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Keeping it Moving

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In Kansas State University's kinesiology department, the study of movement takes a variety of directions: from space exploration to CrossFit and standing desks; from beetroot juice to cancer treatments. But despite the differences, the researchers share the goal of improving human health and well-being by studying physical activity.

The university's kinesiology department was one of the first in the U.S. to adopt the name “kinesiology” and to make a commitment to understanding the connection between physical activity and health, said Craig Harms, department head. “Our focus is unlike many other kinesiology departments in that our research faculty members specialize in two disciplines: physiology and exercise behavioral science,” Harms said. “Our faculty members are truly outstanding.”

Their outstanding work shows, and the department is recognized as one of the top kinesiology programs in the U.S.

The department's success extends to the classroom, too. Kinesiology students have a high acceptance rate into health professional schools, such as medical, physical therapy, nursing and physician assistant schools. Kinesiology research projects often require large teams, and undergraduate and graduate students play a crucial role helping with the projects. They gain valuable experience in the process.

Research teams frequently collaborate, and faculty members approach their work from multiple perspectives using basic, clinical, behavioral and social science approaches, Harms said. “It is common to have two or more of our faculty on grants because each is able to provide a unique skill and knowledge set,” Harms said. “We are very fortunate that we have great camaraderie within our department. It is not uncommon that new ideas are generated from hallway conversations.”

Read on for a sampling of some of the current research projects in the kinesiology department and understand why it is among the best in the country.
Carl Ade wants to keep astronauts safe. His team of undergraduate and graduate students are researching astronaut health. They created a mock-up of NASA’s Orion space capsule to determine how an astronaut’s body responds to performing emergency escape maneuvers.

“We need to keep astronauts safe in flight and following landing,” Ade said. “With this research, we can develop fitness standards and in-flight interventions that keep astronauts healthy during long-duration missions that can last several years.”

Ade and Thomas Barstow, professor of exercise physiology, have collaborated with the Johnson Space Center in Houston to tackle one of the many challenges facing the deep-space astronaut: the return to earth. After a deep-space mission, the Orion spacecraft will land in the ocean. In emergencies, astronauts must perform a quick escape, which is difficult after months in zero gravity.

“Microgravity deteriorates astronauts’ skeleton, muscle and cardiovascular systems, similar to what occurs during several weeks of bed rest,” Ade said.

Ade is studying research participants as they perform the same tasks in the model Orion capsule as astronauts would during an emergency escape. Participants wear special equipment that takes physiological measurements — such as muscle activity, oxygen uptake, heart rate and blood pressure — to determine the stress the body experiences during an emergency escape.

Ade also has studied other aspects of astronaut health. For a recent study with the Johnson Space Center, he found that astronauts on the International Space Station have decreased cardiorespiratory function because of a decrease in both the way the heart and small blood vessels move blood and oxygen.

“If we can figure out how to keep an astronaut healthy in the extreme environment of outer space, we can translate that to life on Earth,” Ade said. “Our research helps both individuals: the astronaut and those here on Earth.”

Exercise for astronauts
Carl Ade, assistant professor of exercise physiology
Area of expertise: Cardiovascular physiology and gravitational physiology

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Army strong and fit
Katie Heinrich, associate professor of exercise behavioral science
Area of expertise: Physical activity and exercise interventions

Nearly 16 percent of U.S. Army personnel are obese — the highest percentage among the armed forces. Katie Heinrich wants to address that by comparing Army fitness with CrossFit, a form of high-intensity functional training.

Heinrich’s research team has partnered with Walker Poston from the National Development and Research Institutes to develop the Army Training at High Intensity Study.

The current Army physical fitness test involves two minutes of pushups, two minutes of situps and a two-mile run.

“There has been concern over the Army’s current fitness test,” said Heinrich, who directs the Functional Intensity Training Lab. “Instead of following the Army physical readiness training manual, many soldiers will just train for the test.”

Additional concerns are that the current test does not measure soldiers’ combat readiness or fitness relevant to real-world activities, Heinrich said.

She is using a five-year, $2.52 million National Institutes of Health grant to study obesity prevention and health promotion in the military. It is the first cluster-randomized clinical trial on the Army physical fitness training program.

“Because people train for the physical fitness test, there are lots of repetitive stress injuries, such as lower leg injuries from running,” Heinrich said. “We’re testing to see if a high-intensity functional training program can minimize injury and improve outcomes.”

Her team is comparing a group of active-duty soldiers who follow the current physical training method to a group that follows a high-intensity functional training, or HIFT, program. They are comparing changes in body fat percentage, fitness and health levels, and mental and physical aspects.

Soldiers in both groups complete a six-month exercise program of one-hour workouts five days a week. The daily sessions are offered on the Manhattan campus and at the Command and General Staff College at Fort Leavenworth. The HIFT workouts vary each day and include cardio, weightlifting and gymnastics.

“The HIFT workouts offer measurable results,” Heinrich said. “The program helps soldiers compare one workout to the next.”

Her collaborative team includes co-investigator Craig Harms, department head and professor of exercise physiology; National Development and Research Institutes personnel; and 13 graduate and undergraduate students. They continue to gather data and will analyze results when trials are complete.

“We need an army to test the Army,” Heinrich said.
Matters of the heart (and blood vessels, too)

Brad Behnke, professor of kinesiology
Area of expertise: Cardiovascular physiology

Brad Behnke is improving patient care, from cancer treatments to heart surgery. His research focuses on the cardiovascular system: the heart and blood vessels.

“The common theme with our research is that we use strategies to alter rapidly the vasculature to improve patient care,” Behnke said.

For one project, Behnke is using a $750,000 American Cancer Society grant to investigate how exercise can alter the tumor microenvironment and improve radiation treatments. He has found that moderate exercise — such as a slow jog or a brisk walk — can boost tumor oxygen delivery, which may improve cancer treatments.

But his cancer-related research goes beyond improving treatment itself. Behnke and Carl Ade, assistant professor of exercise physiology, are combating cardiotoxicity associated with chemotherapy. They particularly are addressing the lower five-year survival rates in cancer patients who develop cardiovascular disease, versus those who do not, during treatment.

“We want to maximize long-term survival by mitigating cardiovascular disease,” Behnke said.

For another project, Behnke is collaborating with David C. Poole, professor of exercise physiology, to improve mechanical ventilation, which can greatly drive up health care costs when applied.

Mechanical ventilation is when patients — during open chest surgery or resulting from drug overdose — are intubated and a machine breathes for them. Behnke and Poole’s team is using a $450,000 National Institutes of Health grant to make it easier for patients to wean off mechanical ventilators.

Regardless of the research area, Behnke and his collaborators — which include graduate and undergraduate students — continue to improve patient care by focusing on the cardiovascular system and the role of exercise.

“As physiologists, we try to understand the coordination of every system in the body,” Behnke said. “Many people think exercise is easy, but it’s probably one of the most impressive feats a human can perform.”

Upstanding workplace behavior

Emily Mailey, assistant professor of exercise behavioral science
Area of expertise: Physical activity interventions

Sedentary behavior is increasing our health risks and decreasing our workplace productivity. But Emily Mailey is standing up for employee health.

Mailey, who directs the Physical Activity Intervention Research Lab, researches behavior change, specifically sedentary behavior. She is developing workplace interventions to reduce sitting time and improve employee health.

“We know that breaking up sedentary behavior is important and a lot of people sit all day at work, which makes the workplace a good place for an intervention,” Mailey said.

Her latest research aims to change workplace environments at offices across Kansas with a large number of sedentary employees. Mailey and her collaborators — which include Sara Rosenkranz, assistant professor of food, nutrition, dietetics and health — will evaluate the effectiveness of the Stand Up Kansas intervention over a six-month period.

For the study, workers wear an electronic device called an activPAL to measure time spent sitting, standing and stepping throughout the day. The researchers also are gathering health outcome data — including blood pressure, cholesterol and body composition — as well as fatigue, productivity and job satisfaction.

The project incorporates evidence-based strategies such as health coaching calls and workplace policy changes. The researchers encourage workers to frequently interrupt sitting by taking the stairs or having walking meetings. Workers also receive a standing desk.

“There is good evidence that standing desks are effective for reducing sedentary behavior,” Mailey said.

At the end of the study, Mailey and her team hope to have a program that successfully reduces sedentary behavior, which benefits the employee and the employer.

“We want to demonstrate that we can see positive changes in the workplace as people reduce their sitting time,” Mailey said. “If we can develop effective interventions, they can potentially be disseminated to have a significant public health impact.”
Keeping hearts beating with beetroot

David C. Poole, professor of exercise physiology
Area of expertise: Cardiorespiratory disease and oxygen transport

David C. Poole is helping heart disease patients with a common dietary supplement: beetroot juice. His latest research has found that a daily dose of beetroot juice can help combat diseases related to aging and heart failure.

About 6 million Americans have heart failure, but only about 3,000 new hearts are available for transplants, Poole said. Heart failure treatments cost the U.S. health care system about $100 billion each year.

“One of the most prevalent diseases in America is heart failure,” Poole said. “The No. 1 symptom that sends someone to the clinician with heart failure is a decrease in exercise capacity.”

Poole is using beetroot juice to change that. While many athletes use beetroot juice to improve muscle efficiency and performance, Poole sees possibilities for heart failure patients.

Heart failure starts when the heart cannot pump enough blood, the blood vessels get much smaller and muscles do not get enough blood and oxygen. As a result, a person’s exercise capacity goes down. The problem is that the best way to combat heart disease is an exercise program, said Poole, who directs the university’s Cardiorespiratory Exercise Laboratory.

He started looking into nitrate therapies, particularly beetroot juice, to help oxygen flow to vital muscles. His laboratory demonstrated that beetroot juice increased blood flow to exercising muscles. Subsequently, he partnered with the Penn Cardiovascular Institute in Philadelphia to conduct a National Institutes of Health-indicated patient trial with severely compromised heart failure patients and beetroot juice.

The team found that a single daily dose — about 2.4 fluid ounces — of beetroot juice provided enough nitrates to increase the amount of oxygen that a patient could use by 10 percent.

“That translates to a better quality of life, fewer hospital visits and potentially longer, and certainly happier, lifespans,” Poole said. “It’s offering a lot of hope for these patients.”

The research team is conducting further studies to improve beetroot juice dosages and make it more effective when partnered with exercise. By making exercise seem easier and physical activity less onerous, there is the likely possibility that the efficacy of exercise for cardiac rehabilitation will improve, Poole said.

“The real key is to get these people more active,” Poole said. “When they’re more active, they’re happier and healthier. That is a message that should resonate with all of us.”