P rqlwrulqj #yrodwloh# rujdqlf#frp srxqgv#q# kxp dq#euhdwk

Gu#Fkulvwrskhu#Z dong

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R grxu#) #rddfwlrq#q# p hglfdo#gldjqrvlv

- Long history
  - Earliest days of medicine
  - Odours on the breath of patients well known
  - Diabetes (“fruity”); liber disease (“fetor”)
- Reflects biochemical state
  - Potentially useful as diagnostic tool
- Odour itself is qualitative
  - Modern interest in breath analysis
  - Held to date from late C19th

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Euhdwk#dqdq|vlv#0 dgydqwdjhv

- Non-invasive
- Rapid
- Repeatable
- Little preparation of volunteer or operator
- Point-of-care

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Z kdwÃv#q#euhdwkB

- Nitrogen, oxygen, carbon dioxide
- Water
- Nitric oxide, carbon monoxide
  - Diagnosis/monitoring of pulmonary disease
- Complex molecules
  - Detectable in exhaled breath condensate
  - Proteins, including hormones and enzymes
- Volatile Organics Compounds (VOCs)

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Wkh#rulj q#ri#YR Fv

- VOCs arise from normal physiological processes, the body’s response to infection, and products of microbial metabolism
- Blood carries everything around
- VOCs reach urine, blood, breath

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YR Fv

A number of breath VOCs found to be significant e.g.:

- Acetaldehyde & formaldehyde – potential cancer marker
- Isoprene: cholesterol biosynthesis; oxidative stress
- Sulphides: gut bacteria, mouth bacteria
- Ammonia: kidney & liver disease; protein metabolism

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Euhdwk#YRF#frqwhqw

- Each human breath contains hundreds, perhaps thousands of VOCs
- By no means all are metabolites
  - inhalation, ingestion, skin contact
- Those that are metabolites are not necessarily useful

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Euhdwk#dqdo|vv#0 sureohp v

- Range of concentrations
- What are the target analytes? (Biomarker identification)
- Handling breath/quality/stability of sample
  - Large sample volumes
  - Leakage
  - Adsorption/desorption on container
  - Water content can cause problems
- Compensating for background

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Vhqvru#j dv#dqdo|vhu

- SMOS-GA a.k.a. the “Breathotron”
- Designed and built at Cranfield University
- Provides automatic breath sampling onto a mixed metal-oxide sensor (MMOS)
- Parallel sampling onto thermal desorption (TD) tube for GC-MS analysis
- Proof-of-concept device for point-of-care diagnosis
- Mains-powered portable device
- Uses PC or PDA for control and data logging

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Euhdwkrwurq

10

Idfhp dvn#dvvhvvphqw

- Volunteer wears a facemask and breathes normally
- Mass flow sensor to measure expiratory flow rate
- Used to control sampling process
- Allowance for respiratory dead space
- Sampling generally takes 3-4 minutes

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P l{hg#p hwdo#r{ lgh#j dv# vhqvruv

CAP 25

- Adsorption of gas onto metal oxide semiconductor can produce large change is resistance
- CAP 25; p-type; chromium-titanium oxide
- Designed as a general air quality monitoring sensor
- (Was) commercially available: low-cost
- Nonspecific, though some control is possible by adjusting sensor temperature
- Sensor resistance increases as VOCs adsorb onto it

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