

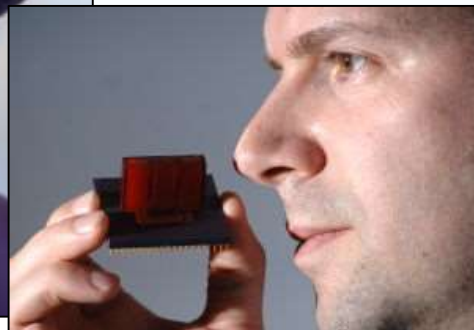
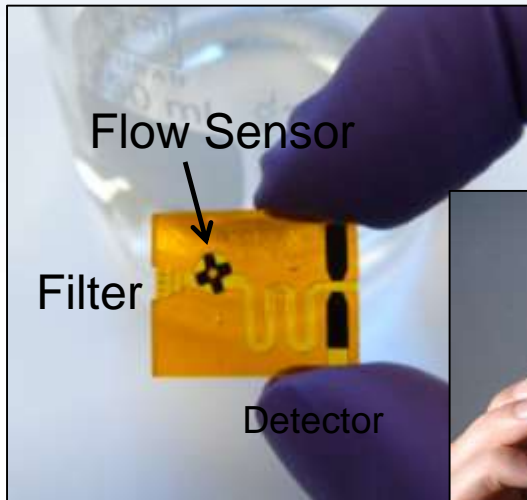
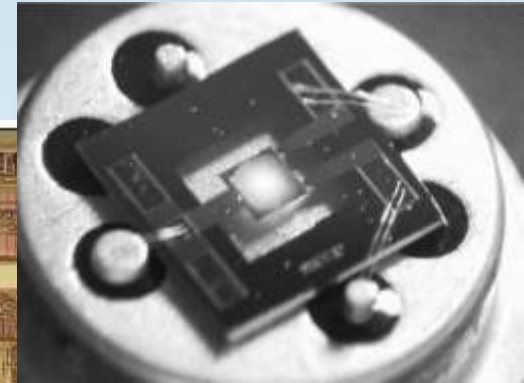
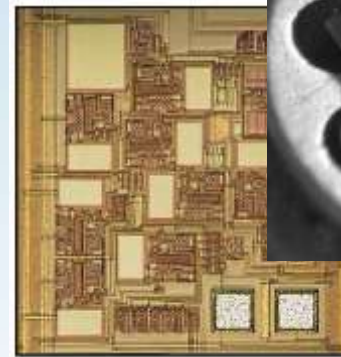
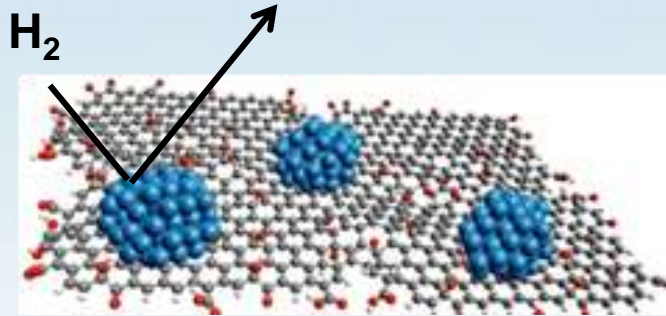
University of Warwick

Sniffing out Tuberculosis

Dr J.A. Covington
Biomedical Sensors Lab
School of Engineering



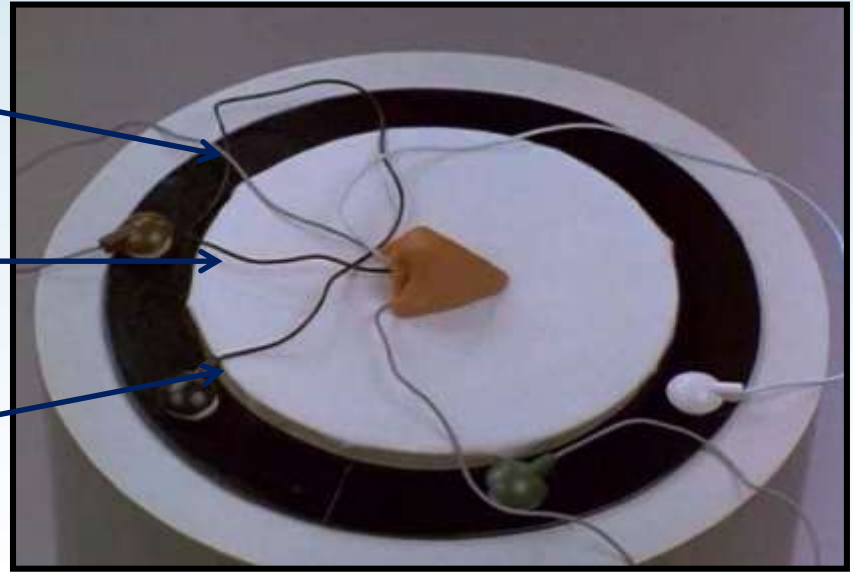
A life in smell...



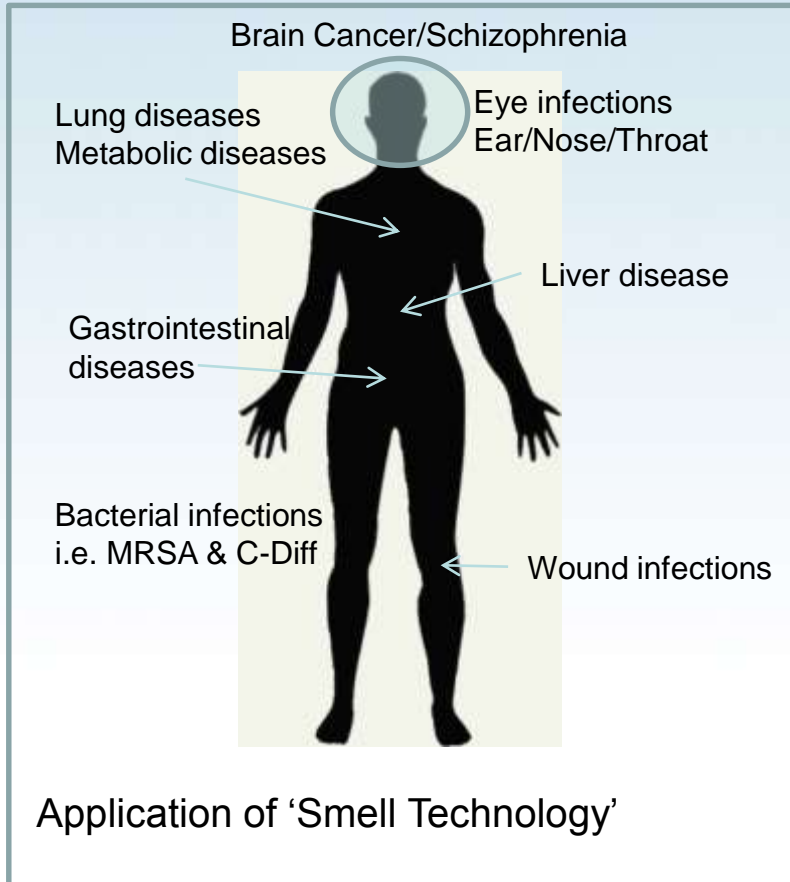
Motivation...

- Point of care
- Rapid
- Patient acceptable
- Low-cost
- Simple
- Hospitals/Home
- Developing countries





Warwick/University Hospital Coventry & Warwickshire



- Diseases investigated...

- Bile acid malabsorption
- Bladder/prostate Cancer
- Coeliac's disease
- Clostridium difficile
- Colorectal Cancer
- Crohns disease/Ulcerative colitis
- Diabetes
- Hepatic encephalopathy
- Irritable bowel syndrome
- Liver disease
- Obesity
- Pelvic radiation
- Pre-term labour



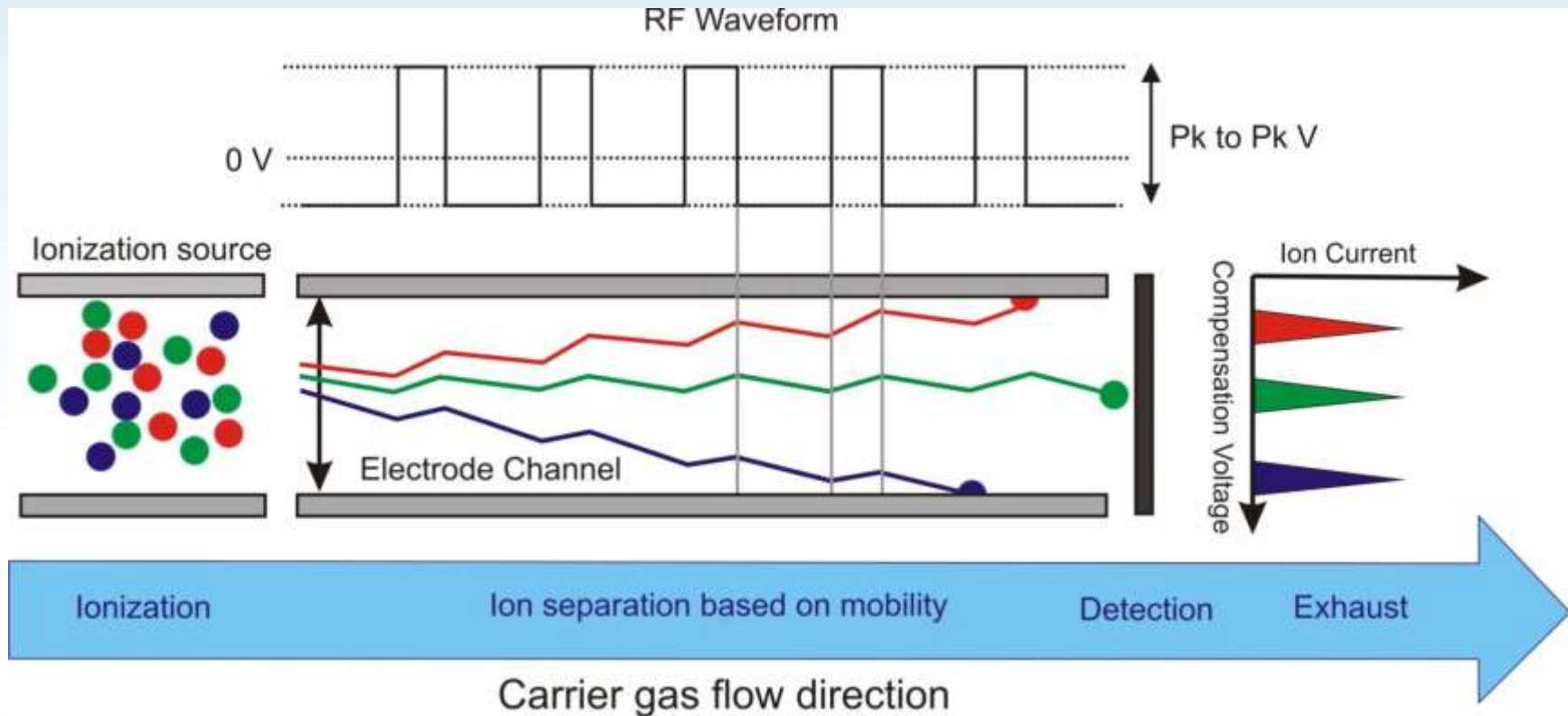
TB Breath “sniffers”

- Testing of breath for TB targeted for decades
- Show promise...
 - Most high-end analytical instruments (GCMS etc.)
 - Others based on electronic nose
- However, limited by the core sensor technology or by carrier gas
- Hence, each system needs to be individually configured and will drift significantly over time



Ion Mobility Spectrometry - FAIMS

- Used in chemical warfare detection
- Applications for military or home security

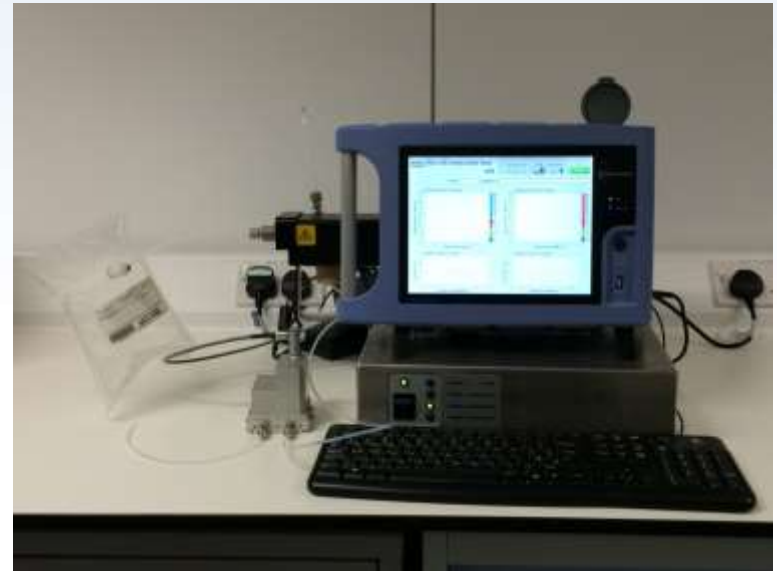


Subject groups

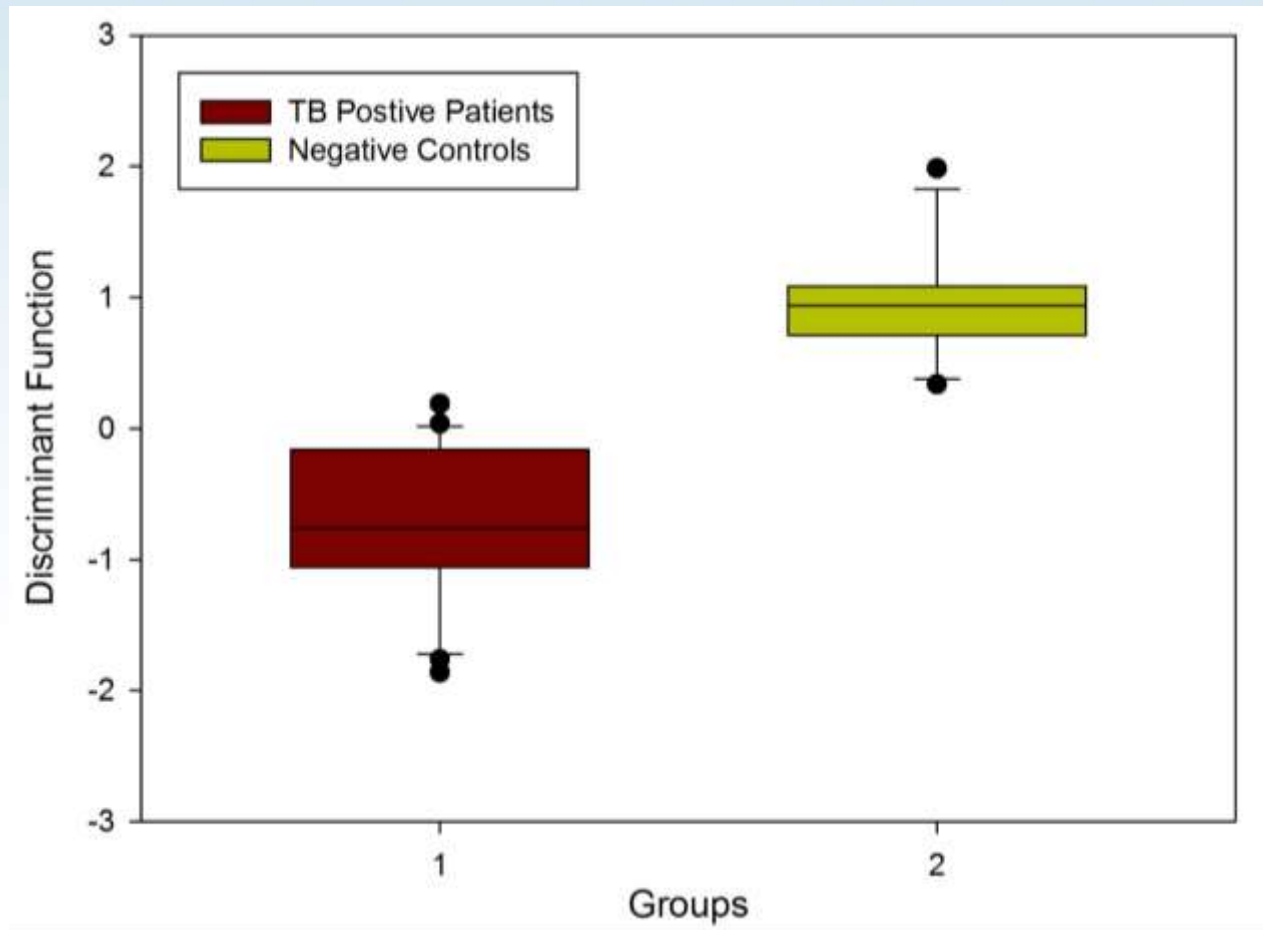
- 26 patients with confirmed TB
 - 7 smokers, 9 drinkers, Av. Age 46 (21-85)
- 19 negative controls (from suspected patients and TB positive family members)
 - 4 smokers, 11 drinkers, Av. Age 39 (24-63)
- Smear, Cx, T-spot etc. confirmation
- Patients were asked not to eat/drink/smoke for 2 hours before collection

Sample Collection

- All samples collected and tested at UHCW over 5 months
- In-house breath capture system employing 3L tedlar bags
- Breath samples tested on day of capture (stored in fridge)
- Urine samples stored at -80°C for batch sampling

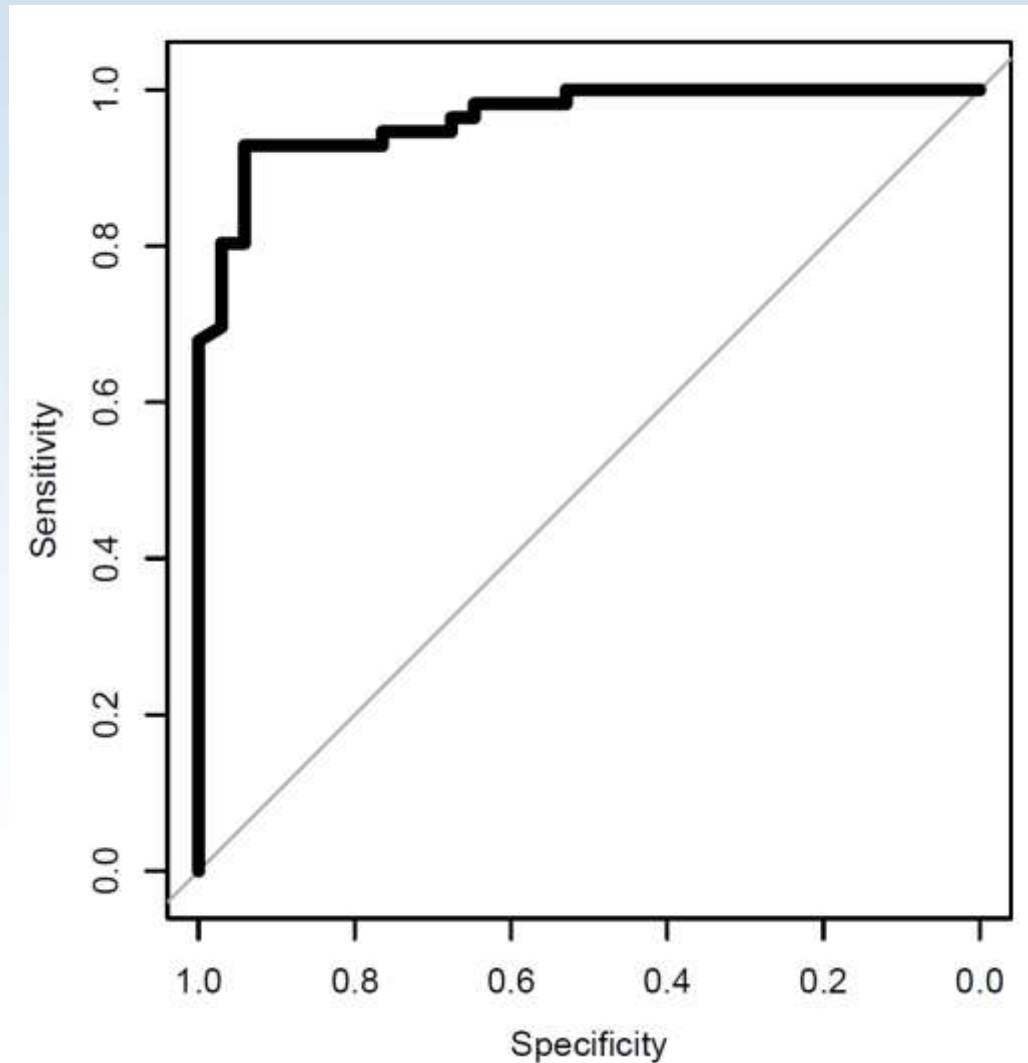


Breath Results – Multivariate Analysis



ROC - Breath

- Random Forrest Classifier
- 10 fold cross-validation
- AUC = 0.96 (95% CI: 0.93,1)
- Sensitivity: 93%
- Specificity: 94%



Conclusions & Further work

- Initial breath results show promise...However
 - Sample collection & post testing challenging
 - Difficulty in sample introduction
 - Current technology now superseded
 - Requires validation with larger cohort
 - Investigation of ethnicity, diet etc.
 - Exploring commercial partnerships
- Second development phase
 - But too expensive...
 - Creation of low-cost, small, portable instruments
 - Dedicated to harsh environments
 - WOLF research programme...

And thank you to...

- Dr E. Adams – LSTM
- Prof S. Ward – LSTM
- Dr A. Sahota - UHCW
- Dr R. Gowda – UHCW
- Dr R. Arasaradnam – UHCW
- Dr N. Sagar - UHCW
- Ms S. Wurie - UHCW
- *And my PhD students...*

