SCH: INT: Personalized Wearable Metabolic Rate Monitors and Learning Social Networks-A Synergy for Smart Connected Health

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Purpose of your project

•Novel bio-mimicking chemo-actuators that detect gaseous biomarkers for metabolic disorders, emitted from the skin, non-intrusively and without relying on sweat, are made in this project (**PI:Gouma**)

• These are being integrated with novel electromagnetic transducers for effortless and continuous gas monitoring (**co-PI: Kiourti**)

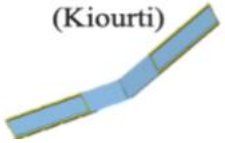
• Novel organic-inorganic hybrid materials-"melting gels"- are being explored for gas-tight seals (**co-PI: Klein**)

• Physiological predictive models correlative skin gases to metabolic rate and fat burning are being developed (**co-PI:Srinivasan**)

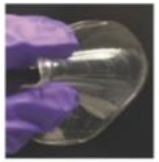
• Our team has also been harnessing the data revolution:
- by interfacing learning social networks with nanomedicine tools
-for educating the next generation high-technology work-force

Acetone-selective chemo-mechanical actuator (Gouma)

Electromagnetic sensor for deformation measurement (Kiourti)



Packaging (Klein)



Modeling, inference human metabolic studies (Srinivasan)

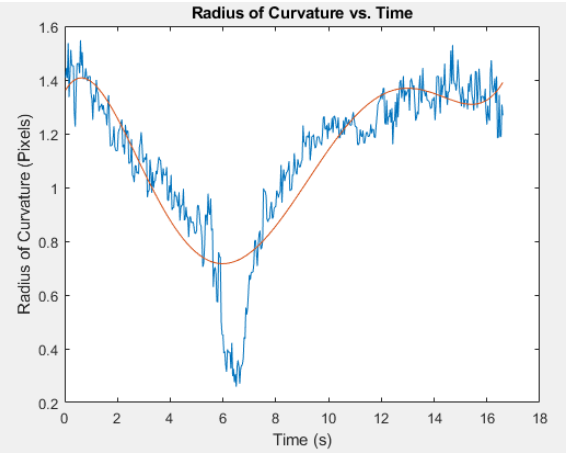
Information management systems

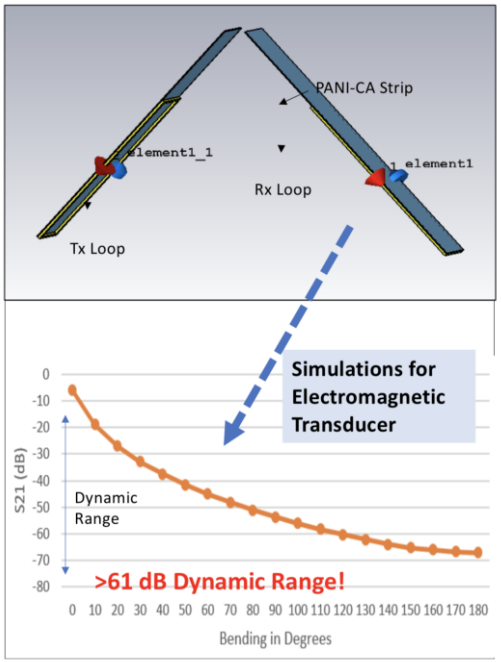
Findings

***Technical perspective*- Novel Proprietary Computer Vision Tool for Mapping Chemo-Mechanical Actuation** –

<u>Accurate Measurement of Sensor Sensitivity</u>

- Streaming RGB video from low-cost camera
- Convert to binary and isolate actuator shape
- Fits high order polynomial to actuator shape and finds curvature
- Characterize mean curvature versus chemical actuation
- **Fully Automated, Based Off Video Metadata**





Health/Medical Perspective-

•The PANI/CA chemo-actuators were found to be non-magnetic, low loss and low permittivity materials

•A skin acetone gas sensor with electromagnetic transduction was thus designed for monitoring metabolic rate

•Acetone released in breath and skin is a product of lipid degradation

•Breath acetone increases up to 500nmol/L in a week indicates a weight reduction of about one-half pound

•The skin acetone equivalent is expected to be a fraction of this value and it is currently being determined in our studies

• With these novel sensors we can monitor when someone loses weight effectively through fat loss and not by losing muscle

Pernicious Problems

- A critical issue for devices detecting gaseous biomarkers is the lack of appropriate regulatory policies to deal with such novel technologies

- Skin gases, much like the breath gases, are thought of as novel assays compared to blood, urine, saliva, by agencies like the FDA

- However, this is a misconception as skin-gases are much cleaner assays overall

- Our proposed approach of using gas-tight seals and wireless transmission of the output signal will also eliminate any interferences from the environment

- Therefore, we anticipate to overcome any obstacles in getting this technology approved and widely adopted

- Since our sensors do not need to be consciously monitored, we anticipate that they will be adopted fast by the public and they guide the way to a healthy lifestyle and will significantly improve the quality of life and welfare