

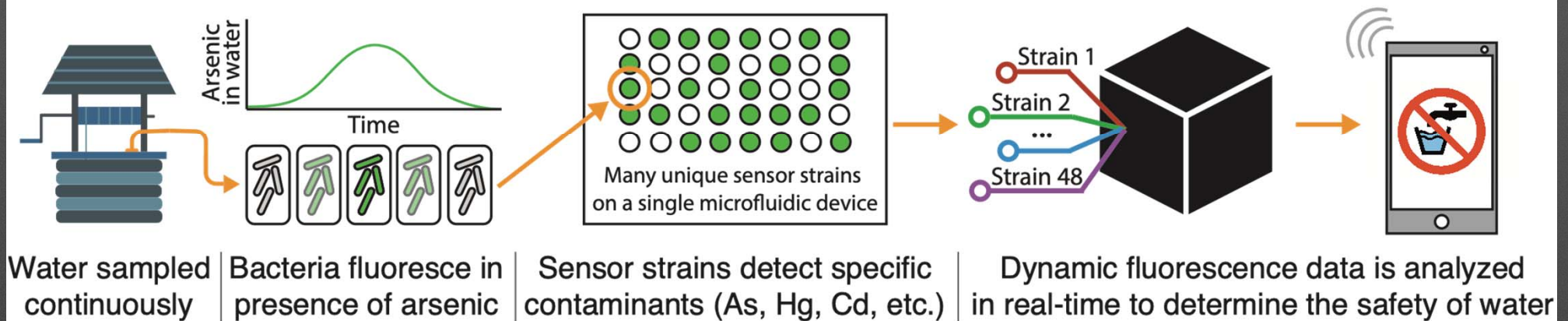
A Customizable Biosensor for Multiparameter, Real-Time Water Monitoring

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Biosensor Platform Overview

A Microfluidic Biosensor Platform for Real-Time Contaminant Monitoring



- We have developed a biosensor platform that continuously monitors water for a suite of contaminants or other analytes of interest
- Our biosensor platform uses microbial sensor strains that fluoresce in response to contaminant exposure to continuously monitor water
 - Many sensor strains are patterned on a single microfluidic device
 - Customized optics and electronics translate cell signals into analyte concentrations
 - Data is analyzed in real time and results can be transmitted wirelessly or tied into a feedback system, e.g. for process control

Improvements over State-of-the-Art

- **Customizable:** we can engineer new sensor strains and have demonstrated the ability to design strains for specific detection needs
- **Flexible and Expandable:** no need for a new unit if targets of interest change; simply change the sensor strains on the cartridge
- **Multi-parameter:** a single sensor unit can detect many parameters and can replace a suite of probes and kits used by a facility

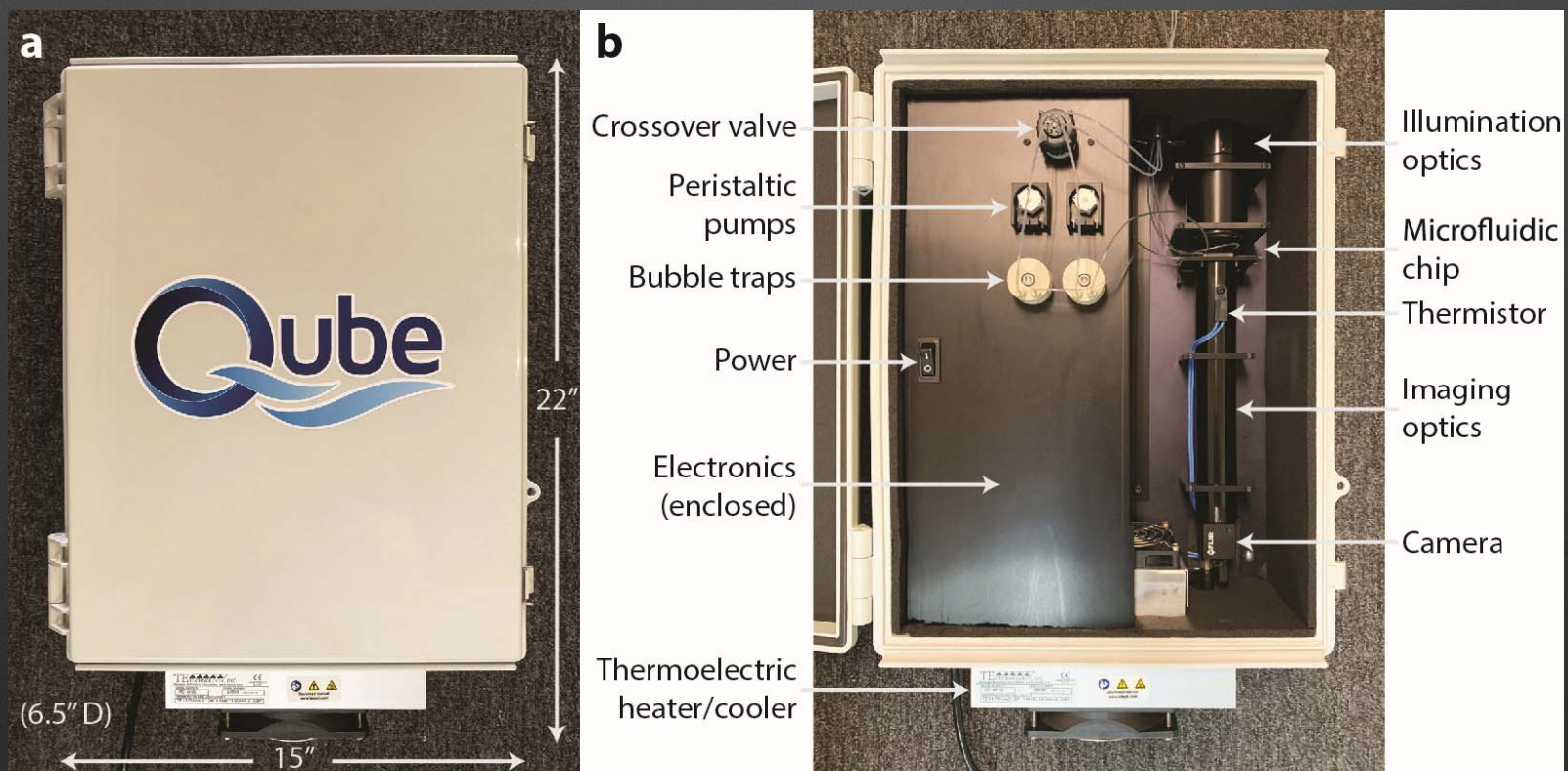
TARGET	DETECTION LIMIT (ppb)
Arsenic	5
Cadmium	2
Uranium	300
Mercury	1
Lead	30
Zinc	50
Iron	300
Nitrate	25
Nitrite	250
Phosphate	25
Ammonium	250

Improvements over State-of-the-Art

- **Continuous operation and real-time results:** a major benefit over grab sampling, particularly when detecting analyte fluctuations is critical
- **Low maintenance:** the sensor can run with no intervention for a month
 - A simple monthly media and cartridge swap enables continued operation with little expertise required
- **Significantly cheaper than other on-line sensors:** current continuous sensors are expensive (~\$50k) and only detect one or two targets
 - Our sensor will cost ~\$5k with a \$80 monthly cartridge and can sense many targets simultaneously

Biosensor Technology: Sensor Hardware

- Our sensor is housed in an environmental enclosure that contains the optics along with the hardware and software needed to sustain cell growth and handle image acquisition and processing
- The platform can be used in a laboratory or outdoor environment



Sensor Applications

- Environmental Monitoring: continuously monitor water sources to track contaminant fluctuations and inform remediation efforts
- Process Control in Water Treatment & Management: track critical parameters used in water treatment in real time to use as feedback for process optimization
- Environmental Enforcement: monitor water streams for sporadic or fluctuating events to inform waste, chemical, and/or cleanup enforcement efforts
- Smart Nutrient Dosing: provide real-time nutrient measurements to enable smart nutrient dosing and optimization of crop growth at algae and other agricultural operations

Future Directions

- We are interested in input and feedback from potential end users on the utility of the platform as well as what features to add:
 - New targets to sense: analytes that are currently difficult or expensive to detect or can't be monitored continuously?
 - Deployment traits: size, power, environmental constraints
- We are interested in partnering with facilities to do trials to validate and further develop our platform