

2017 Tripartite Symposium



Speakers



Alex Star, Ph.D. University of Pittsburgh
***Carbon Nanotube-based Gas Sensors toward
Breath Analysis***

Biography

Alexander Star is a Professor of Chemistry, Bioengineering, and Clinical and Translational Science at the University of Pittsburgh. Originally from Kazakhstan, Professor Star received his B.Sc. and Ph.D. degrees in chemistry from Tel Aviv University in 1994 and 2000, respectively. He then spent two years as a postdoctoral associate with Sir J. Fraser Stoddart at California NanoSystems Institute at the University of California, Los Angeles, where he investigated synthetic schemes to functionalize carbon nanotubes. Between 2002 and 2005 he served as Senior Scientist and Manager of Applications Development at Nanomix, Inc. – a nanotechnology startup company – where he worked on development and commercialization of carbon nanotube-based sensors. He joined the Chemistry faculty at the University of Pittsburgh in 2005.

Abstract

Breath analysis is a promising method for rapid, inexpensive, noninvasive disease diagnosis and health monitoring due to the correlative relationship between breath biomarker concentrations and abnormal health conditions. However, current methods to identify and quantify breath components rely on large, bench-top analytical instruments. Carbon nanotube (CNT)- based gas sensors are desirable candidates to replace benchtop instruments because of their sensitive chemical-to-electrical transducer capability, high degree of chemical functionality options, and their potential for miniaturization. This talk will give an overview of the synthetic methods used to functionalize CNT-based gas sensors, specifically those sensors that target biologically relevant breath markers. Specific examples will be provided to highlight the sensing mechanisms behind different classes of CNT hybrid composites. Finally, the current challenges and prospective solutions of applying CNT-based sensors to breath analysis will be discussed.



Rick Burkhard, Air-Scent International
The Role of Scent in Business Today

Biography

Rick Burkhard has been in the fragrance industry for over 20 years. As the business manager for Air-Scent International he is engaged with the many levels of ambient scent application. In the early 2000's Rick became an early adopter and engaged with the sensory marketing portion of the fragrance industry. He has worked with such companies as Bath & Body Works, TimeMist, Yankee Candle Co. Pier1 and ScentAir and shared his knowledge through lectures at Concordia University under Jordan LeBel and Rowan College under Robert Ambrose.

Abstract

Olfactory awareness is an impactful way of connecting a person to a situation, item or memory through the sense of smell. The olfactory system is how our brain associates aromas with our surroundings. Attached to our limbic system, it immediately creates impressions – *memories* – that will always be associated and available for immediate recall.

How do you create brand awareness through Scent Marketing?

Utilizing extensive knowledge and fragrance design, aromas can be deployed to set a controlled sensory environment. Whether you are enhancing an apartment, fitness center, advertisement, or product, the potential is endless. Through fragrance development and designed an effective aroma can be utilized to invoke a positive emotional response for any brand.



Sergeant Chad O'Brien and K-9 Bartje, Pittsburgh Police Department
Demonstration of K-9 Bartje Detecting Explosives

Biography

Sergeant Chad O'Brien has been with the Pittsburgh Police Department for twelve years, including acting as a sergeant the past four and a half years. Sergeant O'Brien has been a member of the Pittsburgh SWAT Team the past nine years and took charge of the K-9 Unit in 2016. Chad has been partnered with K-9 Bartje since January of 2016.

K-9 Bartje is a 7 year old Belgian Malinois who is trained in Explosive and Gun Detection. Bartje is a dual purpose K-9 who is also trained in Patrol, to include but not limited to high risk tracking, building searches, area searches and bite apprehension.

Abstract

Sergeant Chad O'Brien will introduce us to K-9 Bartje. He will discuss how they work together and demonstrate Bartje's expertise in detecting explosives.



Meghan Ramos, Penn Vet Working Dog Center
***Giving Scent a Meaning: How We Train Dogs
to Recognize Unique Smells***

Biography

Meghan Ramos is a research coordinator at the Penn Vet Working Dog Center (PVWDC). She has been working and training working dogs at the PVWDC for three and a half years. She is a 2018 Veterinariae Medicinae Doctoris (VMD) candidate at the University of Pennsylvania School of Veterinary Medicine and received her Bachelor of Science in Animal Science from Rutgers University. After veterinary school, Meghan will pursue a Master's of Translational Research and residency in Sports medicine and rehabilitation.

Abstract

A working dog's nose has been an essential asset to federal governments, militaries, police departments, and most recently medical research teams worldwide. Research has shown there are an estimated 220 million olfactory receptors in a dog's nose. Together these receptors are capable of detecting compounds at the lower limits of one part per trillion. This is three orders of magnitude greater than the sensitivity of current instruments, which establishes a dog's nose as the best scent detection device known to man. Trainers and researchers utilize the dog's ability to detect one specific scent amongst a vast background through an imprinting training technique. Imprinting consists of presenting the scent of interest to the dog in a reward-based clicker and treat method. The dog relentlessly searches for the scent and is rewarded with high value food or an elaborate tug of war session with his handler. Upon successful completion of imprinting, the dog has formulated a strong connection between the scent and the toy or food reward. At the Penn Vet Working Dog Center (PVWDC) every dog undergoes both foundational and career specific scent training. Career specific odors include explosives and narcotics for police K9s, disaster victims and human remains detection for Urban Search and Rescue dogs, or volatile organic compounds associated with cancer and infectious disease for medical detection dogs. A successful working dog career requires meticulous training to enhance the dog's natural olfactory abilities, which contributes to the future of national security and medical advancements



George Preti, Ph.D. Monell Chemical Senses Center
***An Interdisciplinary Approach to Detecting
Ovarian Cancer using its Odor Signature***

Biography

Dr. George Preti was born and raised in Brooklyn, NY. He received his B.S. in Chemistry from the Polytechnic Institute of Brooklyn in 1966 and his PhD in Organic Chemistry in 1971 from the Massachusetts Institute of Technology, with a specialty in Organic Mass Spectrometry in the laboratory of Professor Klaus Biemann. That same year he joined the Monell Chemical Senses Center in Philadelphia. The Center, a non-profit research institute, is renowned throughout the world as a leader in multidisciplinary, basic research in olfaction and gustation. Dr. Preti is a Member of Monell and an Adjunct Professor in the Department of Dermatology, School of Medicine at the University of Pennsylvania. For more than four decades, his research has focused upon the nature, origin and functional significance of human odors. His current studies center upon human odors which are diagnostic of disease, a bioassay-guided approach to the identification

of human pheromones, malodor identification and suppression as well as examining the “odor-print” of humans and the effect of genetics on body odor.

In addition to having published numerous peer-reviewed papers and reviews, Dr. Preti holds more than a dozen patents related to deodorancy, odor-mediated control of the menstrual cycle and the use of odors in diagnosis. His unique area of research has resulted in hundreds of clinician-directed referrals of patients with idiopathic body- and oral malodor production problems. His efforts in this area have revealed a large, undiagnosed population of people suffering from trimethylaminuria, an odor-producing genetic disorder. In addition his research has resulted in frequent citations and coverage in print and electronic media throughout the world.

His research on human and agricultural odors was featured in the New York Times Magazine section on 10/15/00 (“The War on Stink;” see below) as well as described in a feature article about Monell’s research done by Chemical and Engineering News (C&E News): 1/7/02 issue. More recently his laboratory’s research into the volatile organic compounds associated with skin cancer was the subject of articles in the Philadelphia Inquirer (8/21/08), C&E News (9/22/08) as well as electronic and print media around the world. In addition, C&E News described his on-going research into human odor signatures on 10/12/09: “You Stink.”

Several television segments have also described his research into body and oral odors, including appearances on “CBS Sunday Morning” which discussed his research into human primer and modulator pheromones found within axillary secretions (it was the subject of world-wide press coverage) and ABC’s “Primetime-Medical Mysteries” series which featured Dr. Preti and two of the individuals he has diagnosed with Trimethylaminuria, a genetic, odor-producing disorder. “CBS This Morning” and Fox News Health report (<http://www.foxnews.com/health/2013/10/07/woman-best-friend-dogs-being-trained-to-sniff-out-ovarian-cancer/>) have recently described his current research aimed at identifying the odor signature of ovarian cancer. This unique research effort was also detailed in the New York Times Magazine (http://www.nytimes.com/2013/11/24/magazine/what-does-cancer-smell-like.html?_r=0).

Abstract

Introduction: Ovarian carcinoma is the most lethal of the gynecological malignancies and the fifth leading cause of cancer death in women. The high mortality rate is due to the late stage of detection when therapeutic strategies are limited and morbidity and mortality are high. Diagnosis of ovarian cancer is severely hindered by the lack of reliable early-stage diagnostic tools despite its importance to treatment success. Studies using proteomics, genomics, metabolomics as well as imaging techniques have not yielded successful screening methods to date. To our knowledge, none have attempted what we are doing, viz., examination and use of the volatile organic compounds (VOCs) produced by ovarian carcinoma to enable diagnosis.

Hypothesis: Based on previous studies with trained dogs, we hypothesized that endogenous volatile metabolites emanating from the tumor will provide a reliable, detectable signal of cancer’s presence.

Innovative Approach: To test this hypothesis, we employed a multidisciplinary approach using a) trained canines to demonstrate the presence of volatile organic compounds (VOCs) from the disease, b) organic-analytical techniques (SPME; GC/MS) to identify volatile biomarkers of the disease and c) using the volatile biomarkers to help identify single-stranded-DNA-coated carbon nanotubes (DNA-NT) for incorporation into a nanotechnology-enabled E-nose to “sense” the VOCs and serve as a screening tool.

Results: Our medical-detection dogs have been trained to recognize the odor of ovarian carcinoma from biopsied tissue and are able to distinguish with 90% or higher mean proportion of success pooled and individual plasma samples from patients with ovarian cancer vs. those from healthy controls. Results obtained using both organic-analytical techniques and DNA-NT sensors suggest the existence of reliable quantitative differences in VOCs emanating from pooled and individual plasma samples collected from healthy controls as well as patients with benign growths and patients with various forms of primary ovarian cancer. The nature of the compounds distinguishing the samples as well as differences in the DNA-NT analyses of individual samples from both patient groups as well as controls will be shown and discussed.

Conclusion: Ovarian cancer does have a characteristic odor signature and it is reliably detected by trained canines, GC/MS and the arrays of DNA-NT sensors that we have employed.

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Saturday, May 20, 2017, 8:30 am – 2:00 pm

Carlow University – AJ Palumbo Hall of Science and Technology – Room 107
3333 Fifth Avenue (between Forbes and Fifth on corner of Craft), Pittsburgh, PA 15213

- 8:30 Registration and Opening Remarks
- 9:00 **Carbon Nanotube-based Gas Sensors toward Breath Analysis**
Alex Star, Ph.D. University of Pittsburgh
- 9:45 **The Role of Scent in Business Today**
Rick Burkhard, Air-Scent International
- 10:30 Intermission
- 10:40 **Demonstration of K-9 Bartje Detecting Explosives**
Sergeant Chad O'Brien and K-9 Bartje, Pittsburgh Police Department
- 11:10 **Giving Scent a Meaning: How We Train Dogs to Recognize Unique Smells**
Meghan Ramos, Penn Vet Working Dog Center
- 11:55 **An Interdisciplinary Approach to Detecting Ovarian Cancer using its Odor Signature**
George Preti, Ph.D. Monell Chemical Senses Center
- 1:40 Luncheon and Discussion

Parking

Enter parking lot at the corner of Craft and Fifth Avenue. The AJ Palumbo Center is directly across the street from the parking lot.

