5minute Research

Troy Lowry

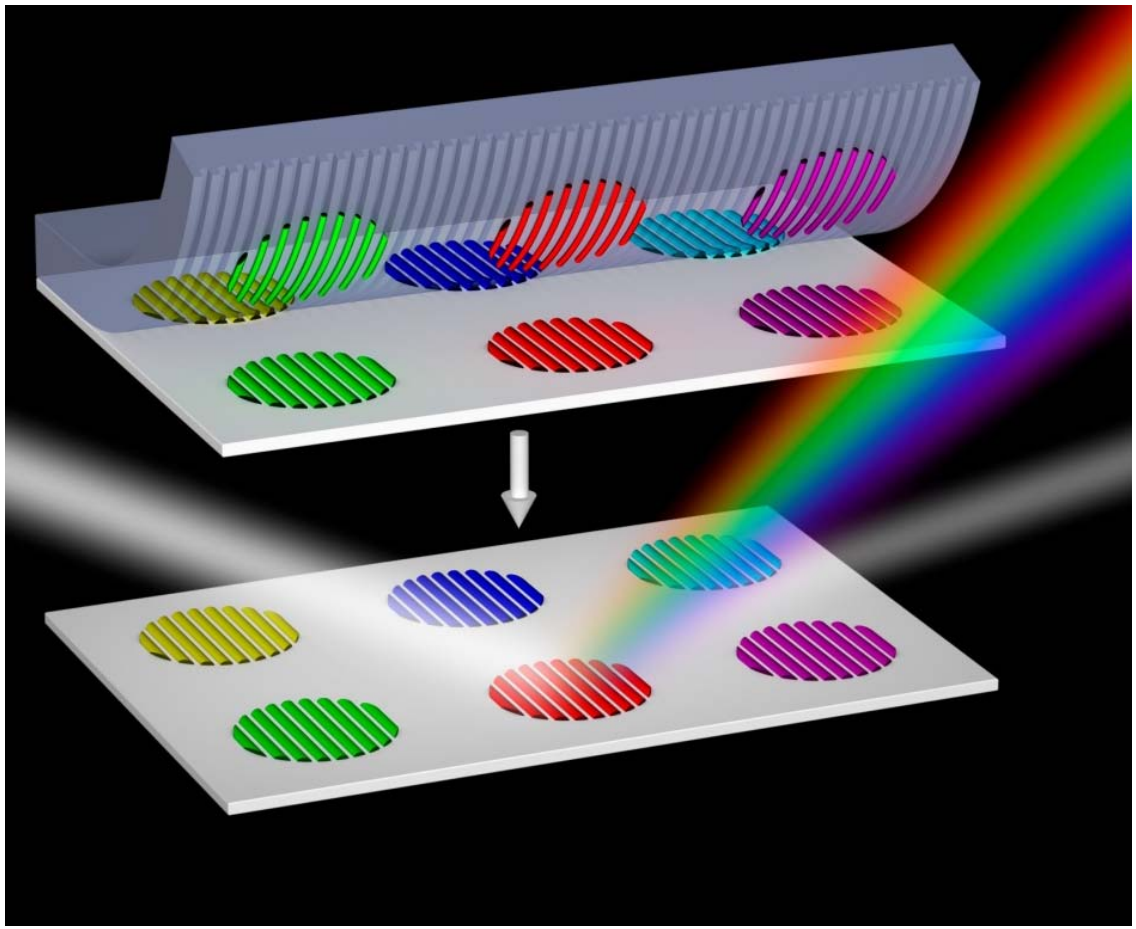
Biological Science/Neuroscience

Development of an Artificial Nose Using Lipid Nanotechnology

The Office of Postdoctoral Affairs

The Graduate School | Florida State University

DEVELOPMENT OF AN ARTIFICIAL NOSE USING LIPID NANOTECHNOLOGY



Troy Lowry
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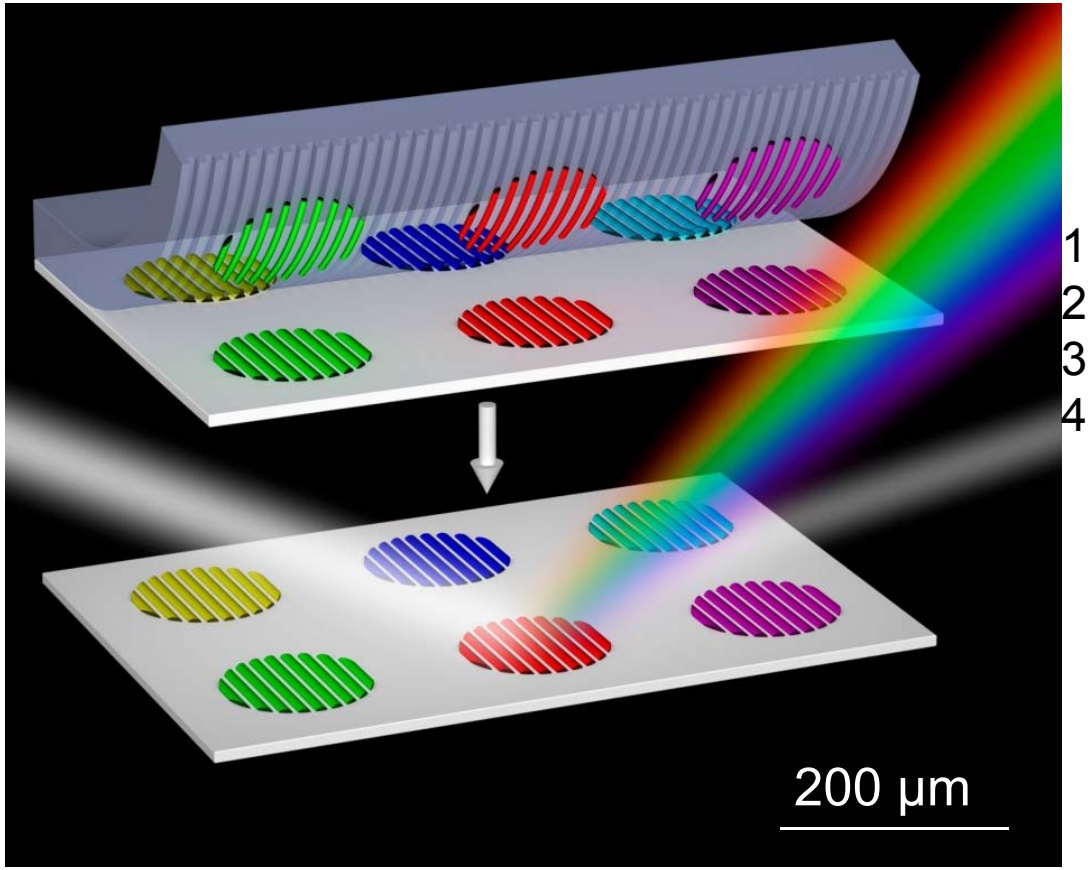
Purpose: Developing Effective Sensors

Famous Examples of Sensors

- In the early 1900s, canaries were first used to detect carbon monoxide in coal mines.
- The glucose monitor is essential for treatment of Diabetes – which according to the CDC affects 29 million people in the United States.

Sensors have traditionally been limited to detect the presence of only one substance of interest. What if sensors could be more versatile (like our nose)?

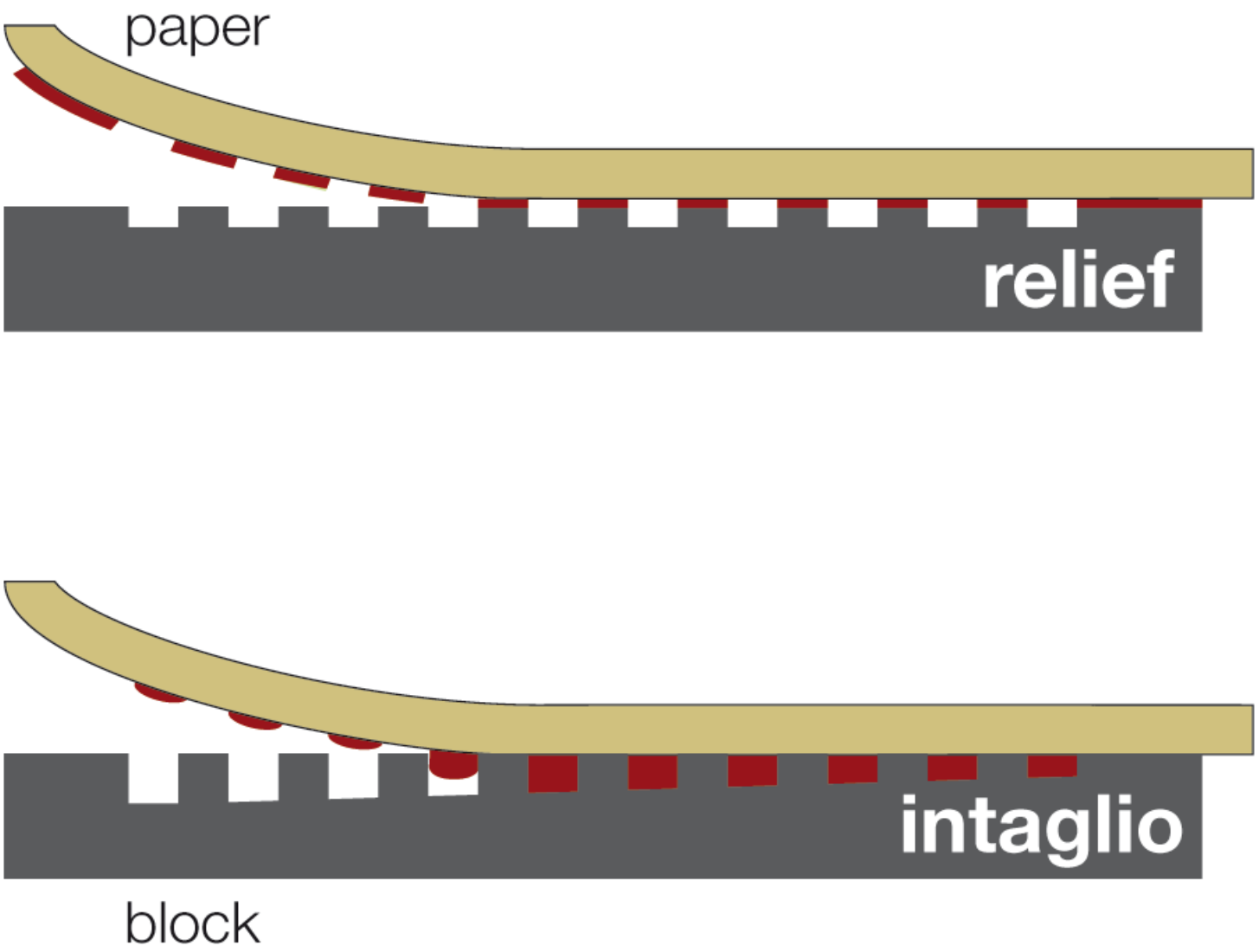
To Improve Current Sensors: Miniaturizing the Sensor Chip



Properties of the Chip:

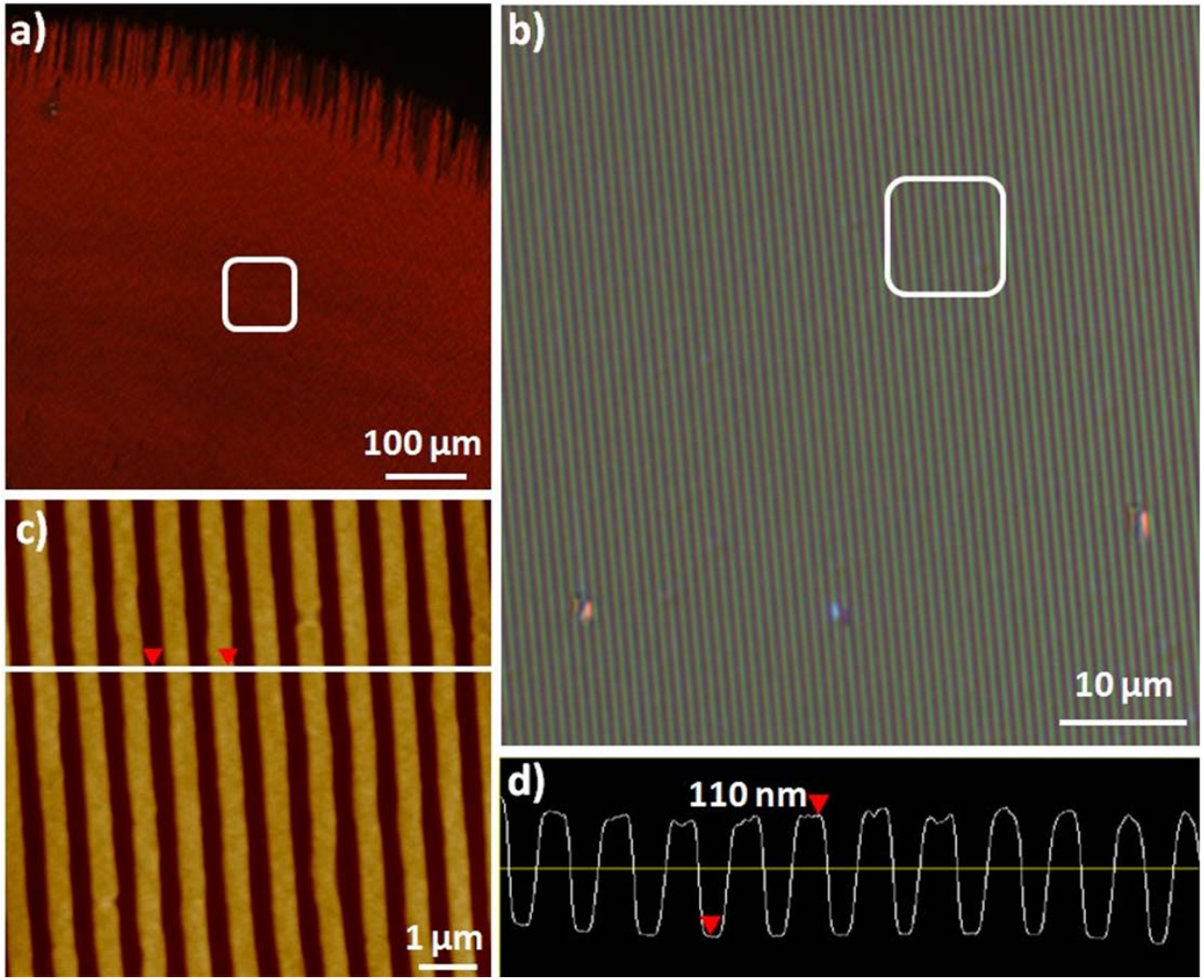
1. Detect multiple substances
2. Label-free
3. Provide information about substance activity
4. Sensitive

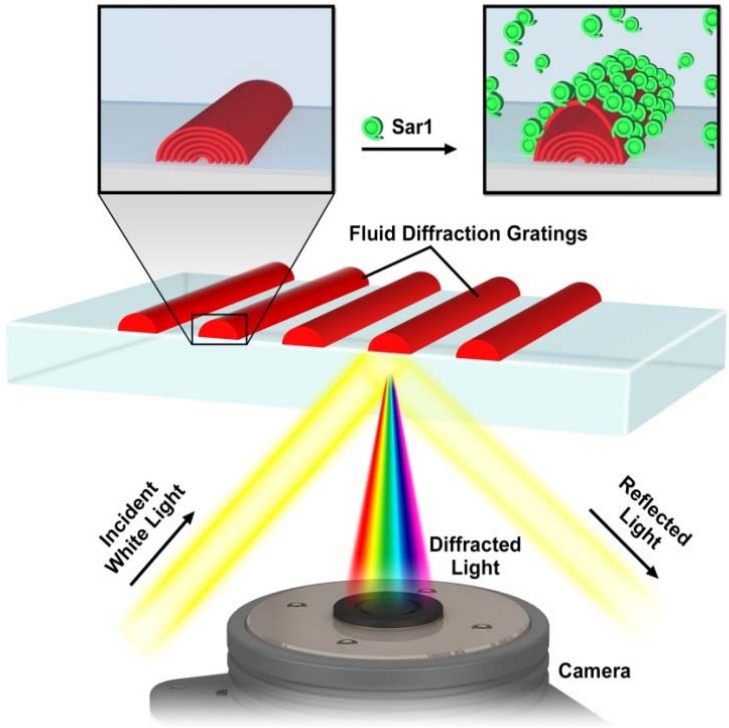
How It’s Made: Intaglio Printing Process From Application in Art



A US Treasury Department, Rembrandt and Picasso Approved Method!

How It Works: Iridescent Oil Gratings



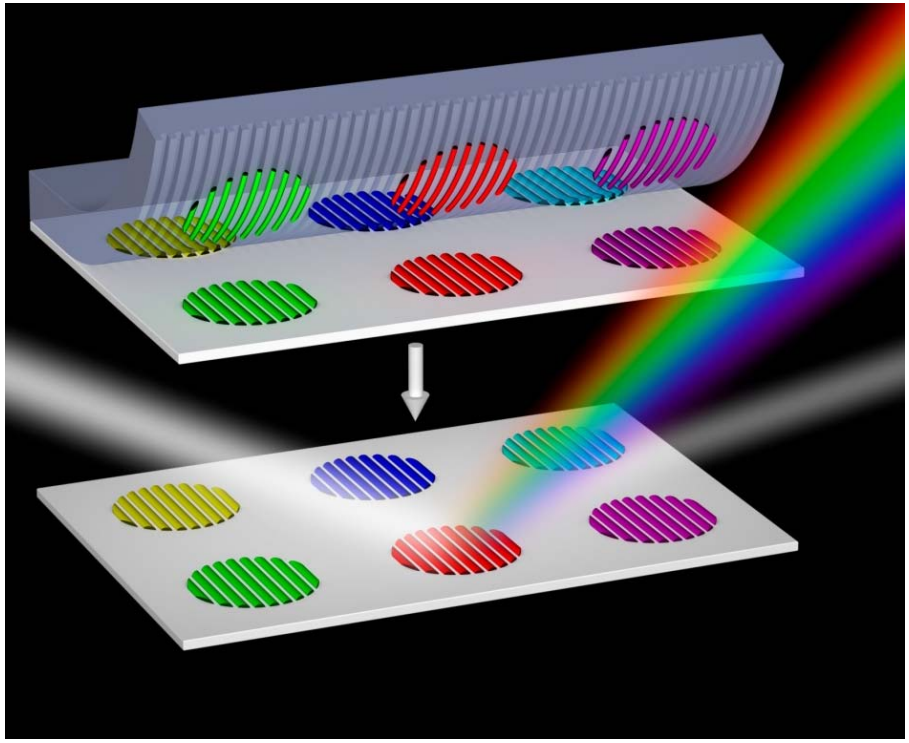


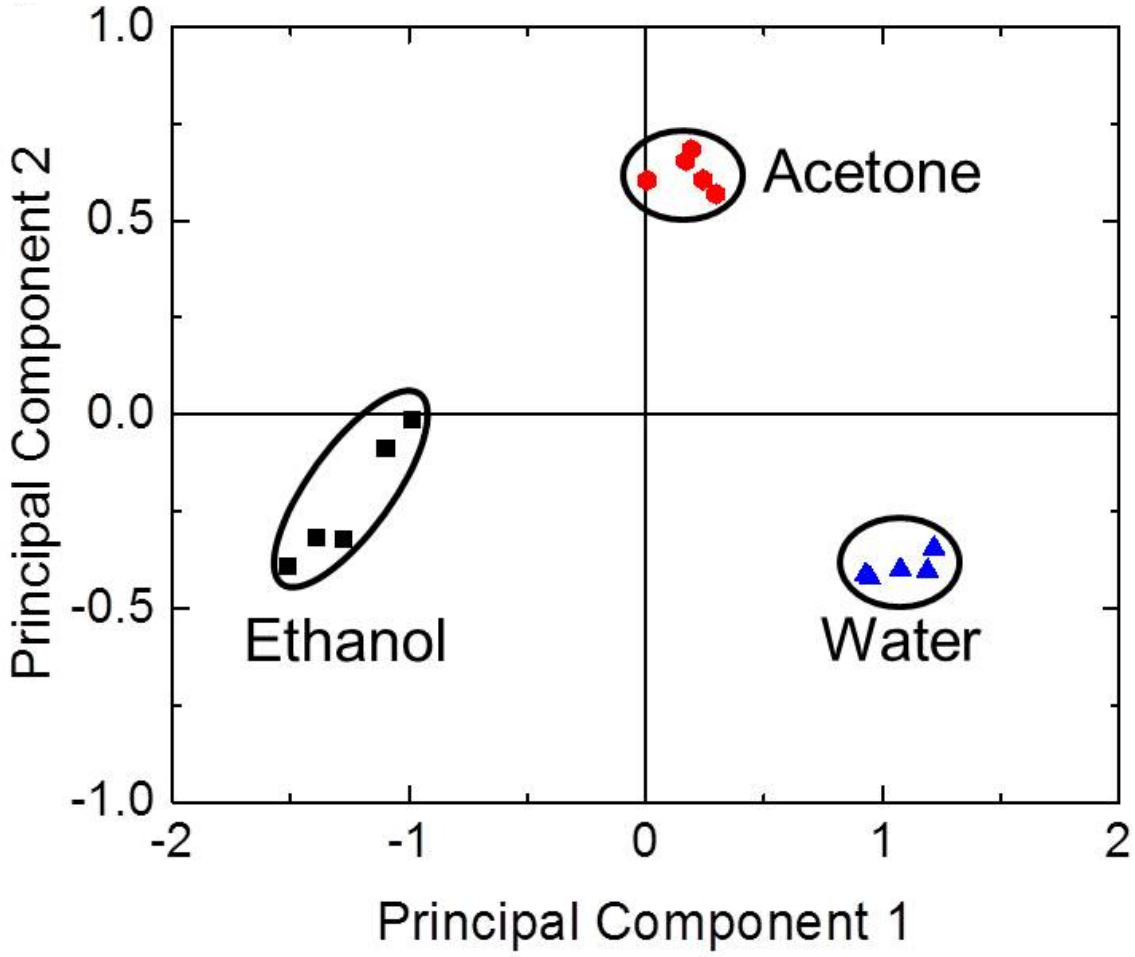
Change in the lipid structure itself changes optical properties

Nafday O, Lowry T.W., Lenhert, S. (2012). Multifunctional Lipid Multilayer Stamping. *Small* 8(7): 1021-1028.

Lowry, T. W., Hariri, H., Prommapan, P., Kusi-Appiah, A., Vafai, N., Bienkiewicz, E. A., Van Winkle, D. H., Stagg, S. M. and Lenhert, S. 2016. Quantification of Protein-Induced Membrane Remodeling Kinetics In Vitro with Lipid Multilayer Gratings. Small 12:506–515.

Application: Development of an Artificial Nose





Lowry, T.W., Prommapan, P., Rainer, Q., Van Winkle, D.H., and Lenhert, S. 2015. Lipid Multilayer Grating Arrays Integrated by Nanointaglio for Vapor Sensing by an Optical Nose. Sensors 15:20863-20872.

Conclusions

1. A new method of nanofabricating lipid multilayer gratings (nanointaglio) was created.
   - Cost Effective
   - Scalable
   - Suitable for Integrating Multiple Materials
   - Addresses Some Shortcomings of Other Methods

2. Outlook
   - **Impact**: The method is expected to be applicable to a wide variety of membrane binding proteins, environmental concerns and real odor receptors for making a not so artificial nose!

Thank You!