard practice in the future.

Rundown

- Allows nebulized treatment in patients with infectious diseases
- Prevents environmental contamination
- Preliminary testing exhibits excellent recapture of aerosolized saline

INVENTORS
- Heather Nichold
- Michael Wadman
- Thang Nguyen
- Wesley Zeger

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Medical Devices

Wound irrigation system

Faster, easier wound-cleaning with continuous spray control

Inspired by their frustrations of repeatedly plunging a syringe into a sterile solution to spray a wound, emergency room personnel at UNMC found a way to save time and energy with a new irrigation system called "Wadwand."

Wound cleaning is an art where the doctor or nurse must pour the sterile saline solution into a basin, load the solution into a syringe, and spray the liquid from the syringe with the same force and consistency each time.

This method produces inconsistent amounts of pressure, particularly for deep wounds, which require much greater amounts of saline pressure.

The Wadwand uses a standard sterile solution bottle fitted with a specialized cap that hooks up to a uniquely designed irrigation wand. Providers are then able to initiate the flow of the saline solution and adjust the fluid pressure with the press of a finger.

The inventors have also developed a portable version that allows the user to clean wounds outside a healthcare facility.

UNeMed is seeking a partner to complete preclinical testing and help place a Wadwand irrigation system in ERs across the nation.

Rundown

- Fitted to a sterile solution
- Ergonomic design
- Cost-efficient
- Adjustable fluid pressure
- Continuous wound irrigation
- Improve wound cleansing
- Faster irrigation process

INVENTORS
- Michael Wadman, M.D.
- Thang Nguyen, A.P.R.N., M.S.L.
- Vincent Morris, A.P.R.N.
- Richard Morris

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Tongue retractor
Intubating made easier

Airway intubation, the procedure where an inserted tube assists a patient to breathe, can be complicated by the patient's anatomy, lack of mobility in the neck, and trauma in the mouth and throat.

Rundown
- Inexpensive device specialized for clearing the mouth and opening the jaw
- Easy to manufacture as a durable or disposable device
- A perfect complement to camera assisted intubation

INVENTORS
- Ben Boedeker, M.D., Ph.D.

UNMC physician Ben Boedeker developed a novel tongue retractor with a wider working blade and a more ergonomic curve that helps manage complications during intubation by immobilizing the tongue and facilitating jaw opening.

The intubating tongue retractor is a proven tool to help manage the difficult airway. It fills a recognized gap in airway management and will be an essential tool for any intubation kit.

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Medical Devices

Tissue regeneration scaffold

Nanofiber technology enhances wound healing, tissue regeneration

A new expanded nanofiber-based scaffold will help enhance tissue growth and regeneration within the body.

Invented at the University of Nebraska Medical Center, expanded nanofiber scaffolds can be customized to various shapes and dimensions allowing them to better fit within wounds and tissue defects. The new scaffolds are layered with a highly porous structure that allows optimal cell and tissue growth, compared to traditional nanofiber materials. The expanded nanofiber scaffolds are manufactured to contain an array of wells, or holes, for placing cells or minced tissue, which helps jump-start the tissue repair process.

The nanofiber scaffolds were tested in preliminary in vivo studies. The scaffolds were implanted subcutaneously in rats for one, two, and four weeks. Cellular infiltration occurred throughout the scaffold, along with blood vessel formation.

Rundown

- Made out of biodegradable and biocompatible expanded nanofibers
- Enhanced cell infiltration
- Size and shape of the nanofiber scaffold is customizable

INVENTORS

- Jingwei Xie, Ph.D.
- Mark Carlson, M.D.

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Medical Devices

Ergonomic surgical loupe head strap

Doctors no longer need to sacrifice precision for comfort

A new head strap for surgical magnifying eyeglasses—or surgical loupes—will relieve strain and fatigue for surgeons, clearing the way for more accurate and efficient procedures.

The new design removes the weight of cumbersome surgical loupes from the nasal bridge and ears, and redistributes the burden evenly across the head. The ergonomic surgical loupes head strap relieves the pain associated with poor posture and long procedures. It is easy to use, and fastens comfortably and securely to the user's head.

A leading pediatric ophthalmologist at the University of Nebraska Medical Center, Donny Suh, M.D., and a local inventor, James Hermsen, teamed up to invent the device.

Rundown

- Comfortably redistributes weight from nasal bridge
- Easily adjustable, one size fits most
- Securely holds surgical loupes in place

INVENTOR

- Donny Suh, M.D.
- James Hermsen

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Medical Devices

MedLens

Upgrade any smartphone into a diagnostic tool

MedLens is a versatile attachment that fits any smartphone, upgrading it into a diagnostic tool, such as a fundoscope or otoscope. MedLens can be quickly and easily attached to a smartphone and positioned over the camera lens using a simple rail-and-clamp system.

Once in place, the modular lens package design allows for multiple anatomical imaging applications. Users can even control the level of illumination for perfect contrast no matter the application.

Rundown

- Flexible fit for several smartphone models
- Modular lens packages for multiple anatomical imaging applications
- Illumination control for perfect contrast no matter the application

INVENTORS
- Donny Suh, M.D.
- Jesse Cox

This new device saves clinicians time and money, particularly in outreach or out-of-clinic settings. It also provides clinicians with a convenient way to record images and share them for further diagnostic examination and second opinions.

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Medical Devices

Distal radius fracture plating system

Universal plating system saves time, improves outcomes

Wrist fractures don't come in one shape and size, but a new fixation device just might. A leading orthopedic surgeon at the University of Nebraska Medical Center, Daniel Firestone, M.D., invented a universal wrist fracture fixation plate. By studying fragment-specific plating systems, Dr. Firestone designed a novel plate that blends the essential components of each. The result is an elegant system with enough flexibility to secure any of the most common wrist fracture patterns.

The Firestone Plating System is a next-generation technology that provides all of the benefits of fragment specific plating without the drawbacks associated with surgically placing multiple devices. It singlehandedly addresses a number of fractures in both dorsal and volar fragments. It's is easy to use and easier to install, potentially increasing operating room and surgical efficiency.

Rundown

- Universal plate for distal radius fractures
- Benefit of optimal fragment fixation systems
- Benefit of surgeon comfort with the procedure
- Replaces, combines several plating systems into one

INVENTOR

- Daniel Firestone, M.D.

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Medical Devices

Antimicrobial wound dressing

Improved wound dressings for treating, preventing 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. 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.

Rundown

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

INVENTORS
- Gus Wang
- Jingwei Xie

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Medical Devices

Sympathetic vasomotion monitoring

New device will improve outcomes in renal denervation procedures

Researchers at UNMC developed a device capable of making high blood pressure more treatable by accurately measuring the rhythmic constriction and relaxation of blood vessels, known as sympathetic vasomotion.

The sympathetic nervous system controls the body's automated functions such as digestion, heart rate and the vasomotion of blood vessels. Disruption of the sympathetic nervous system can contribute to a variety of chronic diseases, including high blood pressure.

Rundown

- Detects small changes
- Measures success of renal denervation
- Increase success rate
- Can screen for blood pressure-related fainting
- non-invasive hemodynamic monitoring

INVENTORS
- Irving Zucker, Ph.D.
- Alicia Schiller
- Peter Pellegrino

One potentially effective way to treat high blood pressure is to destroy, or ablate, all or parts of the sympathetic nerves of the kidneys. The problem, however, is until now there has not been an accurate tool that helps clinicians in real-time determine if the procedure is targeting the proper areas of the kidneys.

UNMC's detection system non-invasively monitors sympathetic nerve activity in real time and determines if a renal denervation procedure was successful. This technology will help significantly increase the success rate of renal denervation procedures.

UNMC researchers have shown that the sympathetic vasomotion detection system can accurately detect renal denervation in rat and rabbit models. A current study in pigs is expected to further validate the system's ability and accuracy.

The sympathetic vasomotion detection system is a versatile tool that can also monitor and detect other diseases or conditions associated with the sympathetic nervous system.

In addition to their work with renal denervation, UNMC researchers are also investigating the device's use as a screening tool for blood pressure-related fainting and non-invasive hemodynamic monitoring.

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Medical Devices

Improve AV fistulas

Fistulas mature faster, better & safer

Healthcare providers now have a better, more reliable way to improve dialysis in patients with kidney failure.

Hemodialysis simulates kidneys function by filtering a patient's blood outside the body to cleanse it from toxins. For dialysis to work properly, dialysis machines must filter as much blood as possible during each treatment.

An arteriovenous or AV fistula is a point of entry and exit to the blood vessels that also allows large amounts of blood to flow uninterrupted. This portal serves as a connection between an artery and a vein in the patient's arm and allows the vein to grow large and strong providing reliable access to blood vessels each time.

AV fistulas are a complex and imperfect solution, even when performed by an expert team of surgeons and support staff.

Rundown

- First major improvement for the AV fistula in more than 40 years
- Medical device that promotes fistula maturation
- Capable of maturing AV fistulas in an animal model
- Inexpensive, single use
- Multiple applications beyond fistula maturation

INVENTOR
- Marius Florescu, M.D.

The problem with creating AV fistulas is that they require weeks to months to develop, or mature, and strengthen before a patient can undergo hemodialysis. Many patients undergoing dialysis are never able to mature a large fistula.

A better, more reliable way to create AV fistulas seems like a good idea.

UNMC surgeon, Marius Florescu, M.D. has a new device that represents the first major improvement for the AV fistula in more than 40 years. His device promotes better AV fistula creation and maturation for hemodyalisis.

Dr. Florescu also made a critical discovery during his proof-of-concept work: Identifying the first known animal model in which AV fistulas can mature.

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Medical Devices

Boedeker suction catheter

Manage the airway of trauma patients

When emergency staff are challenged with a trauma patient that needs to be intubated, they must act swiftly. If the patient suffers from abundant bleeding of the mouth, aspiration, or vomiting the airway view could be obstructed.

While standard tubes are used for suction, specialized suction may also be necessary. In addition, for a patient needing intubation, it may also be worthwhile to blow oxygen.

Dr. Ben Boedeker of the University of Nebraska Medical Center has created a solution to the above mentioned problems.

The Boedeker Suction Catheter is unique as it can be customized to fit any manufacturer's blade, it integrates into the blade channel to keep it out of the way, and it does not only provide suction but can also blow oxygen to aid in managing the airway. The medical practitioner utilizing the device can also control the rate of flow or suction.

In addition, 100% of anesthesiologists who surveyed the device stated they would like access to the technology. They would also be very likely to use the device if they had it in their repertoire.

Moreover, according to Emergency Medical Services magazine (EMS World), the Boedeker Suction Catheter is one of twenty most innovative products in the field of 2015.

The Boedeker Suction Catheter is currently produced by Truer Medical. Please contact Dr. Caronda Moore today to find out how to include this award-winning device to your airway management products.

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Medical Devices

Automated REBOA

New device to save patients from catastrophic bleeding

A new automated bleeding-control system that can reduce deaths related to catastrophic internal bleeding has been developed at the University of Nebraska Medical Center.

Internal bleeding is a common result of injuries from car crashes, falls, and gunshot wounds, accounting more than half of all American deaths between 1- and 44-years-old. Depending on the severity of the injury, the risk of death increases if the internal bleeding is not controlled in the first hour after the incident.

Automated hemorrhage control system

- Rapid occlusion and cessation of hemorrhaging vessels
- Shunts blood flow to downstream organs and tissue
- Reduced mortality from traumatic bleeding injuries
- Easy retrieval of a temporary endovascular medical device
- Better and safer alternative for REBOA
- Automated system for reduced operator error

INVENTORS
- Jason MacTaggart, M.D.
- Alexey Kamenskiy, Ph.D.

In the hospital, surgeons can stop severe bleeding by inserting a small balloon into a blood vessel near the injury site. The balloon—called a REBOA or Resuscitative Endovascular Balloon Occlusion of the Aorta device—is then inflated blocking flow and preventing further blood loss.

The problem with this approach is that traditional REBOA devices block all blood flow, which can lead to permanent damage if organs and tissue downstream of the device are starved from their blood supply for too long. UNMC's novel device does more than just block flow: The innovative design has the ability to bypass the damaged area and maintain blood supply to vital organs and tissues downstream of the injury.

The automated REBOA device precisely controls inflation and regulates the amount of blood flow to downstream tissue. The device is fully automated to decrease user error. It can be easily deployed within the injured vessel to prevent blood loss at the site of the injury while preserving blood flow to downstream organs and tissue.

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Medical Devices

Synthetic bypass graft

New design improves bypass success in lower extremities

Researchers at the University of Nebraska Medical Center 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.

A team of researchers at UNMC, led by vascular surgeon Jason MacTaggart, M.D., 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.

Rundown

- reinforces vessels, supports improved blood flow
- more flexible, prevents severe bending and kinking
- ideal for use in major joints like knees, elbows

INVENTORS

- Jason MacTaggart
- Kaspars Maleckis

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Medical Devices

Short nanofiber formulations for bone defects

Nanofiber formulation provides versatile approach to treating bone defects

Researchers at the University of Nebraska Medical Center have developed a nanofiber-based therapy for the treatment of bone defects.

This therapy consists of mineralized short nanofiber fragments that are conjugated to BMP-2 mimicking peptides. These short nanofiber fragments are easy to manufacture and can be made from a variety of polymers. They are versatile and can be formulated into powders, gels, and sprays for easy administration.

These short nanofibers have performed exceptionally well in repairing periodontal injuries in rats following molar tooth extraction.

Additionally, the short nanofibers can be used as a platform technology for delivering other therapeutic agents instead of BMP-2. Work is being done to develop short nanofiber formulations for treating hemorrhage and soft tissue injuries.

Rundown

- Highly customizable scaffold for bone tissue regeneration
- May be formulated with additional therapeutics for targeted therapy
- Biodegradable

INVENTORS
- Jingwei Xie
- Sunil Kumar Boda

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Medical Devices

Fall risk assessment insole

Predict falls to prevent injuries

Slips and falls are random. But we know several risk factors that make falling down much more likely. Risk factors include advancing age, visual impairments, muscle weakness and even prior hospitalization.

A special insole and a proprietary algorithm could help physicians more accurately predict the likelihood of falling, and help prevent serious injuries to elderly patients in particular.

Nick Stergiou, Ph.D., and his colleagues in the biomechanics department at the University of Nebraska at Omaha, developed such a device—the insole and the accompanying algorithm—

for fall-risk assessment. The portable, wireless device can be easily worn to collect critical biometric data after a few minutes of walking. The data can be stored on the device and transferred to the program via USB, or uploaded wirelessly to the cloud.

The current prototype assesses fall risk in a small population with 90 percent specificity. The research team believes they can refine the algorithm to increase specificity even further with a larger sample size.

Contact Tyler Scherr, Ph.D., at tyler.scherr@unmc.edu or 402-559-2140 to discuss partnering and licensing opportunities.

Rundown

- One-third of adults older than 65 fall each year
- Two-thirds of adults older than 65 have been hospitalized after a fall
- Portable insole assesses risk of falling in minutes
- Fall risk can be assessed with 90 percent specificity

Inventors

- Arash Gonabadi
- Max Kurz
- Nicholas Stergiou
- Philippe Malcolm

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Medical Devices

Portable laparoscope

Perform affordable laparoscopic surgery for all

One of the greatest advances in surgery is the advent of laparoscopic surgery, now a standard of care in most countries.

Looking to extend the use of laparoscopic surgery into developing economies, Chandra Are, M.D., a surgical oncologist at the University of Nebraska Medical Center invented a portable system that takes laparoscopic surgery beyond the dedicated operating room and into the hands of surgeons in a non-traditonal environment with minimal support.

Laparoscopic surgery owes its success to the minimally invasive strategy. Laparoscopic surgery occurs with no open incisions as the surgeon makes small holes to insert cameras and other surgical tools. As a result, laparoscopy is a dedicated specialty that involves expensive laparoscopic suites, with state-of-the-art equipment. It's a kind of surgery performed in one kind of place.

Dr. Are's portable laparoscope technology allows emerging economies to keep up with the standard of care and practice laparoscopic surgery. This groundbreaking system takes the function of a laparoscopic suite and reproduces it in a portable system enabling laparoscopic investigation outside of the minimally invasive suite.

Rundown

- Inexpensive to manufacture and employ
- Requires only minimal clinical support
- Improves access to laparoscopy in emerging economies
- Expands the clinical usefulness of the laparoscope beyond the operating room

Inventors
- Chandrakanth Are
- Dennis Alexander
- Madhuri Are

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cancer
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research tools
software
startups

Metabolic

Anti-INHBA siRNA

Targeted RNAi intervention treats several indications

So-Youn Kim, PhD, and Seok-Yeong Yu, PhD of the University of Nebraska Medical Center have developed an RNAi intervention to treat cachexia: a complex syndrome resulting in the progressive loss of muscle and fat. Cachexia is often observed with cancer, heart failure, diabetes and other chronic diseases.

Cancer patient data and animal studies show that cachexia is associated with elevated levels of a certain molecule in the blood called activin A. This molecule, specifically expressed by the INHBA gene, is normally involved in a number of cellular processes, including the creation of blood cells and connective tissue.

Targeting anti-INHBA siRNA constructs in a pancreatic ductal adenocarcinoma mouse study, yielded a decrease in activin A. This approach also prevented the rapid loss of body weight, slowed tumor growth and improved survival rates in pancreatic cancer-driven cachexia.

This intervention could treat a variety of diseases that exhibit increased levels of activin A in the blood, including cancer, autoimmune diseases, fibrotic disorders, blood disorders, allergies, heart failure, neurodegenerative diseases and inflammatory diseases.

To learn more about this technology, contact Amanda Hawley, PhD, at ahawley@unmc.edu or 402-310-5602

Rundown

- Treat cancer and fibrosis
- Targeted gene therapy
- Reduce the impacts of disease-driven cachexia
- Available for licensing

Inventors

- So-Youn Kim, PhD
- Seok-Yeong Yu, PhD

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Type I Diabetes Diagnostic

New blood test may improve diabetic outcomes

A new method for assessing the risk of developing Type I diabetes could help physicians make diagnoses earlier than ever before. A simple blood test developed at the University of Nebraska Medical Center monitors certain immune cell populations which can indicate changes in normal physiology.

Rundown

- Type I diabetes diagnostic
- Simple blood test
- Helps predict immunotherapy treatments
- Flow cytometry based assay to assess populations of T-cell subsets

INVENTORS

- Nora Sarvetnick, Ph.D.
- Robert Harms

This method may catch Type 1 diabetes earlier, which would mean more therapeutic and preventative options for patients and their physicians. This method might also predict patient responses to immunological treatment options.

Current diagnostics of Type 1 diabetes rely on the presence of circulating antibodies. Those antibodies only become detectable once the disease has progressed to the point of irreparably damaging healthy tissue.

Type 1 diabetes occurs when the body's immune cells target healthy tissue in the pancreas. The pancreas is responsible for producing insulin, which is a vital part of how the body processes sugar in the blood. Once the immune cells destroy the parts of the pancreas responsible for insulin production, sugar is no longer processed normally, which is why people with Type 1 diabetes need daily insulin injections to survive.

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Metabolic

Improve AV fistulas

Fistulas mature faster, better & safer

Healthcare providers now have a better, more reliable way to improve dialysis in patients with kidney failure.

Hemodialysis simulates kidneys function by filtering a patient's blood outside the body to cleanse it from toxins. For dialysis to work properly, dialysis machines must filter as much blood as possible during each treatment.

An arteriovenous or AV fistula is a point of entry and exit to the blood vessels that also allows large amounts of blood to flow uninterrupted. This portal serves as a connection between an artery and a vein in the patient's arm and allows the vein to grow large and strong providing reliable access to blood vessels each time.

AV fistulas are a complex and imperfect solution, even when performed by an expert team of surgeons and support staff.

Rundown

- First major improvement for the AV fistula in more than 40 years
- Medical device that promotes fistula maturation
- Capable of maturing AV fistulas in an animal model
- Inexpensive, single use
- Multiple applications beyond fistula maturation

INVENTOR
- Marius Florescu, M.D.

The problem with creating AV fistulas is that they require weeks to months to develop, or mature, and strengthen before a patient can undergo hemodialysis. Many patients undergoing dialysis are never able to mature a large fistula.

A better, more reliable way to create AV fistulas seems like a good idea.

UNMC surgeon, Marius Florescu, M.D. has a new device that represents the first major improvement for the AV fistula in more than 40 years. His device promotes better AV fistula creation and maturation for hemodyalisis.

Dr. Florescu also made a critical discovery during his proof-of-concept work: Identifying the first known animal model in which AV fistulas can mature.

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PDE4B selective inhibitors

Improve treatments for inflammatory diseases

A UNMC chemist has developed new compounds for the treatment of inflammatory diseases.

These compounds target a protein called phosphodiesterase 4, or PDE4 for short. PDE4 regulates inflammation, and is involved in a number of inflammatory diseases such as chronic obstructive pulmonary disease, rheumatoid arthritis, psoriasis, atopic dermatitis, inflammatory bowel disease, and central nervous system diseases that include drug addiction, schizophrenia and neurodegenerative diseases.

Rundown

- Selective for the B isoform of PDE4
- Enhanced uptake into the CNS
- Nanomolar potency
- Useful for treating a variety of inflammatory diseases

INVENTOR

- Corey Hopkins, Ph.D.

Several approved drugs currently target PDE4, but with severe side effects—like nausea and vomiting—that limit their use. Many of the current PDE4 inhibitors have poor uptake into the central nervous system which limits their use in the treatment of central nervous system diseases.

UNMC's new PDE4 inhibitors target a specific isoform of PDE4, the B isoform. Targeting PDE4B should help significantly reduce side effects such as nausea and vomiting.

The new PDE4 inhibitors are designed for increased uptake into the central nervous system, making them more useful than current drugs for treating central nervous system-related inflammatory diseases.

Initial lead compounds exhibit nanomolar potency against PDE4B, an 8-10 fold improved selectivity for PDE4B, and good uptake into the brain. One lead compound has also shown significant improvement in a mouse model of cocaine addiction.

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Modular arm
Prosthetic adapts to user's lifestyle

A modular prosthetic arm, invented at UNO Biomechanics, is body-powered, lightweight and made to accommodate a smorgasbord of task-specific end-effector attachments. The end-effectors are specially engineered to perform specific, challenging tasks such as playing a stringed instrument, swimming, riding a bike, and participating in team sports like basketball and baseball.

The end-effectors can be easily removed and replaced as needed so active users can easily move from one task to the next.

Rundown
- Body-powered prostheses
- Task-specific end-effectors
- Unique end-effectors for: playing stringed instruments, swimming, bike riding, team sports, etc.
- End-effectors can be easily replaced

INVENTORS
- James Pierce
- Jean Peck
- Jorge Zuniga
- Keaton Young

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Hybrid arm

One device combines best of body-powered, motor-driven prostheses

A new cyborg prosthetic arm design brings prosthetics one step closer to replicating anatomy.

Traditional electronically-powered prostheses have two common downfalls: weight and a lack of manual, body-powered control.

To solve these issues, a research team at UNO Biomechanics designed a novel prosthetic arm that incorporates the best of both worlds: It has both the lightweight feel of a body-powered prosthetic and the improved functionality of an electronically-powered device.

Using a body-powered prosthetic base, the hybrid arm still provides manual control.

Manual motor control is an important feature because it permits the development of healthy and strong muscles in children who would normally abandon the use of their affected limb. That leads to long-term weakness and even postural problems such as scoliosis.

To reduce weight and enhance ease of use, fewer (and lighter-weight) motors are used.

Rather than developing all of the force needed to grip objects, the motors in this hybrid design are intended to augment the user's strength to make using the prosthetic easier and to encourage them to use the strength they have.

Rundown

- Strategically combines body-powered and motor-driven actuation
- Lightweight
- Ergonomic
- Decreased muscle fatigue

INVENTORS

- James Pierce
- Jean Peck
- Jorge Zuniga
- Rakesh Srivastava
- Walker Arce

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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.

Rundown

- Bilateral or unilateral assistive device
- Assists hip flexors, extensors
- Easy to use for at-home rehabilitation
- Can be worn under clothing for continual use

INVENTORS

- Kayla Kowalczyk
- Philippe Malcolm

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.

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X-Ray Output Simulator

Train next generation of X-ray technologists, safely

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.

Rundown

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

INVENTORS

- Ellie Miller
- Eric Psota

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.

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Transesophageal Echocardiography Phantom

Modular TEE simulator provides lifelike training

Nick Markin, M.D., Director of Perioperative Imaging at the University of Nebraska Medical Center, invented a modular Transesophageal Echocardiography (TEE) Phantom. The TEE Phantom allows the user to acquire and manipulate 3D color flow Doppler images of multiple heart abnormalities while using a clinical echo machine.

Rundown

- Acquire, manipulate 3D color flow Doppler images
- Modular design enables practice with multiple heart abnormalities
- Connects to clinical echo machines
- Lifelike training experience

INVENTOR
- Nick Markin, M.D.

TEE is a powerful technology for diagnosing heart disease and monitoring the heart condition during surgery. However, the procedure can be tricky and current educational simulators are expensive, limited, or do not use an actual clinical echo machine. This technology would provide crucial training for medical students and residents on the actual clinical machine prior to performing the procedure on a real patient.

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Miscellaneous

Lab safety posters

Let students see themselves in the laboratory

Scientific observations are just like any other: informed by a person's upbringing, biases and likes. The key to good science is diverse scientists so those observations are made from many points of view.

Science education needs to reach out to everyone. Science, Technology, Engineering and Math, STEM education, needs to do more to make scientists, engineers and mathematicians as diverse as the people that rely on their discoveries. Maurice Godfrey, Ph.D., produced science classroom posters that promote laboratory safety rules. The classroom posters depict students from diverse ethnic backgrounds. Each one focuses on a different aspect of laboratory safety.

Rundown

- Fun posters promote laboratory safety
- Available for purchase through Amazon

INVENTORS

- Maurice Godfrey, Ph.D.
- Kim Soper
- Liliana Bronner
- Tracy Arobba
- Roxanna Jokela
- Eric Haas

Dr. Godfrey produced the stem posters to include with teacher resources in mobile science classrooms to educate Native American children. These innovative posters are now available to the public through Nebraska Scientific.

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Nanofiber microspheres

Enhance cell delivery for improved healing

University of Nebraska researchers have designed a new nanofiber-based microsphere can deliver cell therapies for wound healing and tissue regeneration.

The nanofiber microspheres are manufactured using electrospraying and are highly customizable. Invented and developed at the University of Nebraska, the nanofiber microspheres can be made in a wide variety of shapes and designs, including hollow spheres and spheres with various sized pores. The nanofiber microspheres have a large surface-area-to-volume ratio, which helps cellular infiltration from the surface into the microsphere.

The nanofiber microspheres also allow for improved viability and maintenance of stem cells, making the microspheres an ideal tool for cell therapy approaches.

Rundown

- Novel method of microsphere formation via electrospinning and electrospraying
- Delivery of cell therapies for wound healing
- Noninvasive alternative to surgical scaffold placement

INVENTOR
- Jingwei Xie

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COVID-19

Miscellaneous

Naso/Oropharyngeal Swab Specimen Trainer

Training tool improves deft of clinical skill, patient comfort

The UNMC iEXCEL team, in collaboration with the Chamberlain Group, has created a novel oral/nasopharyngeal training model. This anatomically accurate model, created from a CT scan, is the most sophisticated and life-like trainer currently on the market.

Christie Barnes, MD, assistant professor and rhinologist in the UNMC Department of Otolaryngology-Head and Neck Surgery, simulates doing a nasal pharyngeal swab for COVID on the Oral Nasal Pharyngeal Anatomy Clinical Education trainer.

Nasopharyngeal swabbing has become a household term during the COVID pandemic. The technique is both critical for sampling potentially infected tissue and notorious for its discomfort on patients. The fact is that millions of front-line healthcare workers had never performed the technique, and far too few had even practiced the technique.

Enter the Oral Nasal Pharyngeal Anatomy Clinical Education trainers, or ONPACE. The portable trainers provide visual feedback of proper overall technique for the trainee, and contain a clear side view for real-time instructor observation and more precise feedback.

ONPACE trainers are available for purchase via The Chamberlain Group at https://www.thecgroup.com/product/onpace-training-system-9046/.

Rundown

- Correct oral, nasal pharyngeal swabbing training system
- Interchangeable normal and deviated septa
- Visual feedback of proper technique
- Clear side view for real-time instructor observation and evaluation
- Available for purchase or licensing

INVENTORS

- Benjamin Stobbe
- Christie Barnes
- Jayme Dowdall
- Samuel Pate

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Custom Medical Simulators

Lifelike models provide doctors just-in-time training

Nick Markin, M.D., Director of Perioperative Imaging at the University of Nebraska Medical Center, invented custom medical procedures simulators. These anatomically accurate simulators are made with artificial mimics of bone, tissue and vasculature. They are echogenic and provide training for multiple critical vascular access and non-vascular access procedures when they are needed most.

Rundown

- Anatomically accurate
- Layered models: artificial bone, tissue and vasculature
- Echogenic
- Critical vascular and non-vascular access procedures

INVENTOR
- Nick Markin, M.D.

Anesthesiologists perform many routine procedures, but occasionally receive patients with extreme trauma that require immediate and unique assistance. Due to the rarity of these events, it is difficult for clinicians to receive this crucial training. To solve this training gap, Dr. Markin developed a process for creating custom medical procedure simulators that fit into the "just-in-time" educational model. A "just-in-time" training platform is one that provides educational tools and courses as they are needed, rather than waiting for online courses or sporadic seminars.

Dr. Markin's portfolio currently contains intraosseous infusion and arterial cannulation models, with several more simulators in development.

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Parkinson's Disease

Vaccine may signal beginning of end to Parkinson's disease

A novel combination developed by researchers at the University of Nebraska Medical Center may be the final solution that could deliver a knockout blow to Parkinson's disease.

Howard Gendleman, M.D., and his team believe they are on the verge of producing an effective vaccine to battle the debilitating disorder that affects more than 1 million Americans. Right now, the only treatment options for Parkinson's—the world's second-leading neurodegenerative disorder behind Alzheimer's—are methods for reducing symptoms.

Rundown

- Novel therapeutic combination
- Treats underlying factors, not just symptoms
- Treats existing disease
- Prevents future disease
- Potentially useful for other neurodegenerative disorders

INVENOTRS

- Howard Gendelman, M.D.
- R. Lee Mosley, Ph.D.
- Ashley Reynolds, M.D., Ph.D.

But if Gendleman's approach succeeds, the immune systems of vaccinated patients will be armed to fend off the disease and prevent its disastrous effects.

The vaccine turns an old foe into a potential ally.

Vaccination with a protein, alpha-synuclein, alone actually has the ability to make Parkinson's even worse. But when the protein is paired with an immune modulator, it promotes an immune response that protects brain cells from further damage.

Preclinical studies show a remarkable 91 percent survival rate of neurons in treated laboratory mice. In January 2014, early stage clinical trial testing began on one of the vaccine's critical components. The early test will help determine if the immune system of a Parkinson's patient can be successfully modulated.

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Neurologic

Parkinson's Disease
New method allows for early diagnosis

A new discovery at the University of Nebraska Medical Center could take most of the guesswork out of delivering an accurate and reliable diagnosis for Parkinson's disease.

Current methods for diagnosing the more than 1 million Americans suffering from Parkinson's involve a basic neurological exam and information provided by the patient. The resulting diagnosis in early stage patients is often inaccurate, inconsistent, and must be periodically reevaluated.

A team led by research physician Howard Gendelman—the 2008 Scientist Laureate, UNMC's highest research honor—discovered a unique correlation between Parkinson's disease and a protein found in a certain subset of immune cells called T-cells. An abundance of the protein could indicate a more severe case of the disease.

Rundown
- Parkinson's Diagnostic
- Uses patient's cells
- Correlates immune cells with disease
- May allow for earlier and more accurate diagnosis
- Can monitor disease progression and therapy

INVENTORS
- Howard Gendelman, M.D.
- R. Lee Mosley, Ph.D.
- Jessica Hutter Saunders, Ph.D.

Researchers are currently developing a simple blood test that could help physicians detect and monitor the disease at the earliest stages. Early testing indicates a blood screen using this method would help patients and their doctors diagnose, track and monitor Parkinson's disease with more accuracy and confidence than ever before.

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Research Tools

Falcon Tube Insert

Test tube insert improves lab accuracy, efficiency

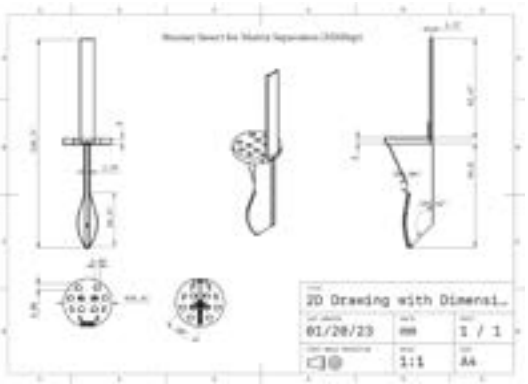
A new product can now enhance pathogen sample separation within a centrifuge tube. It is designed to improve the efficiency and accuracy of separating different components in a pathogen test mixture, a crucial step in various scientific and medical applications.

The strainer insert is easy to use and is specifically engineered to fit inside a standard centrifuge tube used in labs around the world.

It primarily acts as a barrier that allows smaller particles to pass through while retaining larger particles. This separation process is vital for tasks such as isolating cells, purifying samples, and preparing specimens for further analysis. The design also includes multiple layers of filtration, which enhances the precision of the separation process. This multi-layer approach ensures that even the smallest particles are effectively filtered, leading to more accurate and consistent results. The strainer insert represents a significant advancement in laboratory equipment through user-friendly design, durability, and multi-layer filtration system.

Rundown

- Specimen separates easier from sample collection material
- Improves test accuracy for infectious diseases
- Combines density separation with physical filtration



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NR-6-R cells

Cell line available for study of FGF activity

Fibroblast Growth Factors (FGFs) and fibroblast growth factor receptors together form a highly conserved signaling system that is used in both developmental and physiological processes of the adult. The 18 known FGFs are involved in the development and homeostasis of virtually every human tissue. Given its ubiquity, establishing FGF activity is a critical step in understanding a wide variety of biological processes.

Scientists at the University of Nebraska Medical Center have substantial expertise in assaying FGFs. Specifically, the isolation of NR-6-R cells and their use as a highly sensitive bioassay for FGFs was first reported by Dr. Angie Rizzino at UNMC within the Eppley Institute for Research in Cancer and Allied Diseases.

NR-6-R cells are a versatile and sensitive tool for determining FGF activity and have been employed in a variety of assays. UNeMed is currently offering licensing opportunities for the NR-6-R cells produced in Dr. Rizzino's laboratory. The cells can be employed in a wide variety of assays, such as soft agar assays and proliferation assays, to identify and measure FGF activity.

Rundown

- Research use only
- Non-exclusive licenses available

INVENTOR

- Angie Rizzino, PhD

Research Tools

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Research Tools

Optimized Gait Tether

Improve walking with a little boost at just the right time

Biomechanics researchers at the University of Nebraska at Omaha, led by Philippe Malcolm, PhD, have developed a controllable waist tether to optimize human locomotion.

The controllable waist tether can be personalized for various rehabilitation or athletic performance applications based on a user's biometric data.

Rundown

- Novel waist tether and programmable controller
- Individualized, optimized force profiles
- Personalized rehabilitation or athletic training program

INVENTORS

- Arash Gonabadi
- Philippe Malcolm
- Prokopios Antonellis

The device provides timed pulls on the user's waist from a motorized pulley system.

Initial therapeutic applications are currently under investigation for peripheral arterial disease.

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Research Tools

Panc02-MUC1 cells

Cell line available for in vivo study of anti-tumor effects of therapeutic compounds on MUC1-expressing pancreatic tumors

Pancreatic cancer is one of the leading causes of cancer related deaths. Pancreatic cancer is seldom detected at an early stage, spreads rapidly, and has poor prognosis with less than 5% surviving over a five-year time span. The majority of all patients with pancreatic cancer have non-operable disease and current chemotherapies and radiotherapies are largely ineffective. As a result, novel therapies that can effectively target pancreatic cancer and help prevent metastasis are needed.

Researchers at the University of Nebraska Medical Center have developed a mouse pancreatic tumor cell line overexpressing human MUC1. MUC1 is a protein that is expressed in over 90% of pancreatic tumors and is aberrantly glycosylated. Thus MUC1 appears to be a potential target for the development of pancreatic cancer therapies.

Researchers have shown that subcutaneous immunization of mice with MUC1-overexpressing pancreatic tumor cells, provided protection against subsequent intra-pancreatic tumor challenge with MUC1-overexpressing pancreatic tumor cells. Furthermore, through the use of MUC1-overexpressing pancreatic tumor cells researchers have discovered a number of specific immune components required for the elimination of pancreatic tumors expressing MUC1.

This technology provides an in vitro model for testing and developing MUC1 targeted pancreatic cancer therapies and for studying in vivo anti-tumor effects of therapeutic compounds on MUC1-expressing pancreatic tumors.

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Research Tools

Enhance nanofiber mat properties

Better bandages make better scaffolds for repairing tissue

A new technique developed at the University of Nebraska Medical Center creates better nanofiber mats that could impact a wide range of health care applications, and could even improve elements of the environmental, energy, defense and security industries.

In the healthcare industry, better nanofiber mats would make more absorptive bandages and wound dressings; more effective scaffolds for tissue engineering and repair; and more efficient drug delivery materials. More broadly, the technique could also be used to make better filters, and chemical and biological detection sensors.

The new method enhances the properties of nanofiber mats produced by a technique known as "electrospinning."

Electrospinning produces nanometer-sized fibers that, in medical applications, are arranged and layered into bandage-sized mats. The nanofiber mats can then be used as wound dressings and scaffolds for tissue regeneration and cell-growth.

Method increases 3rd dimension

- Increases porosity
- Creates more absorptive materials
- Maintains nanoscale surface features
- Allows for robust cellular infiltration and proliferation in nanofiber mats

INVENTORS
- Jingwei Xie, Ph.D.
- Jiang Jiang, Ph.D.

Traditional electrospinning typically produces uncontrolled and densely packed fibers resulting in compact and thin nanofiber mats. Tightly packed fibers have limited use because they tend to prevent cells from migrating and growing.

UNMC researchers developed the solution with a new method that expands electrospun nanofiber mats in the third dimension. The result is a thicker and deeper mesh that more resembles a sponge.

The method uses a modified gas-foaming technique that essentially enhances the thickness of the nanofiber mats. The resulting mats are significantly more porous, making them more absorbent than traditional nanofiber membranes. Preliminary studies demonstrate robust cellular infiltration and proliferation within the expanded nanofiber mats compared to the limited number of cells that are seen on the surface of traditional nanofiber mats.

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Research Tools

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.

Rundown

- Bilateral or unilateral assistive device
- Assists hip flexors, extensors
- Easy to use for at-home rehabilitation
- Can be worn under clothing for continual use

INVENTORS

- Kayla Kowalczyk
- Philippe Malcolm

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.

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Research Tools

Smart Leg Press

Receive objective muscle, ligament readings from any leg press machine

Biomechanics researchers at the University of Nebraska at Omaha, led by Brian Knarr, Ph.D., have developed a modular force-measuring device for physical therapy and rehabilitation applications.

The Smart Leg Press can be attached to most leg press machines, and provides objective force measurements independent for each leg. Data is wirelessly transferred to a software application for analysis and diagnosis.

Such measurements can be used for numerous applications including assessing limb strength asymmetry and staging ACL rehabilitation.

Rundown

- Modular force-measuring device
- Interfaces with most leg press machines
- Objective measure of limb strength asymmetry
- Validated for ACL rehabilitation

INVENTORS

- Adam Rosen
- Brian Knarr
- Kyle Brozek
- Mason Schleu
- Russell Buffum
- Travis Vanderheyden

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Research Tools

Clinical Training Mat

Smart, responsive mat collects training data

Biomechanics researchers at the University of Nebraska at Omaha, led by Brian Knarr, Ph.D., have developed a portable, durable and modular clinical training mat.

The smart training mat can be used in gyms, clinics, athletic departments and training facilities like any ordinary mat, but it can be programmed with different settings and will collect data accordingly. The data is then wirelessly transferred to a software application for analysis, scoring and diagnosis.

Rundown

- Portable, durable, modular
- Wirelessly transmits data to software application
- Agility training, rehabilitation and diagnostic applications

INVENTORS

- Adam Rosen
- Brian Knarr
- Russell Buffum
- Travis Vanderheyden

Applications include agility training, rehabilitation and diagnostics.

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Research Tools

Deconvolution of NGS mixtures

New tool improves molecular forensics

Jesse Cox, MD, PhD, the Director of Molecular Forensics at the University of Nebraska Medical Center, has developed a method for assigning ancestry and phenotypic information to both a major and minor contributor in a mixed biological sample.

In order to deconvolute the two samples in mixture, identification of anticipated allele frequencies can help to identify those alleles specific to the major contributor, those specific to the minor contributor, and those shared by both.

Currently, next-generation sequencing technology is being used only for single source specimens, but mixed biological samples of more than one individual are common in the field of forensics.

The ability to leverage next-generation sequencing to assign identifying information to major and minor contributors has immediate and practical benefits to the field of forensic pathology.

Rundown

- Algorithm and method for deconvoluting major and minor contributor in mixed biological sample
- Assign ancestry, phenotypic interpretations
- Applications in Next-Generation Sequencing DNA Forensics

INVENTORS

- Courtney Schweikart
- Jesse Cox
- Mellissa Halligso

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Research Tools

Ankle-PLAST
Measure athlete ankle health on the sideline in seconds

Biomechanics and kinesiology researchers at the University of Nebraska at Omaha, led by Adam Rosen, Ph.D., have developed a portable, easy-to-use ankle strength and laxity testing device.

e-PLAST quickly and easily evaluates ankle strength and laxity, providing objective data without the need for bulky, expensive machines. The data is then wirelessly transferred to a software application for analysis, scoring and diagnosis.

Applications include athletics, rehabilitation and diagnostics.

Rundown

- Ankle strength and laxity testing device
- Portable, easy to use
- Quickly, easily assess athlete ankle health in real-time

INVENTORS

- Adam Rosen
- Alec Anderson
- Anthondy Habib
- Brian Knarr
- Jarod Nekl
- Jonathon Pachuncka

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COVID-19

Research Tools

GEMs for COVID-19

Find answers with genetically engineered mice for SARS-CoV-2

Mouse models could create answers to several lingering unanswered questions about the COVID-19 outbreak and the virus that created it, SARS-CoV-2. Geneneticlly engineered mice will help scientists understand the molecular mechanisms of the virus, repurpose currently available antiviral drugs, and provide an opportunity to develop new therapies and vaccines against COVID-19. One major challenge in achieving these goals is the lack of suitable preclinical animal models.

Unfortunately, SARS-CoV-2 only infects mice if they express human ACE2. This feature, combined with a wealth of genetic tools available only in mice, offers a unique opportunity for creating a versatile set of genetically engineered mouse models useful for COVID-19 and SARS-CoV-2 research.

UNMC researcher, Channabasaviah Gurumurthy, PhD, has developed three broad categories of genetically engineered mouse models, and about 30 different model designs for SARS-CoV-2 research:

1. *Knocking-in expression cassettes, or point mutations, into the endogenous mouse ACE2 locus.*
2. *Knocking-in CRE-activatable- or tetracycline inducible-hACE2 expression cassettes into safe-harbor loci, by re-engineering the existing reporter or inducer lines.*
3. *Knocking-in CRE-activatable cassettes into the mouse ACE2 locus.*

The natural non-permissiveness of mice to SARS-CoV-2 infection in combination with a wide variety of available genetic tools and molecular switches offers a unique opportunity to make this species useful for COVID-19 research.

Rundown

- Preclinical mouse models directed towards a variety of members in the SARS-CoV-2 transmission process
- Models are generated under different mouse backgrounds
- Research use only

INVENTORS

- Channabasavaiah Gurumurthy
- Masato Ohtsukan
- Rolen Quadros

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Research Tools

iGONAD: improved-Genome editing via Oviductal Nucleic Acids Delivery

Directly edit zygote genes

The i-GONAD method delivers genome editing molecules, directly to E0.7 embryos in the oviducts of mice, via in situ electroporation. This technique generates mouse models that can contain single base changes, kilobase sized deletions and knock-ins. i-GONAD treated females retain reproductive function and are useful for generating germlines in future generations.

The University of Nebraska Medical Center's Channabasavaiah Gurumurthy, Ph.D., collaborated with Japanese researchers Masato Ohtsuka, Ph.D., and Hiromi Miura, Ph.D., of Tokai University's School of Medicine, invented i-GONAD . Traditionally, generating transgenic mouse-models involves three critical steps: isolation of zygotes from sacrificed females, zygote micromanipulation ex vivo and transfer of these modified zygotes into another set of female mice. This process has remained unchanged for over four decades and is laborious – requiring a high level of expertise, expensive and time-consuming.

The i-GONAD technique relives these steps by delivering genome editing nucleic acids and CRISPR components into embryos in situ. The process involves the exposure of the ovaries and oviduct of pregnant mice bearing E0.7 embryos. The genome editing reagents are injected into the oviductal lumen and the entire oviduct is subjected to electroporation using tweezer-type electrodes. These in situ, genome edited embryos are allowed to develop to term and genotyped for the targeted mutation.

This technique, when used in combination with Easi-CRISPR, another invention from Dr. Gurumurthy and Dr. Ohtsuka, inserts long single stranded DNA donor format with insertion efficiency as high as 100%. This combination changes the landscape of transgenic animal-model generation and provides a tool that is easy-to-perform and has high efficiency.

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Research Tools

Alcohol dehydrogenase-expressing VA-13 cells

Cell line available for the study of ethanol metabolism

Alcoholic liver disease (ALD) is a major problem associated with alcohol abuse. In fact, ALD is the second leading cause of death among all liver diseases. It is believed that ALD is due to a decreased ability of hepatocytes to regenerate due to prolonged exposure to toxic metabolic byproducts produced during alcohol oxidation/metabolism.

Rundown
- Research use only
- Non-exclusive licenses available

INVENTOR
- Dahn L Clemens, Ph.D.

One of the key enzymes involved in alcohol oxidation is alcohol dehydrogenase (ADH). ADH converts ethanol to acetaldehyde, which can then be converted to acetate by aldehyde dehydrogenase. Production of acetaldehyde from ethanol generates reactive oxygen species which in turn cause oxidative stress that can eventually lead to the development of ALD. However there is currently a great deal that is unknown about the exact mechanisms leading to the development of ALD.

To help study the metabolic basis of ethanol-induced hepatocellular injury researchers at the University of Nebraska Medical center have created a cell line using human hepatocellular carcinoma (HepG2) cells stably expressing ADH (VA-13 cells).

They have shown that VA-13 cells metabolize ethanol into acetaldehyde and have a dramatic increase in the NADH/NAD+ ratio indicating an increased redox-state. VA-13 cells cultured in the presence of ethanol also have a significant reduction in cell accumulation due to increased cytotoxicity and impaired DNA synthesis compared to cells without ADH. Further studies determined that the impairment of cell cycle progression in VA-13 cells was due in part to decreased Cdc2 activity.

This cell line is a promising tool that will help further elucidate the mechanisms of ethanol-induced hepatocellular injury.

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Research Tools

Cbl-b conditional knockout mouse

Mouse model available for the study of autoimmune disorders

Casitas B cell lymphoma-b (Cbl-b) is a member of the mammalian Cbl family of proteins which are characterized by an N-terminal tyrosine kinase binding domain, linker domain, RING finger domain, and a variable C-terminal domain. Cbl-b is an E3 ubiquitin ligase that is critical for the proper regulation of various receptor tyrosine kinases and non-receptor tyrosine kinases.

Loss of function of Cbl-b has been linked to a variety of diseases including cancer, myeloproliferative disorders, and autoimmune diseases such as arthritis and type 1 diabetes mellitus.

Researchers at the University of Nebraska Medical Center have created a conditional knockout Cbl-b mouse model. This novel mouse model allows for tissue specific knockdown of Cbl-b, which will be useful for exploring the role of Cbl-b in the development of autoimmune diseases. These mice will also provide a model to assess the efficacy of new anti-inflammatory drugs and will be useful for the identification of new biomarkers and drug targets for autoimmune disorders.

Rundown

- Research use only
- Non-exclusive licenses available

INVENTORS
- Hamid Band, M.D., Ph.D.
- Vimla Band, Ph.D.
- Mayumi Naramura
- Bhopal Mohapatra

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Research Tools

Easi-CRISPR

Increase DNA insertion efficiency with Easi-CRISPR

CRISPR, the newest gene editing technology, efficiently slices DNA unlike any other known procedure. It's a scientist's dream to delete mutated or faulty DNA. But CRISPR solves only half the problem.

While CRISPR can delete DNA, the process for replacing that piece has been unwieldly, imprecise and inefficient.

Easi-CRISPR is a simple protocol that inserts long, single-stranded DNA with remarkably high efficiency rates—up to 100 percent in some genes.

Rundown

- Highly efficient for animal model generation
- Insert large single-stranded DNA fragments with 83 percent efficiency
- Similar efficiency in therapeutic applications using electroporation

INVENTORS

- Channabasavaiah Gurumurthy, Ph.D.
- Masato Ohtsuka, Ph.D.
- Hiromi Miura, Ph.D.

As a research tool, Easi-CRISPR 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. The protocol takes approximately two months to generate either knock-in or conditional knock-out mouse models.

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Research Tools

Cryostat Sample Removal Device

Remove frozen tissue sections with ease

Researchers at the University of Nebraska Medical Center have developed a tool for easily removing sectioned, frozen tissue samples from a cryostat's specimen disk, or "chuck."

Rundown

- Accommodates multiple, standard sized cryostat chucks
- Made from high thermal conductivity material
- Quickly, easily remove frozen samples without heat, damage
- Can include temperature control system
- Can include cryostat machine mounts

INVENTORS
- Bin Duan
- Jiang Jiang

Like paraffin tissue sections, frozen tissue sections are widely used for disease diagnosis, surgical strategy, and medical research. After sectioning, the frozen tissue samples have to be removed from the chucks. The most common method is to simply use a blade, but this method has many disadvantages including the potential to damage the remaining tissue sample and even the potential for injury.

The cryostat sample removal device solves these problems by quickly, easily, and safely removing the tissue section from the chuck using high thermal conductivity material.

The device can accommodate multiple, standard-sized cryostat chucks, and can also include a temperature control system to ensure sample safety and a cryostat machine mount for storage.

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Research Tools

Anti-Ajuba
Ajuba plays an important role in regulation of the kinase activity of AURKA/Aurora-A for mitotic commitment. Ajuba is a component of the IL-1 signaling pathway modulating IL-1-induced NF-κB activation and also plays a role in cadherin-mediated cell-cell adhesion and influences cell migration.
Epitope: Human Ajuba
Species: Human
Uses: WB, IF
Type: Mouse mAb
Publications: None

Anti-ADA3 clone (5C9/C8)
Epitope: Human ADA3
Species: Human
Uses: WB, IHC
Type: Mouse mAb
Publications: Mohibi S et al. J. Biol Chem (2012) v287: 29442-29456 ; Mirza et al. Breast Cancer Res Treat (2013) v137: 721-731; Mohibi S et al. J. Biol Chem (2015) V290: 28299-28310

Anti-Cadherin 11 (16A6)
Cadherins are integral membrane proteins that mediate calcium-dependent cell-cell adhesion.
Epitope: EC domain Cad11
Species: Human
Uses: WB,IP, IF
Type: Mouse mAb
Publications: None

Anti-Cadherin 11 (16G5)
Cadherins are integral membrane proteins that mediate calcium-dependent cell-cell adhesion.
Epitope: EC domain Cad11
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: None

Anti-Cadherin 19 (1C11)
Cadherins are integral membrane proteins that mediate calcium-dependent cell-cell adhesion.
Epitope: Human Cadeherin 19
Species: Human
Uses: WB
Type: Mouse mAb
Publications: None

Anti-Desmoglein 2 (7H9)
Desmogleins are a family of cadherins that play a role in the formation of desmosomes that join cells to one another.
Epitope: N-terminal region of Extracellular domain 1 of desmoglein 2 and a region that is at the fusion between EC1 and the proregion
Species: Human
Uses: WB, IF
Type: Mouse mAb
Publications: Keim S et al (2008) Hybridoma 27 (4) 249-258

Anti-Desmoglein 2 (10D2)
Desmogleins are a family of cadherins that play a role in the formation of desmosomes that join cells to one another.
Epitope: C-terminal region of extracellular domain 1 of desomglein 2
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: Keim S et al (2008) Hybridoma 27 (4) 249-258

Anti-Desmoglein 2 (13B11)
Desmogleins are a family of cadherins that play a role in the formation of desmosomes that join cells to one another.
Epitope: C-terminal region of extracellular domain 1 of desomglein 2
Species: Human
Uses: WB, IP
Type: Mouse mAb
Publications: Keim S et al (2008) Hybridoma 27 (4) 249-258

Anti-Desmoglein 2 (19B9)
Desmogleins are a family of cadherins that play a role in the formation of desmosomes that join cells to one another.
Epitope: N-terminal region of Extracellular domain 1 of desmoglein 2 and a region that is at the fusion between EC1 and the proregion
Species: Human
Uses: WB, IF
Type: Mouse mAb
Publications: Keim S et al (2008) Hybridoma 27 (4) 249-258

WB—Western Blot IF—Immunofluorescence IP—Immunoprecipitation IHC—Immunohistochemistry

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Research Tools

Anti-DHHC5 (11G11)

DHHC5 is a member of the DHHC family of palmitoyl-cyl transferases. These enzymes catalyze the addition of palmitate onto cysteine residues of target proteins.
Epitope: Human DHHC5
Species: Human
Uses: WB
Type: Mouse mAb
Publications: None

Anti-DHHC13 (26D1)

DHHC13 is a member of the DHHC family of palmitoyl-cyl transferases. These enzymes catalyze the addition of palmitate onto cysteine residues of target proteins.
Epitope: Amino acids 40-150
Species: Human
Uses: WB, IF
Type: Mouse mAb
Publications: None

Anti-FGFR4 (19H3)

Fibroblast growth factor receptor 4 (FGFR4), also known as CD334, is a member of the fibroblast growth factor receptor family and a cell surface tyrosine kinase containing three immunoglobulin-like domains. FGFR4 is widely expressed in many tissues including the intestine, muscle, heart, cornea, retina, and pancreas, with highest expression in lung and kidney. FGFR4 binds acidic fibroblast growth factor and ligand binding induces mitogenesis and differentiation. FGFR4 is overexpressed in gynecological tumor samples, suggesting a role in breast and ovarian tumorigenesis.
Epitope: Human FGFR4
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: None

Anti-LGR6 (20E3)

LGR6 is a glycoprotein hormone receptor that is a member of the leucine-rich repeat-containing subgroup of the G protein-coupled 7-transmembrane protein superfamily.
Epitope: Human LGR6
Species: Human
Uses: WB
Type: Mouse mAb
Publications: None

Anti-MastL

Microtubule-associated serine/threonine-protein kinase-like (MastL) has been associated with thrombocytopenia and thrombocytopenia 2. MastL is a serine/threonine kinase that plays a key role in M phase by acting as a regulator of mitosis entry and mmaintenance. Following DNA damage, MastL is also involved in checkpoint recovery by being inhibited. May be involved in megakaryocyte differentiation.
Epitope: C-terminus
Species: Human
Uses: WB, IHC
Type: Mouse mAb
Publications: None

Anti-MUC4 (8G7)

Mucin-4 (MUC4) is a mucin protein and a major constituent of mucus. MUC4 plays various roles in the progression of cancer, particularly due to its signaling and anti-adhesive properties which contribute to tumor development and metastasis. MUC4 is also important in other diseases such as endometriosis and inflammatory bowel disease.
Epitope: Tadem Repeat Domains
Species: Human
Uses: WB, IF, IHC
Type: mAb
Publications: Moniaux N et al (2004) J Histochem Cytochem 52 (2) 253-261

Anti-NHERF-2 (32B6)

Sodium-hydrogen exchange regulatory cofactor NHE-RF2 (NHERF-2) is also known as tyrosine kinase activator protein 1 (TKA-1) or SRY-interacting protein 1 (SIP-1). NHERF-2 acts as a scaffold protein connecting plasma membrane proteins with members of the ezrin/moesin/radixin family, linking them to the actin cytoskeleton and regulating their surface expression.
Epitope: AA 149-231
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: Theisen C et al (2007) Mol Biol Cell 18 (4) 1220-1232

WB—Western Blot IF—Immunofluorescence IP—Immunoprecipitation IHC—Immunohistochemistry

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Research Tools

Anti-OTK18
OTK18 is classified as a transcription factor as it contains 13 C2H2-type DNA binding zinc finger motifs. C2H2 zinc finger motifs are capable of binding to a wide range of DNA sequences, including the HIV-1 LTR. This human immunodeficiency virus (HIV)-inducible zinc-finger protein reduces progeny-virion production in infected human macrophages.
Epitope: OTK 1-178
Species: Human
Uses: ELISA, WB, IHC
Type: mAb
Publications: Buescher J et al (2008) J Neuroimmune Pharmacol 3 (4) 230-235

Anti-p63 (11H1)
A member of the p53 familyof transcription factors, p63 plays a key role in the regulation of epithelial proliferation and differentiation.
Epitope: Human p63
Species: Human
Uses: WB
Type: Mouse mAb
Publications: None

Anti-Plakophilin-1 (19F10)
Plakophilins are proteins of the cytoskeleton.
Epitope: AA 235-726
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: Sobolik-Delmaire T et al (2010) J Invest Dermatol 130 911): 2638-46

Anti-Plakophilin-2 (8H6)
Plakophilins are proteins of the cytoskeleton.
Epitope: AA 1-350
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: Sobolik-Delmaire T et al (2010) J Invest Dermatol 130 911): 2638-46

Anti-Plakophilin-3 (7F6)
Plakophilins are proteins of the cytoskeleton.
Epitope: AA 1-308
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: None

Anti-Pro Desmoglein 2 (3B11)
Desmogleins are a family of cadherins that play a role in the formation of desmosomes that join cells to one another.
Epitope: Proregion human desmoglein 2
Species: Human
Uses: WB, IF
Type: Mouse mAb
Publications: Keim S et al (2008) Hybridoma 27 (4) 249-258

Anti-Pro Desmoglein 2 (20G1)
Desmogleins are a family of cadherins that play a role in the formation of desmosomes that join cells to one another.
Epitope: Proregion human desmoglein 2
Species: Human
Uses: WB, IF
Type: Mouse mAb
Publications: Keim S et al (2008) Hybridoma 27 (4) 249-258

Anti-Pro Desmoplakin (20B6)
Desmoplakin is a component of desmosomes, the intercellular junctions that tightly link adjacent cells. Desmoplakins anchor intermediate filaments to desmosomal plaques.
Epitope: 20B6
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: Sobolik-Delmaire T et al (2006) JBC 281 (25) 16962-16970

Anti-Pro Desmoplakin (23F4)
Desmoplakin is a component of desmosomes, the intercellular junctions that tightly link adjacent cells. Desmoplakins anchor intermediate filaments to desmosomal plaques.
Epitope: 23F4
Species: Human
Uses: WB, IP, IF
Type: Mouse mAb
Publications: Stojadinovic O et al (2008) J Cell Mol Med 12 (6B) 2675-2690

WB—Western Blot IF—Immunofluorescence IP—Immunoprecipitation IHC—Immunohistochemistry

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Anti-α-Catulin (22B9)

α-catulin is an α-catenin-related protein that shares structural similarities with cytoskeletal linker proteins and facilitates Rho signalling.
Eptitope: Human α-catulin
Species: Human
Uses: WB
Type: Mouse mAb
Publications: None

Anti Tau-Tubulin Kinase 1

Epitope: Catalytic domain (1-320)
Species: Human
Uses: WB, IHC
Type: Mouse mAb
Publications: Sato S et al. J Neurosci (2008) v28: 14511-14521 ; Xu J et al. FASEBJ (2010) v24: 2904-2915; Asai H et al. Am J Pathol (2014) v184: 808-818

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COVID-19

Software

Modular Electronic Decision Support Builder

Pediatric interactive screening tool adapts to institutional needs

Physicians from Omaha's Children's Hospital and Medical Center have developed a pediatric-specific COVID-19 screener. This application can be accessed by a one-time download as an offline app or directly on the web.

This tool can be used by a variety of clinical and non-clinical end-users to access information step-by-step. The software also provides tracking to connect user behavior with access of tagged content within the tool. The customization nature of the tool allows for institutional-level branding and adjustment of content to fit the local context.

Commercial applications include user data analytics and observation, branding and delivery of content to target populations, use in public health, and dissemination or implementation of projects to improve healthcare processes or outcomes. The combination of customizable content, user analytics, and interactive surveys combines multiple distinct features into a single software tool.

Rundown

- COVID-19 screener specifically for pediatric patients
- Available as a web-based or native app
- Allows for institutional-level branding

INVENTORS
- Ellen Kerns
- Russell McCulloh

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Software

Fall Prevention

Smartphone app uses biomechanics to help elderly

Something as simple as walking to the beat of chaotic music can help prevent falls in the elderly.

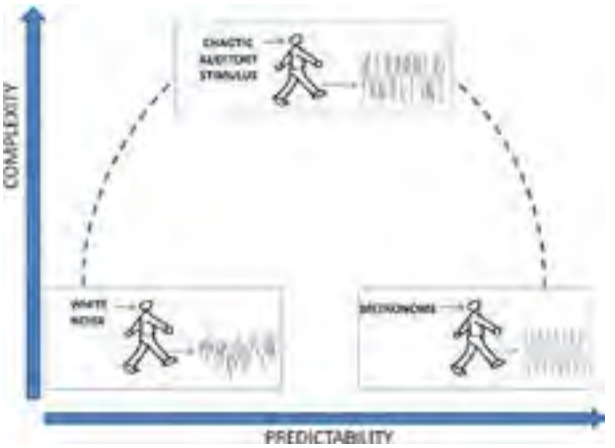
New research from the University of Nebraska at Omaha demonstrates that elderly gait can be made more stable by listening to music with a variable beat: chaotic music.

By simply walking in-beat with chaotic music, gait stability dramatically improved in the elderly, which, in turn, improves safety and fall prevention.

The research is based on the work of UNO's world-leading expert on biomechanics, Nicholas Stergiou, Ph.D. Biomechanics, the study of human movement, demonstrates that a lot can be learned about a person from the variability of their movements.

A person with Parkinson's disease has too much variability. A person with an orthopedic injury has much, much less.

The key to healthy movement is finding and maintaining the right balance of variability in movement.



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Hypertension Detection, Treatment Algorithm

Uncovers hypertension for asymptomatic patients

A new process for identifying and treating hypertension can identify the deadly condition in patients years earlier than with traditional diagnostic tools.

This new process, developed with UNMC's in-house supercomputer, analyzes various measurements and lab values and compares them to 2,000,000to 2,000,000 previous patients. During this comparison, numerous mathematical calculations determine the most probable outcome. The final calculation provides a suggested diagnosis and treatment plan for the physician.

Rundown

- Early diagnosis of previously undetected hypertension
- Patient record analytics produces a diagnosis and treatment plan
- Allows for more personalized patient care, higher precision

This outcome, combined with the physician's clinical acumen, allows for earlier treatment of hypertension and supports real-time symptom management. This means that patients can adjust their treatments more frequently than the typical once- or twice-per-year follow-up appointments, enabling more responsive and personalized care.

Software

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Software

Optimized Gait Tether

Improve walking with a little boost at just the right time

Biomechanics researchers at the University of Nebraska at Omaha, led by Philippe Malcolm, PhD, have developed a controllable waist tether to optimize human locomotion.

The controllable waist tether can be personalized for various rehabilitation or athletic performance applications based on a user's biometric data.

Rundown

- Novel waist tether and programmable controller
- Individualized, optimized force profiles
- Personalized rehabilitation or athletic training program

INVENTORS
- Arash Gonabadi
- Philippe Malcolm
- Prokopios Antonellis

The device provides timed pulls on the user's waist from a motorized pulley system.

Initial therapeutic applications are currently under investigation for peripheral arterial disease.

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X-Ray Output Simulator

Train next generation of X-ray technologists, safely

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.

Rundown

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

INVENTORS
- Ellie Miller
- Eric Psota

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.

Software

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Software

HABIT-VR

Treat cerebral palsy with virtual reality simulations

Cerebral Palsy is one of the most common neurological disorders in children, affecting body movement and muscle coordination. One of the most successful therapies to improve upper-extremity motor function is Hand-Arm Bimanual Intensive Therapy (HABIT). However, as the name suggests, the therapeutic regimen is rather intense, resulting in a high dropout rate.

Researchers at the Munroe-Meyer Institute at UNMC have developed a virtual reality environment full of games tailored to children with cerebral palsy. Called HABIT-VR, the games package the HABIT therapy regimen in fun, engaging environments that can be scaled to ability level. HABIT-VR is a therapeutic VR software for children with cerebral palsy.

RUNDOWN

- Therapeutic VR software for kids with cerebral palsy
- Games built around the HABIT therapeutic program
- Develops upper-extremity motor skills
- Game difficulty is adjustable
- Kids accumulate rewards as they progress through the training

INVENTORS
- Brad Corr
- Jacy Hannan
- James Gehringer
- Janice Flegle
- Max Kurz
- Sandra Willett

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Patient management, charting

Software improves CPR, keeps complete record during codes

UNMC's newest patient management application streamlines medical complexity and simplifies decision support into a simple blueprint that standardizes care for all patients regardless of circumstance, stress, training and experience.

It's rare when a patient's heart stops or codes, but when they do doctors and nurses must have current guidelines at the ready. It's a complex, high-stress scenario where any number of things can go wrong. A seemingly simple error can be the difference between life and death.

Emergency medicine physician Michael Wadman and nurse practitioner Thang Nguyen joined forces to create a catch-all solution: A web-based application that helps physicians and nurses in real-time analyze patients, obtain guidelines, and document the course of care.

Rundown

- Get it right all the time
- Standardize care everywhere
- Eliminates need to recall forgotten protocols
- Easy and dynamic charting real-time
- Keep track of medications and doses
- Review past interventions

INVENTORS
- Michael Wadman, M.D.
- Thang Nguyen, A.P.R.N.

The patient management software helps physicians and nurses get it right all the time. It mitigates the potential for error. As a clinically-driven decision support system, it analyzes the patient's status based on user input and offers clinically-based recommendations.

At the same time, it raises the standard of care, creating better outcomes, better doctors, better nurses and happier patients.

With this system at their side, doctors can fully focus on improving the survival and outcome of code patients.

Because the web-based application automatically cues providers, it can be easily modified to include guidelines for other medical emergencies, such as stroke or poisoning. The application could also function as a training tool for the next generation of clinicians.

Software

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Software

Laparoscopic simulator

Affordable simulator helps train doctors faster

Surgical training is facing a crisis. Restrictions on resident work hours have put new pressures on surgical residency: how do you train new surgeons on fewer residency hours?

The problem is especially acute for laparoscopic surgery. Minimally invasive surgery requires very particular skills that take a long time to master.

One solution is laparoscopic simulation. Medical simulation offers a solution to make the most of the time available to surgical trainees. Medical simulations must be innovative. To maximize their value, simulators must be readily accessible and provide simulations that help trainees acquire skills rapidly.

Current simulators require residency programs to choose: inexpensive simulators with unsophisticated simulations or complex, expensive simulators that provide richer simulation environments.

Rundown

- Sofware as a Service
- Internet-based software makes computer-assisted simulation affordable for all trainees
- Integrated tracking of utilization, progress
- Objective, evidence-based, FLS-ready determination of competency

INVENTORS
- Dimitry Oleynikov, M.D.
- Joseph Siu, Ph.D.
- Carl Nelson, Ph.D.

A team of surgeons and scientists at the University of Nebraska Medical Center invented a new simulator platform that will revolutionize laparoscopic simulation. The simulator itself is inexpensive to produce with the potential for each trainee to get her own simulator. The simulator interfaces with any personal computer. It connects over the internet to an online simulator service that simulates tasks that teach the fundamentals of laparoscopic surgery. The system captures the trainee's performance, offers realtime feedback and evaluation and provides the residency director evaluations of each trainee.

The simulator creates a new software as a service (SAAS) business model for medical simulation. In addition it allows the latest approaches used in popular video games to create more engaging simulation environments.

By creating simulation environments that feel more like medical simulation games the new simulation platform provides new opportunities for custom simulation services to surgical residency programs.

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VR Daily Activity Simulators

Safe, practical simulated environments help autistic patients

Autism Spectrum Disorder is one of the most common developmental disabilities, and results in social, emotional, and sensory processing differences making participation in daily activities difficult. Skill deficits are often practiced in the real world with a behavioral analyst, however numerous skills—such as crossing a road—cannot be safely practiced in the real world. Furthermore, patients are overcome with sensory overload, which cannot be easily manipulated in a real-world environment.

A team of researchers from the Munroe-Meyer Institute at UNMC have developed virtual reality environments to simulate activities of daily living for patients with Autism Spectrum Disorder. The VR environments allow participants to engage with a real-world environment in the safety of a simulation lab. Furthermore, the inventors are integrating biometric data to scale back the sensory experience (e.g., light, sound, etc.) of the virtual environment in real-time.

RUNDOWN

- Virtual reality therapy for Autism Spectrum Disorder
- VR environments simulate activities of daily living
- Safe, responsive
- Real-time biometric feedback

INVENTORS

- Brad Corr
- Jacy Hannan
- James Gehringer
- Janice Flegle
- Max Kurz
- Sandra Willett

Software

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Software

Ankle-PLAST

Measure athlete ankle health on the sideline in seconds

Biomechanics and kinesiology researchers at the University of Nebraska at Omaha, led by Adam Rosen, Ph.D., have developed a portable, easy-to-use ankle strength and laxity testing device.

e-PLAST quickly and easily evaluates ankle strength and laxity, providing objective data without the need for bulky, expensive machines. The data is then wirelessly transferred to a software application for analysis, scoring and diagnosis.

Applications include athletics, rehabilitation and diagnostics.

Rundown

- Ankle strength and laxity testing device
- Portable, easy to use
- Quickly, easily assess athlete ankle health in real-time

INVENTORS

- Adam Rosen
- Alec Anderson
- Anthondy Habib
- Brian Knarr
- Jarod Nekl
- Jonathon Pachuncka

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InstaHealth

Help patients decide if condition warrants hospital visit

InstaHealth is a paradigm shift in the patient decision-making process that takes subjective patient information to determine diagnostic probability, prognosis and treatment recommendations.

Rundown

- Patient-controlled diagnosis software
- Decreased hospital burden
- Algorithm-based diagnostic decisions

INVENTORS

- Michael Wadman
- Thang Nguyen

The current prototype successfully diagnoses cases of group A Streptococcal Pharyngitis in the pre-hospital setting, without the need to physically examine the patient. The inventors developed from medical literature data and objective patient data to formulate diagnostic probabilities and prognoses.

Given this new tool, patients are able to make informed decisions regarding their medical options such as when or where to seek medical care and treatment options. The ability to steer patient decision-making processes improves patient outcomes, reduces medical expenditure and increases patient satisfaction.

This technology can be used in collaboration with potential partners such as:

1. Health clinics such as CVS Minute Clinic, Walgreens MedExpress and Walmart Care Clinics, who spend billions to increase foot travel to their stores;
2. Insurance companies, whose primary goal is to minimize health expenditures; and
3. Consumers, who prioritize accuracy and convenience in their health care services.

Software

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Software

Smart Leg Press

Receive objective muscle, ligament readings from any leg press machine

Biomechanics researchers at the University of Nebraska at Omaha, led by Brian Knarr, Ph.D., have developed a modular force-measuring device for physical therapy and rehabilitation applications.

The Smart Leg Press can be attached to most leg press machines, and provides objective force measurements independent for each leg. Data is wirelessly transferred to a software application for analysis and diagnosis.

Such measurements can be used for numerous applications including assessing limb strength asymmetry and staging ACL rehabilitation.

Rundown

- Modular force-measuring device
- Interfaces with most leg press machines
- Objective measure of limb strength asymmetry
- Validated for ACL rehabilitation

INVENTORS

- Adam Rosen
- Brian Knarr
- Kyle Brozek
- Mason Schleu
- Russell Buffum
- Travis Vanderheyden

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Remote-ICU

Keep patients' loved ones involved, from anywhere

The most effective in-patient care includes family participation, but that is nearly impossible happens when a patient's loved ones can't be there in person.

Breanna Hetland, Ph.D., RN, has developed a software application to ensure patients can stay connected with their families.

Remote-ICU invites patient's and families to co-create a virtual patient profile, which is then visible to healthcare providers as well. In addition, Remote-ICU includes virtual hospital tours and patient-family direct communication.

The ICU tour component of the software application is currently in use at the University of Nebraska Medical Center, while the virtual patient profile is undergoing research trials.

Rundown

- Software application remotely connects patients with loved ones
- Creates virtual patient profile
- Invites patient and family input
- Incorporates "patient/family view" and a "provider view"
- Includes virtual hospital tours and patient/family direct communication

INVENTOR

- Breanna Hetland

Software

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Software

Automated Antibiogram
Automated, real-time antimicrobial stewardship solution

A UNMC Public Health Informatics team led by W. Scott Campbell, MBA, Ph.D., has developed an automated, real-time antibiogram.

All hospitals and clinics are federally required to report antibiotic usage as part of their antimicrobial stewardship. This software application can easily connect with any hospital system to generate real-time, automated reports.

On top of fulfilling a mandated requirement, these reports can also help clinicians make more intelligent antibiotic selections.

Rundown

- Automated software application
- Generates hospital-specific antibiograms
- Uses patient data and controlled medical terminologies
- Could inform antibiotic usage

INVENTORS

- Caitlin Murphy
- James Campbell
- Nicholas Staffend
- Trevor VanSchooneveld
- W. Scott Campbell

The software application is currently in-use at the University of Nebraska Medical Center.

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Clinical Training Mat

Smart, responsive mat collects training data

Biomechanics researchers at the University of Nebraska at Omaha, led by Brian Knarr, Ph.D., have developed a portable, durable and modular clinical training mat.

The smart training mat can be used in gyms, clinics, athletic departments and training facilities like any ordinary mat, but it can be programmed with different settings and will collect data accordingly. The data is then wirelessly transferred to a software application for analysis, scoring and diagnosis.

Rundown

- Portable, durable, modular
- Wirelessly transmits data to software application
- Agility training, rehabilitation and diagnostic applications

INVENTORS

- Adam Rosen
- Brian Knarr
- Russell Buffum
- Travis Vanderheyden

Applications include agility training, rehabilitation and diagnostics.

Software

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COVID-19

Software

Modular Electronic Decision Support Builder

Pediatric interactive screening tool adapts to institutional needs

Physicians from Omaha's Children's Hospital and Medical Center have developed a pediatric-specific COVID-19 screener. This application can be accessed by a one-time download as an offline app or directly on the web.

This tool can be used by a variety of clinical and non-clinical end-users to access information step-by-step. The software also provides tracking to connect user behavior with access of tagged content within the tool. The customization nature of the tool allows for institutional-level branding and adjustment of content to fit the local context.

Commercial applications include user data analytics and observation, branding and delivery of content to target populations, use in public health, and dissemination or implementation of projects to improve healthcare processes or outcomes. The combination of customizable content, user analytics, and interactive surveys combines multiple distinct features into a single software tool.

Rundown

- COVID-19 screener specifically for pediatric patients
- Available as a web-based or native app
- Allows for institutional-level branding

INVENTORS
- Ellen Kerns
- Russell McCulloh

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Deconvolution of NGS mixtures

New tool improves molecular forensics

Jesse Cox, MD, PhD, the Director of Molecular Forensics at the University of Nebraska Medical Center, has developed a method for assigning ancestry and phenotypic information to both a major and minor contributor in a mixed biological sample.

In order to deconvolute the two samples in mixture, identification of anticipated allele frequencies can help to identify those alleles specific to the major contributor, those specific to the minor contributor, and those shared by both.

Currently, next-generation sequencing technology is being used only for single source specimens, but mixed biological samples of more than one individual are common in the field of forensics.

The ability to leverage next-generation sequencing to assign identifying information to major and minor contributors has immediate and practical benefits to the field of forensic pathology.

Rundown

- Algorithm and method for deconvoluting major and minor contributor in mixed biological sample
- Assign ancestry, phenotypic interpretations
- Applications in Next-Generation Sequencing DNA Forensics

INVENTORS

- Courtney Schweikart
- Jesse Cox
- Mellissa Halligso

Software

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Software

Motion capture system

Use a smartphone for true motion capture system

Motion capture is a growing and versatile tool. From 3D animation to physical therapy, the data from motion capture is gaining wider and wider usage. Unfortunately, motion capture requires multiple high-speed cameras and a variety of active or passive reflectors. Expensive and complicated equipment limits wider use.

Mobile motion capture technologies exist but lack versatility. Current systems only record video, which must be processed at a later date. Even then, the information from the motion capture systems is not always at the same level of quality, which limits the utility of the motion capture data.

Doctors Ka-Chun Siu and JC Chien invented a new algorithm that allows for true mobile motion capture using a smartphone. Unlike other mobile motion capture systems, their invention makes it possible for real time motion capture, without expensive equipment—just a camera and some disposable markers. In laboratory tests, the mobile motion capture system captured motion just as precisely as a state of the art motion capture laboratory system.

Rundown

- Capture motion anywhere, using only mobile devices and proprietary software
- Novel algorithms extract motion capture data in real time
- Inexpensive sensors require no special equipment or skills

INVENTORS
- Joseph Siu
- Jung-Hung Chien
- Melissa Parks

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Fall risk assessment insole

Predict falls to prevent injuries

Slips and falls are random. But we know several risk factors that make falling down much more likely. Risk factors include advancing age, visual impairments, muscle weakness and even prior hospitalization.

A special insole and a proprietary algorithm could help physicians more accurately predict the likelihood of falling, and help prevent serious injuries to elderly patients in particular.

Nick Stergiou, Ph.D., and his colleagues in the biomechanics department at the University of Nebraska at Omaha, developed such a device—the insole and the accompanying algorithm—

for fall-risk assessment. The portable, wireless device can be easily worn to collect critical biometric data after a few minutes of walking. The data can be stored on the device and transferred to the program via USB, or uploaded wirelessly to the cloud.

The current prototype assesses fall risk in a small population with 90 percent specificity. The research team believes they can refine the algorithm to increase specificity even further with a larger sample size.

Contact Tyler Scherr, Ph.D., at tyler.scherr@unmc.edu or 402-559-2140 to discuss partnering and licensing opportunities.

Rundown

- One-third of adults older than 65 fall each year
- Two-thirds of adults older than 65 have been hospitalized after a fall
- Portable insole assesses risk of falling in minutes
- Fall risk can be assessed with 90 percent specificity

Inventors

- Arash Gonabadi
- Max Kurz
- Nicholas Stergiou
- Philippe Malcolm

Software

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TECHNOLOGY PORTFOLIO 2025

cancer
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software
startups

STARTUPS

A selection of key startups born from UNMC & UNO innovations.

AcademicEdgar+
Burch Kealey, Ph.D., developed and licensed software to make EDGAR searches more efficient. Dr. Kealey, an accounting associate professor of at the University of Nebraska at Omaha, developed the program as a way to solve frustrations he encountered during a large research project.

Alievio
Originally named Camras Vision, the startup was founded on an intraocular pressure device developed by the late Carl Camras, M.D., a UNMC physician. His daughter, Lucinda, founded the company.

AutomatedAssessments
We provide medical devices to assure the future of medical decisions" or "Providing providers validated data that changes people's lives assuring the right decision.

Breezmed
Breezmed is a health informatics startup developing a new platform to ease workflow around prior authorizations. Breezmed streamlines the different documents insurance companies often require, making it easier for patients to get their prescriptions.

Carecubes
Carecubes provides portable, modular negative-pressure isolation chambers designed to allow rapid access to patients while protecting front-line workers.

ECD Measure
ECD Measure helps build better lives for young children around the world through data.

Exavir
Exavir is developing an ultra-long acting antiretroviral portfolio that is a multi-class arsenal for HIV treatment and prevention regimens. Their agents are de-risked by existing antiretrovirals already proven to work at target drug exposure levels. Exavir's next-generation formulations and CRISPR-based technology are aimed eradicating HIV.

Impower Health
Impower was created on a remarkable innovation developed at the University of Nebraska at Omaha's world-class Biomechanics facility: The world's first biomechanics-based self-pacing treadmill. The treadmill relies on a coordinated sensor system and algorithm to detect the user's center of mass and leg swing velocity to sense the user's position and adjust speed accordingly.

NeAT Surgical
Omaha startup is based on a freehand-navigated, computer-aided orthopedic surgery system developed at UNMC. NeAT Surgical's handheld saw and its tracking system could eliminate the need for complex and expensive jigs that are used today in joint replacement surgeries. It could also dramatically reduce the amount of surgical training and specialized support staff, cutting the overall cost of the procedures and making them more accessible to a wider range of patients throughout the world.

ProTransit NanoTherapy
Co-founded by former Entrepreneur-In-Residence, Gary Madsen, Ph.D., ProTransit Nanotherapy is based on the work of former UNMC researcher Vinod Labshetwar, Ph.D., who is also a co-founder in the Omaha-based startup. ProTransit is developing a nanoparticle as a delivery vehicle for antioxidant enzymes to the deepest layers of the skin. The final product could be a topical application such as skin cream or sun lotion that better protects the skin against cancer, blemishes and wrinkles. There is also potential for additional applications that include treatment for some spinal cord injuries or certain types of brain damage.

Startups

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Startups

Radux Devices, LLC

Greg Gordon, M.D., a former Interventional Radiologist at UNMC and the Veteran's Administration, is commercializing new tools that help reduce radiation exposure. The devices also reduce the stress and strain often experienced by interventional radiologists, improving their work flow, efficiency, career longevity and quality of life.

RespirAI Medical

RespirAI is a medical device startup in the pulminary, cardiovascular, and long-term care spaces currently collaborating with Jennifer Yentes, PhD at UNO Biomechanics, Stephen Renard, MD at UNMC College of Medicine and their team to commercialize innovative respiratory monitoring devices.

ScanMed Enterprises

ScanMed was created in the 1990s when UNMC faculty member Randy Jones, Ph.D., commercialized MRI coils he created. ScanMed later escaped the economic downturn by pivoting into a service company that repairs MRI scanning coils. More recently, ScanMed has enjoyed significant growth and now uses its repair service to bankroll some of the most innovative MRI coil designs in the world, including a novel prostate cancer screening coil that could dramatically improve a physician's ability to make the earliest possible diagnosis.

Suh Hermsen Strap

Suh Hermsen Strap is a leading innovator creating vision solutions for special needs and requirements that traditional eyeglass manufacturers can't or won't address. Suh Hermsen Glasses sells hundreds of ergonomic surgical loupe head straps monthly to dentists, ophthalmologists, surgeons, and jewelers, etc. Suh Hermsen Strap is also developing modular glass frames with a pediatric focus. https://suhhermsen.com

University Medical Devices, Inc.

University Medical Devices, Inc. is built on MicroWash, an innovation developed by clinicians in the Department of Emergency Medicine at the University of Nebraska Medical Center and Nebraska Medicine. MicroWash offers a fast and painless solution to collecting samples with nasal swabs. The device is a self-contained nasopharyngeal irrigation tool, elegantly designed to collect specimens to test for common diseases like COVID-19, Influenza, RSV, and Rhinovirus.

Vireo Systems

Nebraska manufacturing startup Vireo Systems was established in Plattsmouth, Neb., about 20 miles south of Omaha. Vireo manufactures popular muscle-building health supplements that were developed at UNMC, Creatine Ethyl Ester and Creatine HCL. Vireo eventually outgrew its first facility, expanding into a larger space in 2012. More than 20 Nebraskans are employed at Vireo, which holds more than 40 manufacturing contracts.

Virtual Incision Corporation

Virtual Incision was born out of a collaboration between UNMC surgeon Dmitry Oleynikov and UNL robotics engineering professor Shane Farritor. Together, the cofounders are developing miniaturized surgical robots that could transform highly invasive major surgeries into minimally invasive procedures. Their surgical platform has also shown potential for remote surgical applications, and has undergone zero-gravity testing with NASA. In 2015, Virtual Incision raised more than $11.2 million, then entered first human trials in 2016, and raised another $13 million for Series B financing in 2017.

VisionSync

VisionSync is an innovative cloud-based software solution meticulously designed to empower organizations in architecting, refining, and executing strategic plans with unparalleled efficiency and precision. As a comprehensive platform, VisionSync seamlessly integrates the vital components of strategic planning, enabling users to craft, manage, track, and report on multiple strategic initiatives within an organization effortlessly.

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