Cell-free Biosensors to Detect Creatinine, Creatine, and Sarcosine

Low-cost, point-of-care kidney function monitoring and biomarker detection

Georgia Tech researchers are improving upon currently existing available assay kits for creatinine (a biomarker for renal function) with a portable, low-cost biosensor that uses a cell-free expression (CFE) system and a reporter system that yields a color shift corresponding to the creatine levels. The result is an assay that detects creatinine, creatine, and/or sarcosine molecules enabling point-of-care (POC) quantitative measurement of these biomarkers in biofluid specimens (e.g., blood or urine) without expensive instrumentation.

Creatinine levels play an important role in the assessment of kidney function and determining the course of treatment in chronic kidney disease and other conditions, such as human immunodeficiency virus (HIV) and various cardiovascular diseases. Further, any aggressive pharmacotherapy (drug treatment) requires the monitoring of renal function, as the risk of kidney failure is greatly increased while undergoing such treatments. Similarly, evidence suggests that sarcosine could be a biomarker for several diseases, including prostate cancer.

Summary Bullets

- **Portable**: This technology demonstrates the potential to develop point-of-care screening and monitoring, which is essential to expanding access to care worldwide, including to low- and middle-income countries.
- **Inexpensive**: CFE-based biosensors can cost as little as a few cents per test and could provide a low-cost alternative to current renal function monitoring and diagnosis, which currently involves laboratory visits, trained phlebotomists, skilled technicians, and expensive, specialized equipment.
- **Cell-free**: The use of a cell-free expression system could enable easier-to-read quantitative output that is less susceptible to matrix effects.

Solution Advantages

- **Portable**: This technology demonstrates the potential to develop point-of-care screening and monitoring, which is essential to expanding access to care worldwide, including to low- and middle-income countries.
- **Inexpensive**: CFE-based biosensors can cost as little as a few cents per test and could provide a low-cost alternative to current renal function monitoring and diagnosis, which currently involves laboratory visits, trained phlebotomists, skilled technicians, and expensive, specialized equipment.
- **Cell-free**: The use of a cell-free expression system could enable easier-to-read quantitative output that is less susceptible to matrix effects.

- **Fundamental**: Assessing and monitoring renal function is key to both the diagnosis and treatment of numerous diseases. Developing a point-of-care alternative could allow widespread use as a screening technique.

Potential Commercial Applications

This technology could enable low-cost, quantitative diagnostics for a variety of conditions including chronic kidney disease, cardiovascular disease, and cancer. It could also be used as a screening tool across large patient populations for usage on a potentially global scale.

Inventors

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IP Status

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Publications

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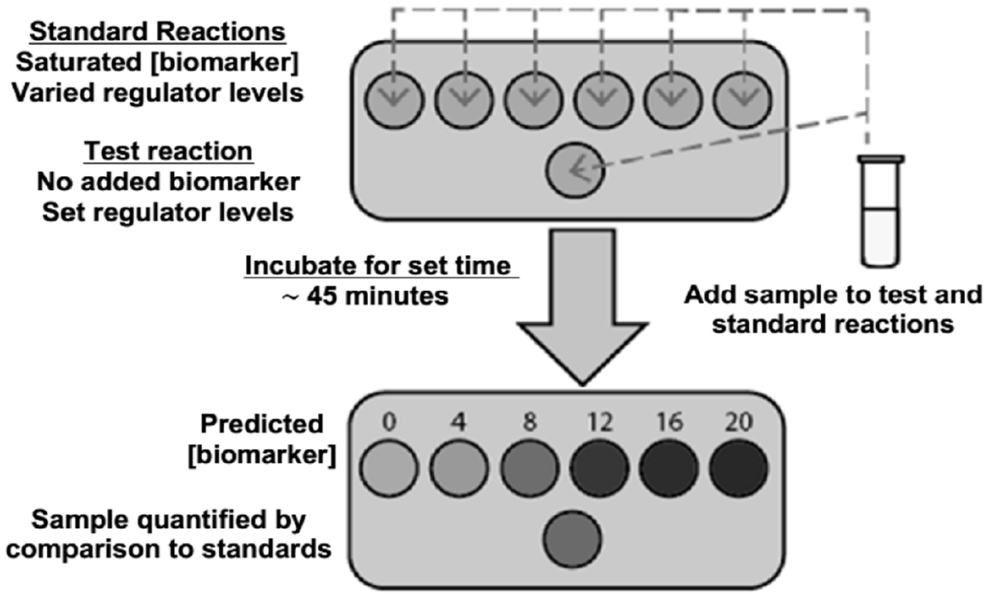
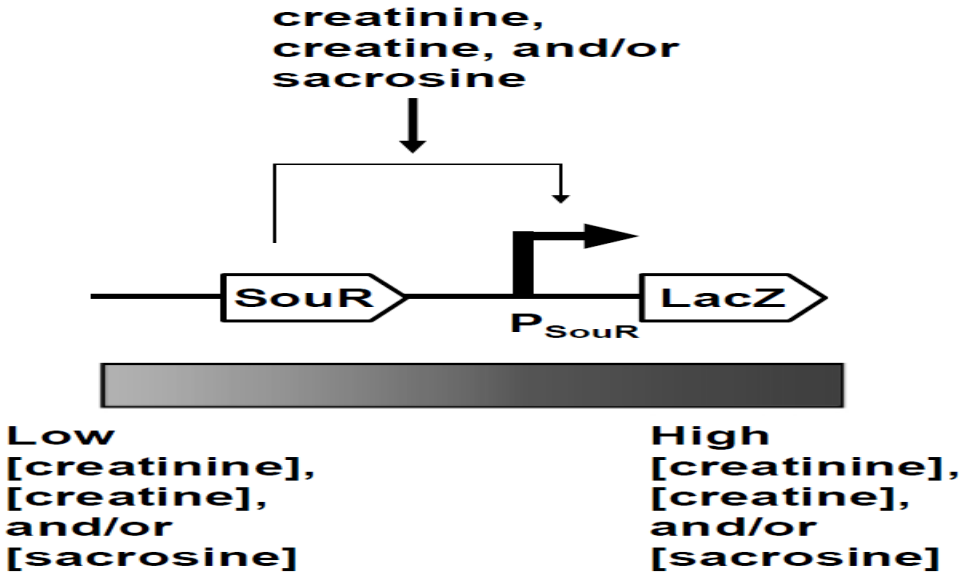
Images



A schematic of standardization method to account for matrix effects.



A schematic of an exemplary sarcosine-responsive circuit used to control ? galactosidase production. ?-galactosidase is expressed from the SouR-regulated promotor.

Visit the Technology here:
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