

Identification of bio-related research and education themes for future investment

Frank Tittel

ECE and IBB

Idea:

My idea of educational themes for future investment at Rice include:

Financial support for summer undergraduates, graduate students, post-doctoral fellows as well as visiting faculty from the US and outside the US.

Affordable housing devoted to students, post docs and faculty in unfinished BRC space.

Funding of one two assistant faculty positions

Current Strengths:

For the past 11 years the thrust of the Rice Laser Science Group (lasersci.rice.edu/) has focused on the development of reliable, compact sensor systems for the detection of trace gas species and their applications in medical diagnostics, the life sciences and public health. State-of-the-art. infrared chemical sensors are effective new tools for the identification and quantification of trace gases in human breath for clinical uses on and quantification. Increased or decreased concentrations of these molecules are associated with the pathogenesis of a large number of diseases. Current technologies enable breath analyses to be performed on a single breath and the results are available in real time. Critical parameters including sensor sensitivity, selectivity, real-time monitoring capability, robustness, cost, size, and weight, determine the progress that made toward the development and availability of commercial diagnostic sensors. Breath analysis has enormous potential, because sampling breath is noninvasive, inherently safe to the subject, and poses minimum risk to the person collecting the sample. The only requirement to collect a breath sample is that the subject must be breathing “normally”. Breath samples can be collected easily and reproducibly in the field, in a clinic, at the bedside, in the operating room, or in an intensive care unit from infants to the elderly. For example, hydrocarbons (such as methane, ethane, ethylene, and 1-pentane) and hydrogen have been identified in breath. Colonic bacteria metabolizing carbohydrates that were not absorbed in the small bowel produce methane and hydrogen. Elevated levels of methane and hydrogen can therefore be used to diagnose the presence of carbohydrate malabsorption syndrome. Nitric oxide (NO) as an endothelial-derived relaxant factor and showed that NO plays critical roles in numerous physiological processes and in the pathophysiology of various disease states. These studies and the direct measurement of NO in breath were the catalyst for many studies that related NO in breath to pulmonary diseases.