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Swallowable Robots With Power generation for In-vivo Rumen health and methaneMonitoring

New Agrobacterium strains enable temporary genetic expression in plants without permanently modifying the plant's genome.

Researchers from Purdue University developed a morphing robot structure for the rumen of livestock to monitor their health and methane output in real time. The origami-inspired structure can be swallowed by animals and allows the robot to change its density and distribution of buoyant forces to traverse the depth of the rumen, enabling high-precision and high-granularity study of the interlayer rumen dynamics. It is the first machine that can traverse the depth of the rumen which enables high-precision and high-granularity study of interlayer rumen dynamics which is impossible to do otherwise Additionally, the robot can convert energy from the inherent motions of the rumen and livestock to usable electric charge to power the robot, eliminating the need to frequently change batteries. This also ensures long battery life and operation life of the robot and optimizes data collection.

This robot has applications in welfare and sustainability of livestock operations and animal agriculture. For example, this device may be able to detect diseases such as sub-ruminal acidosis (SARA) more effectively than alternative methods such as monitoring milk quality parameters and biomarkers such as body temperature, or the use of rumen boluses. Rumen boluses are capsule-shaped sensors that are implanted into the rumen through the mouth. However, they only collect temperature data and do not provide information about the interlayer dynamics of the rumen.

Technology Validation:

The researchers have demonstrated low energy consumption of the device. Ongoing work includes developing a mathematical formula to tie the methane measured from the system with industry standard equipment. They are also iterating on the design of the robot to make it more morphable.

Technology ID
2024-VOYL-70663

Category
Biotechnology & Life Sciences/Synthetic Biology & Genetic Engineering
Agriculture, Nutrition, & AgTech/Livestock & Animal Health Solutions
GreenTech/Carbon Management
Robotics & Automation/Autonomous Systems & Perception AI

Authors
Yuanmeng Huang
Upinder Kaur
Richard M Voyles

Further information
Raquel Peron
rperon@prf.org

View online

Advantages:

-Morphable structure

-Power generation

-Real-time monitoring

-High precision

Applications:

-Livestock management

-Animal welfare

-Animal science research

Publication:

https://web.ics.purdue.edu/~rvoyles/Pubs/ReMar2021_Hybridization.pdf

https://dl.acm.org/doi/abs/10.1145/3560905.3568419

TRL: 2

Intellectual Property:

Provisional-Gov. Funding, 2024-11-26, United States

Keywords: Agrobacterium strains, transient expression, non-integrating T-DNA, gene expression, plant biotechnology, genetic modification, gene delivery, novel vector, plant transformation, gene therapy, buoyancy-based locomotion, energy scavenging, Food and Nutrition, livestock health monitoring, methane measurement, morphable structures, robot, swallowable robots, Veterinary