

# Nijmegen, NL



# Radboud University Nijmegen (RUN)

18.000 students in approx. 107 study programs

9 faculties:

1. Faculty of Theology
2. Faculty of religious Studies
3. Faculty of Philosophy
4. Faculty of Arts
5. Faculty of Law
6. Faculty of Social Sciences
7. Nijmegen School of Management
8. **Faculty of Science**

**(Physics, Chemistry, Biology, Mathematics and Computing Science)**

1. Faculty of Medical Sciences



**Dept. of Molecular and Laser Physics,  
Life Science Trace Gas Research Group**





# Physics techniques for trace gas detection on biological systems

**Simona M. Cristescu**

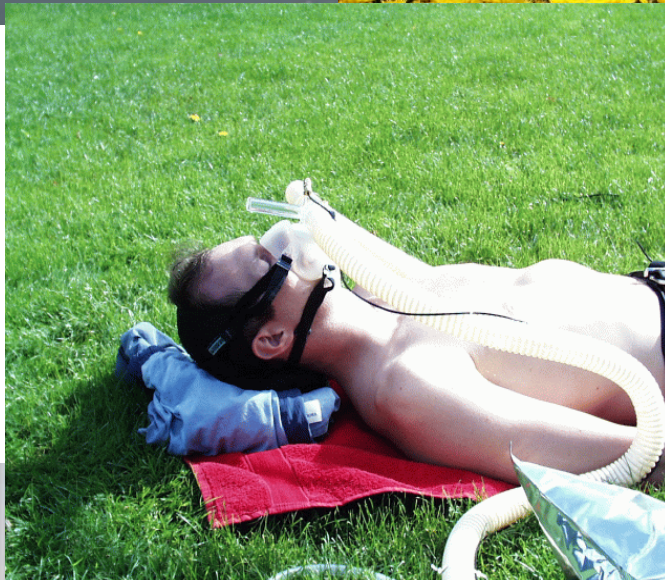
Life Science Trace Gas Research Group  
Dept. of Molecular and Laser Physics,  
Radboud University Nijmegen, NL

[www.ru.nl/tracegasfacility](http://www.ru.nl/tracegasfacility)

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# Trace gases in Life Sciences





# European Trace Gas Facility



- ❖ Selectivity
- ❖ Sensitivity (*below ppbv*)
- ❖ Speed (*min. >>sec.*)
- ❖ On line
- ❖ Non-invasive

**Life Science Trace Gas Facility  
CALL FOR PROPOSALS**

Access, training and full support for fast and on-line detection of ultra low gas concentrations from biological samples at and below the ppbv-level (1 ppbv = 1 part per billion volume = 1:10<sup>9</sup>)

Application form and information on: [www.ru.nl/tracegasfacility](http://www.ru.nl/tracegasfacility)

Travel, accommodation and subsistence costs are covered for scientists from EU and associated countries. Every 3 months new users are selected.

EU: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom. Candidate countries: Bulgaria, Croatia, Romania and Turkey. Other countries associated to the FP6: Iceland, Israel, Liechtenstein, Norway and Switzerland.

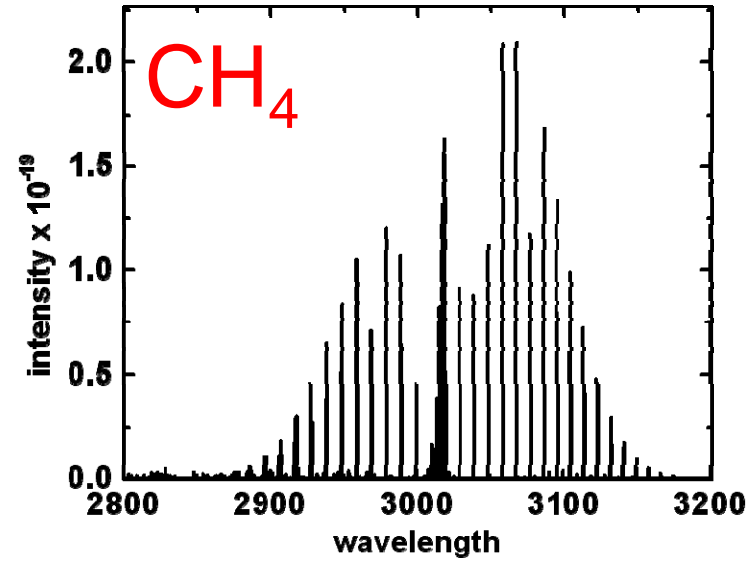
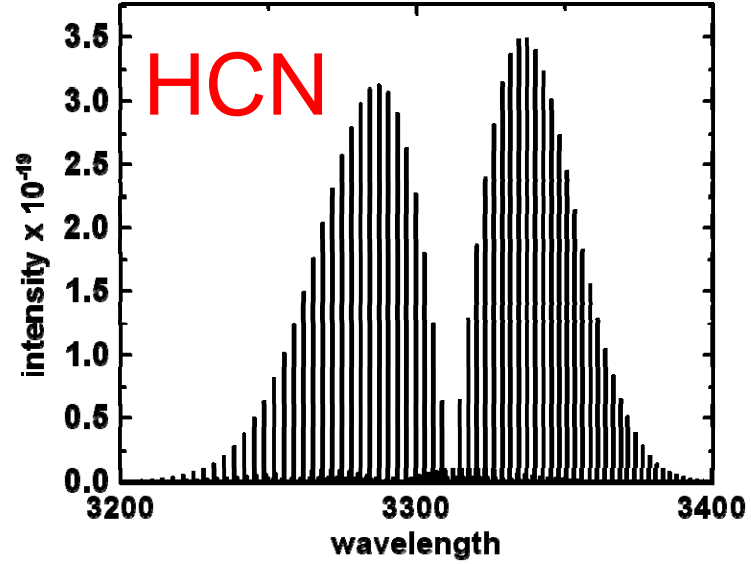
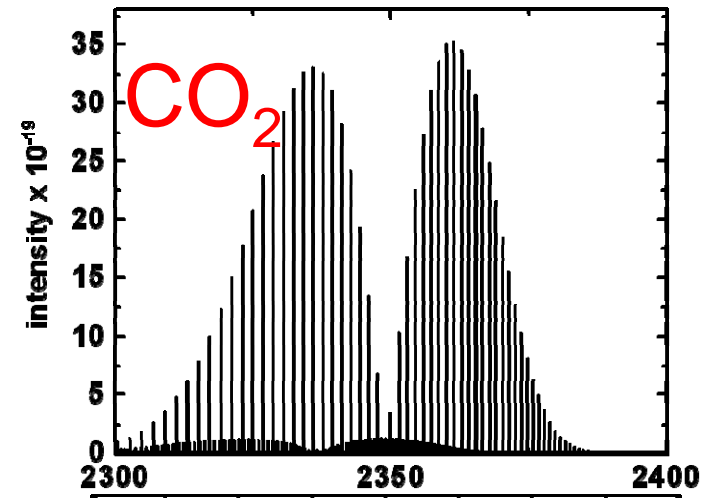
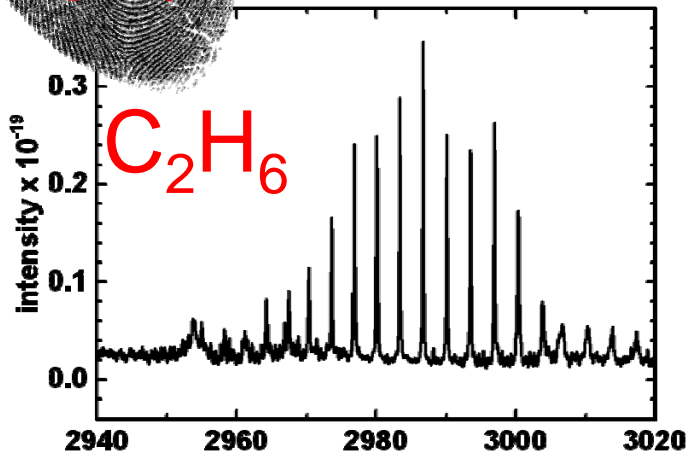
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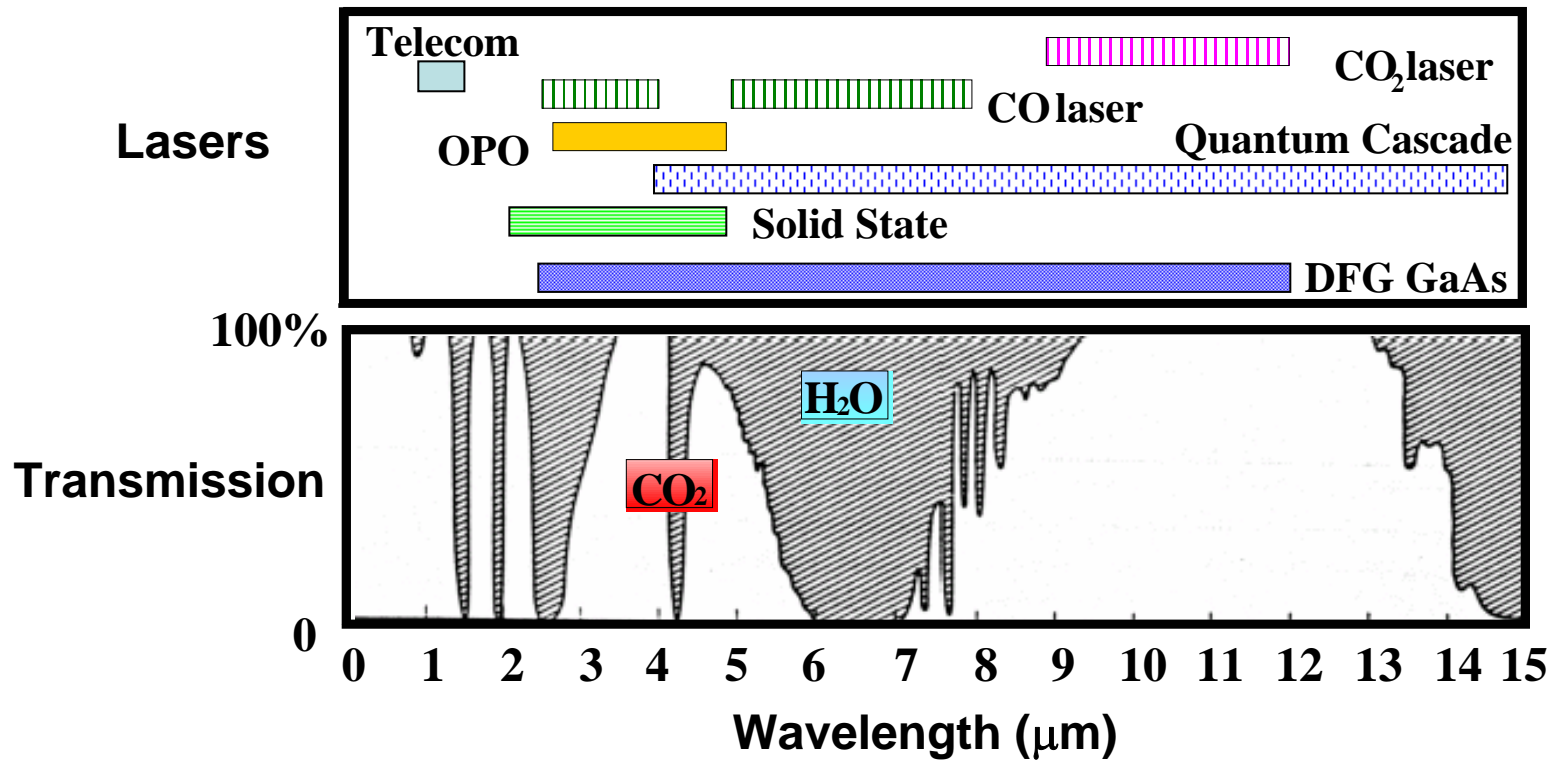
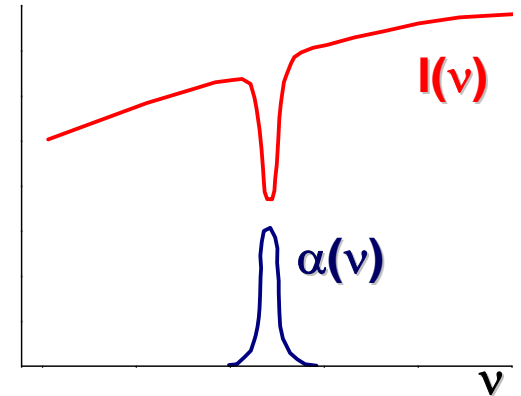
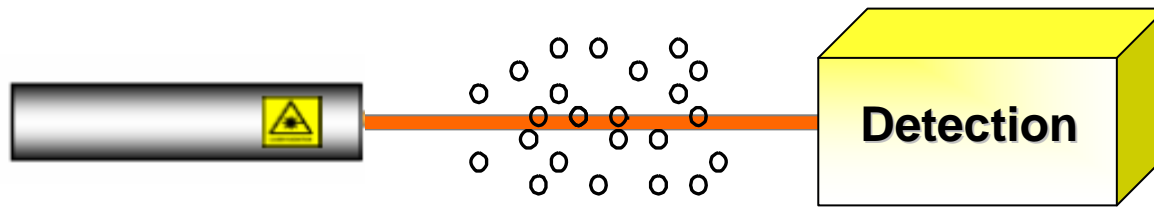


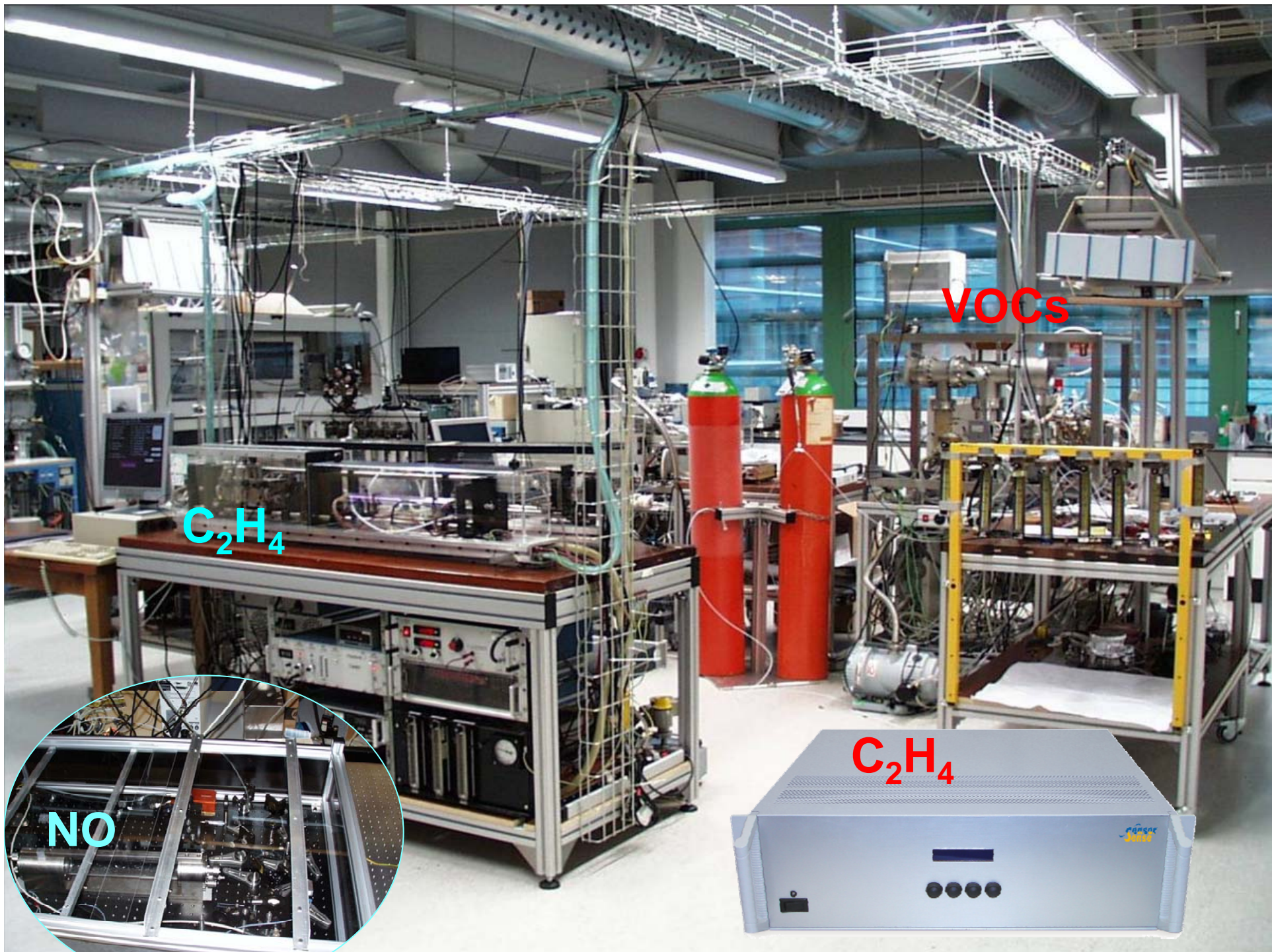
Many gases have strong absorptions in Mid-IR region

**"Fingerprints"**



# Detection with mid-IR Spectroscopy





VOCs

$C_2H_4$

$C_2H_4$

NO



# Exhaled Breath Monitoring



- Breath analysis for (early) disease diagnosis
- Drug monitoring



Drinking & driving:  
legal limit ~ 80 ppm

The Optical Nose :: Nest Adventure :: Trace gas sensing applications - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://www.opticalnose.nl/>

New and emerging science and technology (NEST) – ADVENTURE

## THE OPTICAL NOSE

An on-line, non-invasive and total-profiling instrument for trace gas sensing applications in medical sciences

Welcome to Optical Nose

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### BREATH TEST

**BREATH:** The key to convenient and early medical diagnosis.

### NEST ADVENTURE

**A challenge to modern medicine in the spirit of Nest Adventure:** Novel laser-based analytical instrument for rapid and sensitive screening of breath.

[Read more about our project](#)

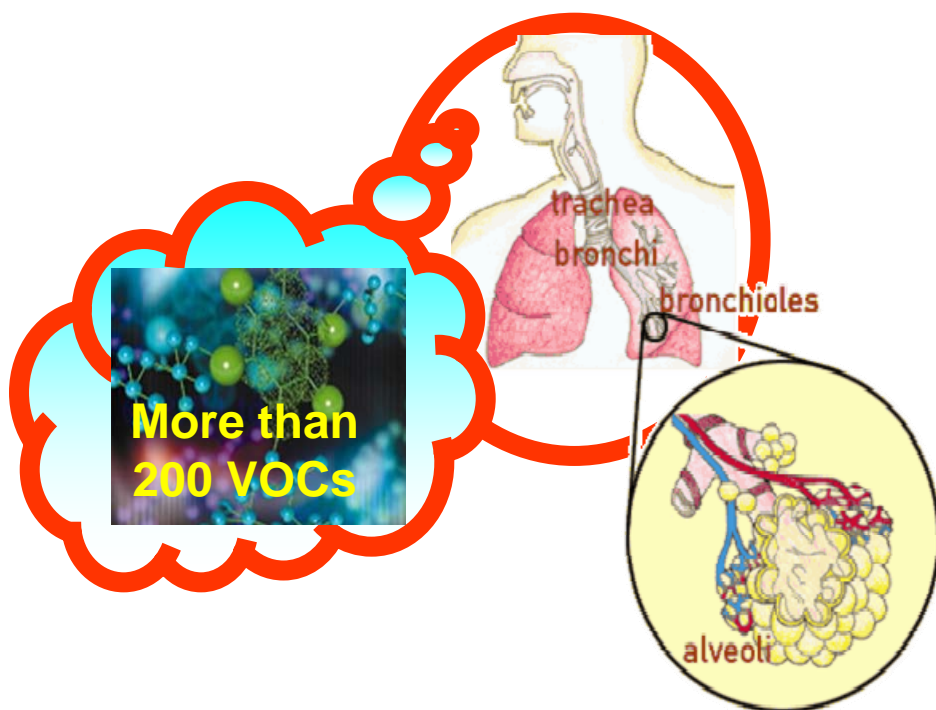
Diagnosis of many medical conditions may be possible through breath testing, however technological and scientific barriers are slowing progress towards this goal.

OPTICAL NOSE intends to tackle them head-on through two complementary strands of investigation one into advanced mid-infrared fibre-laser sources and sensitive spectroscopic detection methods, the other into the relationship between breath composition and the progression of colorectal cancer and chronic obstructive pulmonary disease.

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# Breath analysis



**Cancer tumor cells emit different volatiles than the healthy ones !!!**

Biomarker	Condition
$C_2H_4$	Oxidative stress
CO	COPD
NO	Lung diseases Asthma
$NH_3$	Kidney & liver diseases, chronic fatigue, obesity
HCN	Cystic fibrosis, airways infection
$C_3H_6O$	Diabetes, fat burning



# Multidisciplinary collaboration



## Medics

Is the *breath test* a solution ?

## Technics

A solution in search of a problem !

- ❖ **Simple cost-effective non-invasive tool**
- ❖ **Combination with other techniques (e.g. imaging, etc.)**



# Future



**Breath tests will become as common  
and easy as the blood tests today ...**