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 (Pl: Gouma)

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

• Novel organic-inorganic hybrid materials—“melting gels”—are being explored for gas-tight seals (co-Pl: Klein)

• Physiological predictive models correlative skin gases to metabolic rate and fat burning are being developed (co-Pl: 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
Findings

- 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
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.