The NA-NOSE Concept

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The Nanoscale Artificial NOSE (™NA-NOSE) is a nanomaterial-based artificial olfactory system developed by Prof. Haick and his group for the detection of volatile organic compounds in the gas phase. It was developed for diagnostic breath testing but can also be adapted to other applications in medicine, homeland security, environmental monitoring, etc.

Bio-inspired, NA-NOSE performs odor detection using an array of broadly cross-reactive sensors in conjunction with pattern recognition methods. This is in contrast to the “lock-and-key” approach, where a highly selective sensor is designed to respond to a specific analyte.

Sensor arrays are often called artificial olfactory systems or electronic noses because they mimic our sense of smell. Every constituent sensor in the array responds to all (or to a large subset) of the mixture compounds. Our NA-NOSE sensors are sufficiently diverse to provide individually different responses to a given mixture but are not strictly chemically selective. The combined responses of the NA-NOSE elements are used to establish analyte-specific response patterns by applying pattern recognition algorithms and classification techniques. This increases the variety of compounds to which an NA-NOSE is sensitive and thus increases the degree of
component identification, enabling an analysis of individual biomarkers in complex multi-component media. Pattern recognition algorithms, such as principal component analysis (PCA), supported vector machines (SVM), or neuronal network analysis can then be applied on the entire set of signals to acquire information on the identity, properties and chemical composition of the vapor exposed to the sensors array. The constituent NA-NOSE sensors, which have been developed and characterized in Prof. Haick’s laboratories at the Technion, are based on tailor-made molecularly modified nanomaterials.

**Illustration of breath analysis with NA-NOSE** (a) A lab prototype of a hand-held device that collects exhaled breath from cancer patients. (b) Exposure chamber with inlet for breath samples. (c) Array of cross-reactive molecularly capped metal nanoparticle chemiresistors for the diagnosis of breath samples — see inset for a scanning electron microscopy image of the sensor’s template.

**REFERENCES:**
Videos:

Nano Artificial Nose (Na-Nose) and Cancer (1’58’’)

http://www.youtube.com/watch?v=b47phYuNVf4

Prof. Hossam Haick artificial nose cancer detection (3’08’’)

http://www.youtube.com/watch?v=xwMx2lrfnyA