

UNIVERSITY OF LOUISIANA AT LAFAYETTE

STEP Committee

Technology Fee Application

**Lab Skills for Graduate and Undergraduate
Kinesiology Students**

Title

Greggory R. Davis

Name of Submitter
(Faculty or Staff Only)

College of Education

Organization

Title: Lab Skills for Graduate and Undergraduate Kinesiology Students Date: June 27, 2019
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Department/College/Org: Kinesiology/Education/Academic

ABSTRACT (250 words or less):

The School of Kinesiology seeks to maintain and enhance the laboratory equipment used by Kinesiology (430 unique students per year), Psychology (10 unique students per year), and Engineering (5 unique students per year) as well as student athletes (140 unique students per year), totaling approximately 585 unique students per year. This funding will directly impact learning activities in our freshmen-level KNES 110 class, our junior-level KNES 304 class, and our graduate-level KNES 502 class. The funding will also directly impact data collection performed by undergraduate and graduate student researchers in Kinesiology, Psychology, and Engineering as well as other departments that may be interested in utilizing the equipment. The job-specific skills training that Kinesiology students receive requires that equipment be replaced periodically. In addition, the larger state-of-the art equipment requires periodic professional maintenance. By maintaining this equipment and replacing equipment as necessary, we can attract potential students to attend UL Lafayette, continue to train our current students at a high level, increase competitiveness of our students in the workforce, increase competitiveness of our students for professional school applications, and produce high quality student research.

The purpose of this grant is to maintain and continue to enhance the laboratory areas in the School of Kinesiology. While several universities within the state of Louisiana and throughout the country have Kinesiology programs, the exercise physiology labs at UL Lafayette offer students unique opportunities that are not provided elsewhere. Students learn about traditional lab measurements and techniques, but they also have the opportunity to learn about biochemical and molecular changes that occur during or following exercise through hands-on experiences and gain valuable technical skills, which is critical for job placement following graduation. Our freshmen-level KNES 110 class enrolls approximately 135 students each semester, all of whom are introduced to the equipment listed in this proposal. Our junior-level KNES 304 lab enrolls approximately 75 students each semester, all of whom get direct hands-on training with the equipment listed in this proposal. Our graduate-level KNES 502 enrolls approximately 10 students each year, all of whom get in-depth training with all the equipment listed in this proposal. Undergraduate and graduate students interested in research also have an opportunity to gain significant experience using, calibrating, troubleshooting, and maintaining the equipment listed in this proposal. Specifically, this enhancement proposal seeks to:

1. Replace our current AMTI force plate amplifier.

a. What is the equipment?

This equipment measures ground-reaction forces as well as the rate of force development in the x-, y-, and z axes. Essentially, every time you take a step, the force that is generated by your foot contacting the ground is matched in the opposite direction by the ground (this is Newton's third law – for every action there is an equal and opposite reaction). If you run, your foot creates more force, more force pushes back from the ground, if you jump, more force is generated, etc. How much force is generated, and how quickly, from running, jumping, lifting weights, etc. can provide students and researchers with information related to expected sport performance, biomechanics, muscle physiology, and metabolism. A force plate is a large (2' x 3') thick metal plate that a person stands on. Within that plate are detectors that determine how much and how quickly force is generated. This information is then sent through an amplifier (the piece of equipment we are seeking) to software that converts the information into usable data.

b. Why are we seeking this item?

Our current AMTI force amplifier is broken. It is not entirely clear how it broke, but it was likely dropped. To prevent this from happening again, we will mount the amplifier to the wall so it will not be possible to drop it. The amplifier must come from AMTI (the company), as it is the only amplifier compatible with our force plate and our software.

c. How does this equipment benefit students and what is the impact?

The software for the force plate not only provides raw data, which students can use for multiple purposes, but it provides an immediate visual feedback for the students to view. It shows users time, amplitude, and direction of forces which not only reinforces learning through visual cues but provides real-time feedback. In most exercise physiology labs throughout the country, students only perform a vertical jump test (exactly what you see at the NFL combine when a person jumps up as high as he can and touches markers to measure height), our use of the force plate provides much more data-rich information and for students interested in physical therapy or biomechanics, it provides them with technical knowledge and skills that most other students do not get until they enter doctorate programs.

The force plate has also been used by students in Kinesiology, Psychology, and Engineering for research purposes and is available for any student research upon request.

2. Add a new Millipore water purification system to our lab

a. What is the equipment?

A water purification system is much like what you might find in a household refrigerator, removing impurities from the water. A lab-grade water filter doesn't just remove large particles, it removes metal ions, proteins, and RNA. When we perform biochemical or molecular experiments, we are typically looking for changes in protein expression or gene expression (RNA) in muscle tissue, saliva, plasma, etc. To analyze these outcomes, the experiments require the use of water. If water is contaminated with anything, the results of the experiment will be compromised, thus, a lab-grade water purification is a must and is a standard in all chemistry, biology, biochemistry, and molecular biology labs.

b. Why are we seeking this item?

We currently have one water purification system, but as the number of faculty have increased and the lab spaces have increased, so has the number for experiments for both research and teaching. During peak hours, one water filter cannot keep up with the demands for our experiments. An additional water filter would greatly improve workflow for teaching and research.

c. How does this equipment benefit students and what is the impact?

Typical exercise physiology labs do not include biochemical or molecular outcome measurements. Students can directly observe how exercise affects protein expression (changes in cortisol, for example), as well as changes in gene expression, which has effects on sport performance as well as clinical outcomes, depending on the gene of interest. Our students get hands-on learning and technical skills that most other students do not get until they enter doctorate programs.

3. Replace our current skinfold calipers.

a. What is the equipment?

Skinfold calipers can be used in the laboratory or in the field (fitness center, clinic, etc.) to estimate body density and body fat percentage. The calipers measure the thickness of the skin on various parts of the body and are widely used in a variety of settings worldwide.

b. Why are we seeking this item?

Our current calipers are plastic and over the course of a year, the springs in the calipers become loose and therefore, invalidate the measurement. Since plastic calipers are relatively inexpensive (\$50), they cannot be recalibrated when the springs become loose, they are just replaced. Baseline (brand) calipers are metal, the springs are much thicker and last 4 – 5 years before they start to loosen, at which point they can be recalibrated. While the initial cost of these calipers (\$130) is higher than the plastic calipers (\$50), over the course of five years, these calipers will save us ($\$50 \times 5 \text{ years} = \$250 - \$130$) \$120 each $\times 8$ calipers = \$960 savings over five years. Every student in our undergraduate KNES 110, 304, and 400 classes uses these calipers during lab sessions. We are requesting eight calipers so that student pairs ($15 \text{ students per lab} / 2 = 8$) can all work at the same time and receive direct feedback from the instructors.

c. How does this equipment benefit students and what is the impact?

Since skinfold calipers are used in a variety of settings worldwide, the skills required to take accurate and reliable skinfold measurements is often a requirement for many Kinesiology-related jobs. Allowing students to use high-quality calipers will provide better training which should lead to higher quality job placement.

4. Replace our current Polar heart rate monitors

a. What is the equipment?

Heart rate monitors can be found in most new smart watches, it detects how frequently your heart beats every minute.

b. Why are we seeking this item?

During exercise, heart rate increases, the extent to which the heart rate increases during exercise is important to understand from a learning perspective but is also critical from a clinical perspective. During maximal and submaximal graded exercise stress test (exercise test commonly performed in cardiology clinics as well as fitness centers), heart rate is monitored closely to ensure proper physiological responses and minimize chances of an adverse health-related event (e.g. heart attack). While heart rate monitor technology has improved drastically in recent years, it is critical that students know how to accurately measure heart rate through palpitation (manual detection) in the event a monitor stops working or is not available during a test. The heart rate monitors allow the students to check their manual measurements against a reliable automated method. Similar to skinfold calipers, we are requesting fifteen heart rate monitors so that each student (15 students per lab) can all work at the same time and receive direct feedback from the instructors.

c. How does this equipment benefit students and what is the impact?

The skill of heart rate palpitation is necessary for many allied health-related jobs and therefore, it is critical that students master this skill to maximize job opportunities upon graduation.

5. Provide professional maintenance to our BOD POD and Metabolic Cart

a. What is the equipment?

A BOD POD uses pressure/volume relationships and air displacement plethysmography to determine body density and estimate body fat percentage. This is a validated instrument utilized by clinics and sports medicine facilities worldwide. The metabolic cart measures energy expenditure during exercise via respiratory gas analysis.

b. Why are we seeking this item?

In order to ensure validity and reliability of the BOD POD and metabolic cart, periodic professional maintenance is required. The internal components of these instruments are highly complex and requires hardware engineering expertise.

c. How does this equipment benefit students and what is the impact?

While some exercise physiology labs have a BOD POD and most have a metabolic cart, few allow undergraduate or master's students to gain hands on experience with the equipment. We require our students in the undergraduate lab (KNES 304) and the graduate lab (KNES 502) to practice using this equipment. We also routinely use this equipment in student research as well as UL Athletics testing. Thus, our student athletes benefit from this equipment, our students have the opportunity to gain research experience, which can help with a resume for professional schools (physical therapy, medical school, etc.), and it provides all Kinesiology students with a unique skill-set to help with job placement.

6. Provide professional maintenance to our Qiacube and Qiagen Roto Gene

a. What is the equipment?

The Qiacube performs reverse-transcription experiments. Essentially, we can start with a sample (muscle tissue), take the RNA from that sample and make complementary DNA (cDNA). We can use this cDNA to analyze how much of a gene is "turned on" (i.e. being expressed) in a specific sample through quantitative polymerase chain reaction (PCR) experiments using the Roto Gene.

b. Why are we seeking this item?

In order to ensure validity and reliability of the Qiacube and Roto Gene, periodic professional maintenance is required. The internal components of these instruments are highly complex and requires hardware engineering expertise.

c. How does this equipment benefit students and what is the impact?

Kinesiology programs that do not offer a PhD or are not affiliated with a medical school typically do not have access to this type of equipment. We require our students in the undergraduate lab (KNES 304) and the graduate lab (KNES 502) to practice using this equipment. We also routinely use this equipment in student research. Thus, our students have the opportunity to gain research experience, which can help with a resume for professional schools (physical therapy, medical school, etc.), and it provides all Kinesiology students with a unique skill-set to help with job placement.

7. Provide professional maintenance to our BioRad Western Chemiluminescent Imager

a. What is the equipment?

The BioRad Western Chemiluminescent Imager captures the light intensity emitted from a sample when an enzyme and a specific antibody are bound to it. Essentially, it tells us how much of a specific protein of interest is present in a specific sample (muscle tissue).

b. Why are we seeking this item?

In order to ensure validity and reliability of the BioRad Imager, periodic professional maintenance is required. The internal components of these instruments are highly complex and requires hardware engineering expertise.

c. How does this equipment benefit students and what is the impact?

Kinesiology programs that do not offer a PhD or are not affiliated with a medical school typically do not have access to this type of equipment. We require our students in the undergraduate lab (KNES 304) and the graduate lab (KNES 502) to practice using this equipment. We also routinely use this equipment in student research. Thus, our students have the opportunity to gain research experience, which can help with a resume for professional schools (physical therapy, medical school, etc.), and it provides all Kinesiology students with a unique skill-set to help with job placement.

To maximize the lifetime of all equipment, Exercise Science faculty will always oversee student operation. Assuming the equipment is not abused or accidentally dropped, the force plate amplifier hardware will be usable for 15 – 20 years. The water purification system should last indefinitely, the filters (\$100 - \$200) are replaced on an annual basis and the UV light (\$500) is replaced every five years. The skinfold calipers are professional-grade quality and will last approximately 5 – 10 years. The heart rate monitors will last 5 – 10 years on average. Our lab has had the COSMED BOD POD and Metabolic Cart since 2014 and it is now requiring maintenance five years later. Therefore, it is anticipated that the maintenance performed on this equipment should last five more years. Our lab has had the BioRad Imaged, Qiagen Roto Gene, and Qiacube since 2016 and is now requiring maintenance three years later. Therefore, it is anticipated that the maintenance performed on this equipment should last three more years. Thus, the lifetime of this enhancement is three years for some equipment up to and possibly exceeding twenty years for other equipment.

Dr. Davis will be responsible for the implementation and installation of all equipment. He has implemented and installed all requested equipment previously. Dr. Davis and all other Exercise Science Faculty, including Jim Clemons, Brian Campbell, Shuichi Sato, and Scott Fuller will be responsible for day-to-day maintenance of the equipment. Large annual maintenance projects will be completed by the equipment companies.

All Exercise Science faculty will be responsible for the operation of the equipment and all use the equipment on a regular basis. Faculty will also train undergraduate and graduate students on the operation of the equipment.

All faculty have earned a Ph.D. and have used the equipment on a regular basis during their Ph.D. training and throughout their academic careers. Graduate and undergraduate students will be trained how to operate the equipment under the guidance of a faculty member for them to enhance student learning outcomes and technical skills needed for job placement.

Price quotes for equipment maintenance as well as general pricing information related to all equipment is provided as a reference.

No prior STEP grant applications have been submitted by the PI.

Funded External Research Grants and Contracts:

- 2019** Cherry Research Institute. \$33,260 (Active)
Bellar DM and Davis GR. Examination of the anti-hypertensive properties of heat treated Montmorency Cherries in Pre-clinical obese and overweight adults.
- 2018** Drink Maple. \$3,739 (Complete)
Bellar DM, **Davis GR**, McDermott M, Aldret R. Efficacy of Maple Water for Enhancing Human Health.
- 2018** Chemi Nutra, LLC. \$42,120 (Complete)
Bellar DM, **Davis GR**, McDermott M, Aldret R. Investigation of TMAO Levels with Chronic Ingestion of A-GPC and Choline Salts.
- 2017** Lifespan International, LLC. \$9,262 (Complete)
Bellar DM, **Davis GR**. The Effects of 10 Days of Extreme Endurance on Repeat Sprint Cycling Performance: Determining Watts (Power), Buttering and Muscle Damage Change.
- 2017** Romanian Sports Science. \$5,750 (Complete)
Bellar DM, **Davis GR**, Leger A. Lab Techniques.
- 2016** Lafayette Parish School System GEAR UP grant. \$50,994 (Complete)
Roberts, N, Bellar DM, **Davis GR**. Teachers Gear Up for Leadership Camp/Monitoring Muscle Oxygenation and Blood Flow to Examine Human Physiology in Science Education.
- 2016** Cherry Research Institute. \$49,473 (Complete)
Bellar DM, Boudreaux S, Murru S, **Davis GR**. Investigation of the Effects of Tart Cherry Concentrate on Oxygen Kinetics and Muscle Oxygenation During Exercise.
- 2016** Anderson Global Group. \$19,422 (Complete)
Bellar DM and **Davis GR**. Evaluation of the effects of CherryPure on bioavailability of nitrate, muscle oxygenation, slow component VO₂ kinetics and inflammation in aerobic athletes.
- 2016** Phenoh. \$9,950 (Complete)
Bellar DM and **Davis GR**. Clinical Testing of Phenoh vs traditional sports drink.
- 2016** Avadim Technologies, Inc. \$7,084 (Complete)
Bellar DM and **Davis GR**. Investigation of Muscle Oxygenation and Innergy Sport Foam.

- Pricing for:
 - AMTI force plate amplifier (Quote Attached)
 - Baseline Skinfold Calipers: https://www.allegromedical.com/exercise-fitness-c523/medical-grade-skinfold-caliper-p561753.html?CS_003=9164468&CS_010=ff8081812917dd6b012918cdb6b820ee&gclid=Cj0KCQjw3uboBRDCARIsAO2XcYC8ybgW7atn46QhtDRdNrb1TYB9WpgSq1YOHQe8wayyvO_Tdr3YUygaAvb-EALw_wcB#1291-8CDB8BB
 - Polar Heart Rate Monitors: https://express.google.com/u/0/product/14532206881073427786_3295965024733380620_268820?utm_source=google_shopping&utm_medium=tu_cu&utm_content=eid-lsjeuxoeqt>im=CIf6s7mlrJS7dhDorJTjrrSP8kAYwImRHCIDVVNEKPDm9OgFMJS0EA&utm_campaign=268820&gclid=Cj0KCQjw3uboBRDCARIsAO2XcYAshokOnQ6LtORfubpEBZmw_IgNNQ5Gs48hLLDnPLVMMQkGu6y2IIaAoHbEALw_wcB
 - Millipore Water Purification System: https://www.hach.com/water-system-ultrapure-millipore-simplicity-with-uv/product?id=7640243089&source=googleshopping&locale=en-US&bt=271169028218&bk=&bm=&bn=g&gclid=Cj0KCQjw3uboBRDCARIsAO2XcYAbuFijUQ09x_euOqee6SP-T6C84sX3vkIqpBf1toy19LT6jgv3GqIaAo2iEALw_wcB
 - COSEMED BOD POD and Metabolic Cart hardware maintenance (Quote Attached)
 - Qiagen Qiacube and Roto Gene maintenance (Quote Attached)
 - BioRad Western Chemiluminescent Imager Maintenance (Quote Attached)

Budget Proposal

1.	Equipment	\$ 3,000 One (1) AMTI force plate amplifier \$1,000 Eight (8) New Baseline Skinfold Calipers (\$130 each) \$975 Fifteen Polar Heart Rate Monitors (\$65 each) \$4,500 One (1) Millipore Water purification system
2.	Software	\$
3.	Supplies	\$
4.	Maintenance	\$5,200 COSMED BOD POD and Metabolic Cart hardware maintenance \$12,300 Qiagen Qiacube and Roto Gene maintenance \$2,500 BioRad Western Chemiluminescent Imager Maintenance
5.	Personnel	\$
6.	Other	\$
TOTAL:		\$29,475