GastroSense - Non-invasive Method to Efficiently Detect Various GI Issues Unaccompanied by Deleterious Effects on the GI Tract

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My research this year was devoted to creating a non-invasive method to efficiently detect gastrointestinal conditions without causing harm to the digestive tract, as GI diseases affect millions worldwide. My hypothesis stated that this device would be effective due to its ability to detect VOCs using my novel device. My hypothesis was supported in my experiment. For my method, I used circuit boards and nC6H12O6, then added an individual chemical, followed by a layer of carbon on top of the board to increase conductivity. I used Polyaniline, a conductive polymer that changes resistance upon exposure, to detect ammonia. I used Platinum Nanoparticles which catalyze the oxidation of hydrogen, lowering the resistance of the material in response to hydrogen presence, to detect hydrogen. I used Tin Oxide to detect as the methane molecules adsorb onto the surface of SnO2, causing a change in its resistance. Various individuals then breathed onto the device, which detected their status based on the presence of ammonia (NH3), methane (CH4), and Hydrogen(H2)—biomarkers linked to gastrointestinal health. The data revealed that a significant rise in NH3 indicated a severe gastrointestinal condition. Meanwhile, a decrease of baseline resistance in CH4 suggested a problem with the large intestine. Similarly, a decrease of baseline resistance in H2 suggested a problem with the small intestine. Overall, the sensor showed a sensitivity of 75% and a specificity of 90%, indicating its potential as a reliable and effective tool for detecting gastrointestinal issues. In conclusion, I was able to refine this device to assess gastrointestinal health and disease severity using breath analysis.

Awards Won: