Chronic Cough Suppression Therapy Device

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Project Budget:

$25,000

Abstract:

Over 30% of people will experience a chronic cough, a cough that persists for more than eight weeks, at least once during their lifetime. Chronic coughing can disrupt sleep, induce fatigue, impair cognition, and cause embarrassment. When an underlying condition that causes the coughing cannot be identified, symptoms are often treated using cough suppression medication, which can further impair cognition and impact health with long-term use.

JMU researchers have identified a promising (patent pending) non-invasive technique to reduce chronic coughing. This therapy uses a wearable device, similar to a necklace, to apply vibrations at the base of the throat. Such vibrations have been demonstrated to desensitize overactive neurons in the throat and reduce the urge to cough. This project will advance the design of the wearable device for manufacturing, with the goal of enhancing research funding, investment, and licensing opportunities for this JMU owned intellectual property.

The chronic cough suppression device illustrates how faculty expertise, curiosity, research, and innovation can impact human wellbeing. While researching therapies for voice and swallowing rehabilitation, retired JMU professor Dr. Christy Ludlow (Communications Sciences and Disorders) recognized that application of low frequency vibrations near the throat reduced the urge to cough. A wearable device, similar to a necklace, could be used to treat a chronic cough without cognition impairing medication or an invasive procedure.

In 2017, the Office of Research and Scholarship, Dr. Ludlow, Dr. Erin Kamarunas (Communications Sciences and Disorders), and Dr. Keith Holland (Engineering) worked with students to develop a proof-of-concept prototype. With approximately $1,200 support from a Madison Trust donors, three necklace-like prototypes were designed and produced to conduct clinical studies and demonstrate technology potential. For fabrication simplicity and to facilitate laboratory studies, this demonstration prototype was wired to laboratory equipment.

Although initial patient studies yielded promising therapeutic results, the tethered form of the prototype made it challenging for them to envision it as wearable device. Similar feedback was received from potential investors and technology licensees. In 2020, an external consultant review of JMU owned intellectual property highlighted the potential of this technology, recommending further prototype development to demonstrate its functioning as a wearable device.

This project will refine the design of the cough suppression to further demonstrate its viability as a commercial wearable therapy. Faculty and student expertise in engineering, design, and wearable device design will be leveraged to

- Design a comfortable and aesthetically pleasing, remotely controlled, wearable device to discretely apply the cough suppression vibration therapy,
- Create the engineering design documentation required for manufacturing and assembly of a fully functional device, and
- Develop the software and interface to remotely control the cough suppression device, monitor therapy progress, and share therapy related information via a smartphone or mobile device.

With this design and documentation, approximately ten devices will be produced. Professionally manufactured devices will clearly convey the technology to patients, technology licensees and potential investors. Additionally, it will position the team to apply for additional research funding to demonstrate and study the efficacy of the technology as a non-invasive, at-home, wearable device therapy to alleviate chronic cough.

As a speech-language pathologist with expertise in rehabilitation science and swallowing, Dr. Erin Kamarunas will guide the product development team on the physiological factors, physical measurements, and clinician requirements for implementing the vibrational cough suppression therapy with a wearable device. Dr. Jason Forsyth, a computer engineer with research expertise in wearable computing will guide the device interface and software development. The electronic and mechanical design for manufacturing aspect of the project will be led by Dr. Keith Holland, an engineer with sensor product design and manufacturing experience. Mrs. Mary Lou Bourne, Director of Technology Innovation and Economic Development at JMU, will continue to work with the team to advance the research funding, investment partnership, and licensing opportunities for the chronic cough suppression technology.

The product development team will involve engineering, design, health sciences, and entrepreneurship students throughout the project, providing experiential learning opportunities while involving them in the advancement of a JMU derived innovation to market.

Project Budget Amount: $25,000

Personnel: $15,000

Supplies/Materials: $10,000

Additional information to explain or expand on budgetary needs:

Primary budgetary needs for this project are personnel compensation and materials.

$15,000 is allocated to support compensation for:

- Dr. Jason Forsyth (Engineering) for wearable computing design work and student advisement
- Dr. Erin Kamarunas (Communication Sciences and Disorders) for consultation on the technology and therapy requirements
- Compensation to Industrial design faculty for advisement of student design work on product form and user interface design
- Compensation for approximately four student research and design assistants ($9,000 –$15/hour, 10 hours/week, 15 week semester term) to be identified by the team
- In-kind support and student guidance for electronic and mechanical design documentation will be provided by Dr. Keith Holland

$10,000 is allocated to materials, supplies, and assembly of approximately ten prototypes, including:

- Acquisition and assembly of electronic circuit board components
- Electronic components (microprocessor and integrated circuits, vibration motors, Bluetooth radios, etc.) - $2,000
- Mobile devices for interface development and testing - $3,000
- Contract printed circuit board fabrication and assembly - $2,000
- Fabrication of custom designed plastic or silicone housing - $2,000
- Miscellaneous tools and materials for prototype assembly - $1,000