About OMICS Group



OMICS Group International is an amalgamation of Open Access publications and worldwide international science conferences and events. Established in the year 2007 with the sole aim of making the information on Sciences and technology 'Open Access', OMICS Group publishes 400 online open access scholarly journals in all aspects of Science, Engineering, Management and Technology journals. OMICS Group has been instrumental in taking the knowledge on Science & technology to the doorsteps of ordinary men and women. Research Scholars, Students, Libraries, Educational Institutions, Research centers and the industry are main stakeholders that benefitted greatly from this knowledge dissemination. OMICS Group also organizes 300 International conferences annually across the globe, where knowledge transfer takes place through debates, round table discussions, poster presentations, workshops, symposia and exhibitions.





About OMICS Group Conferences



OMICS Group International is a pioneer and leading science event organizer, which publishes around 400 open access journals and conducts over 300 Medical, Clinical, Engineering, Life Sciences, Pharma scientific conferences all over the globe annually with the support of more than 1000 scientific associations and 30,000 editorial board members and 3.5 million followers to its credit.

OMICS Group has organized 500 conferences, workshops and national symposiums across the major cities including San Francisco, Las Vegas, San Antonio, Omaha, Orlando, Raleigh, Santa Clara, Chicago, Philadelphia, Baltimore, United Kingdom, Valencia, Dubai, Beijing, Hyderabad, Bengaluru and Mumbai.



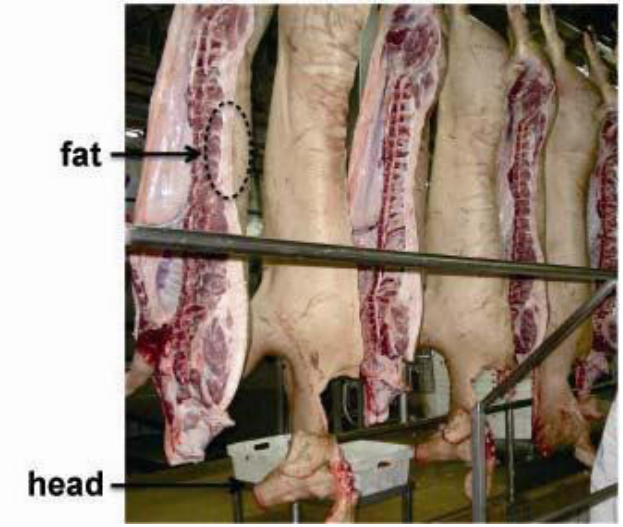


3rd International conference and exhibition on

Biosensors & Bioelectronics

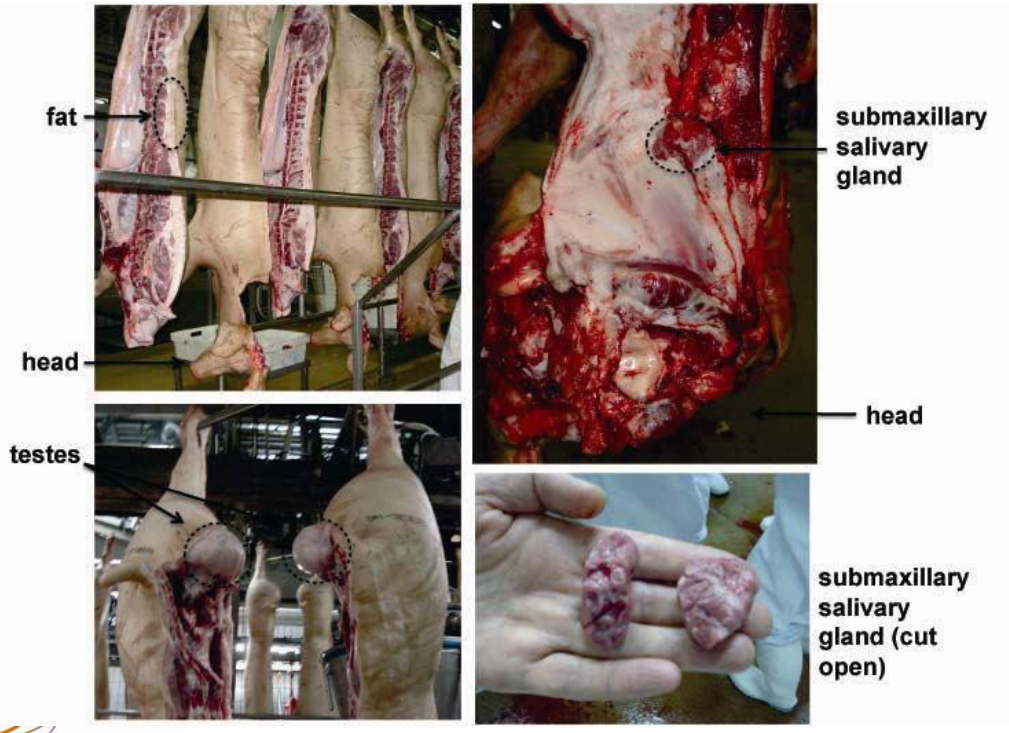
San Antonio, USA, August 11-13, 2014

A novel platform based on immobilized olfactory receptors, for detection odorant molecules characteristics of boar taint.



Boar taint

Boar taint spoils taste and odour of pork meet. It is due to volatile compounds, such as androstenone. They are concentrated in several parts of pig body.



Odorant detection

It is very important to detect odorant molecules because they :

- can constitute a signature of metabolic states or diseases,
- can participate in aromas in food,
- can be associated with drugs and explosives
- or to domestic and environmental pollutants.

Therefore, there is an increasing interest in emerging technologies allowing rapid and non-invasive assessment of volatile odorant compounds.

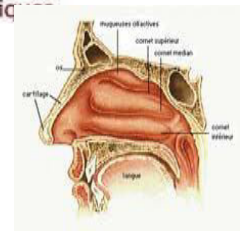
OUTLINE

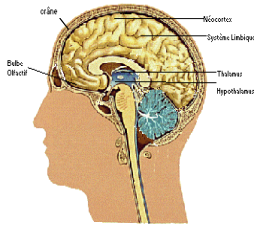
- Principle of the electronic nose and tongue and description of commercial products and market

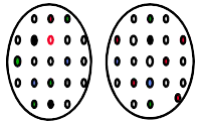
- New directions of research:

New sensors based on olfactory receptors

Principle of the electronic nose compared to an human nose







Recognized as Brazilian coffee



Odor

Nose

Brain

Mind



Acquisition

Signal Processing

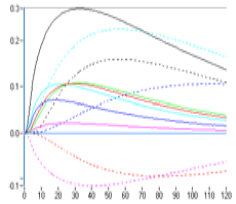
Comparison with odors In database

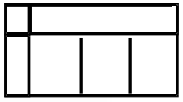
RESULTS

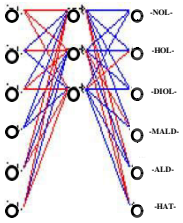
Reaction On sensors

Signal Processing

Data Processing







Recognized as Brazilian coffee



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Objectives of an Electronic Nose

Create an olfactive impression

❖ **Compared to human nose:**

Available (time, no saturation effect)
Lower cost
Reproducibility
Analysis of toxics

❖ **Compared to classical techniques of chemical analysis :**

No separation of compounds is needed
High speed, possible in situ monitoring
Portable, miniaturisation

Many types of Applications



Food industry



Parfumes/Cosmetics



Packaging

R & D / QUALITY CONTROL

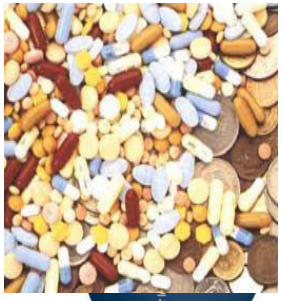
- Ageing / storage impact
- Stability / life time/ freshness
- Contamination / fermentation
- Mixing, roasting, cooking …
- Detection of fraud
- Comparison to a reference
- Control of intermediary products
- Control of plan effluents
- Control packagings and finished products
- Residual solvents / inks
- Corns/ meets/ fishes ..
- ……



Environment

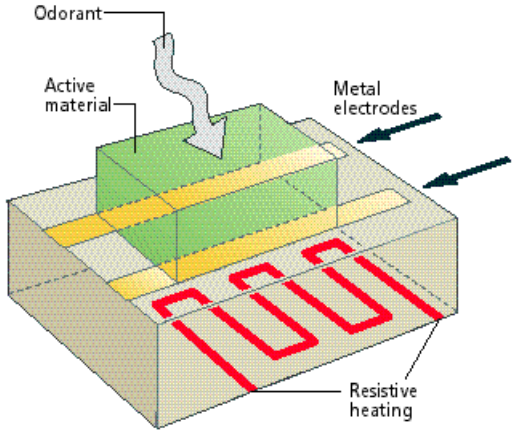


Chemistry



Pharmaceutics

Gas Sensors



Metallic Oxide Sensors (MOS)

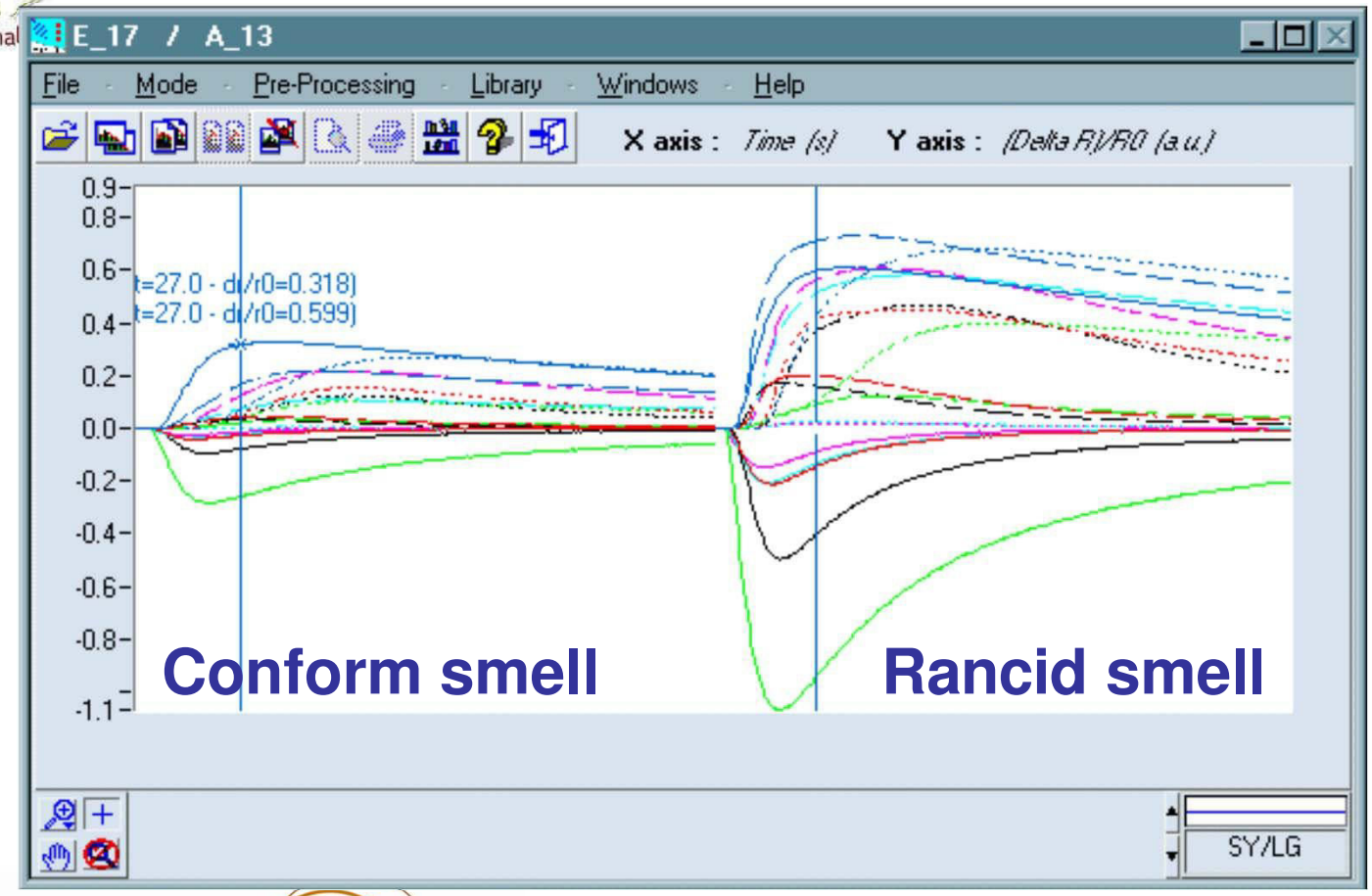
At high temperature (100°C- 400°C), volat react on the sensitive surface of the sensor → resistance variation

Selectivity: modulated through working temperature

Inorganic materials: stable, long life time, weakly sensitive to humidity, low cost, easy to be used

Most commonly used

Responses of the sensors : Comparison of two samples of oils



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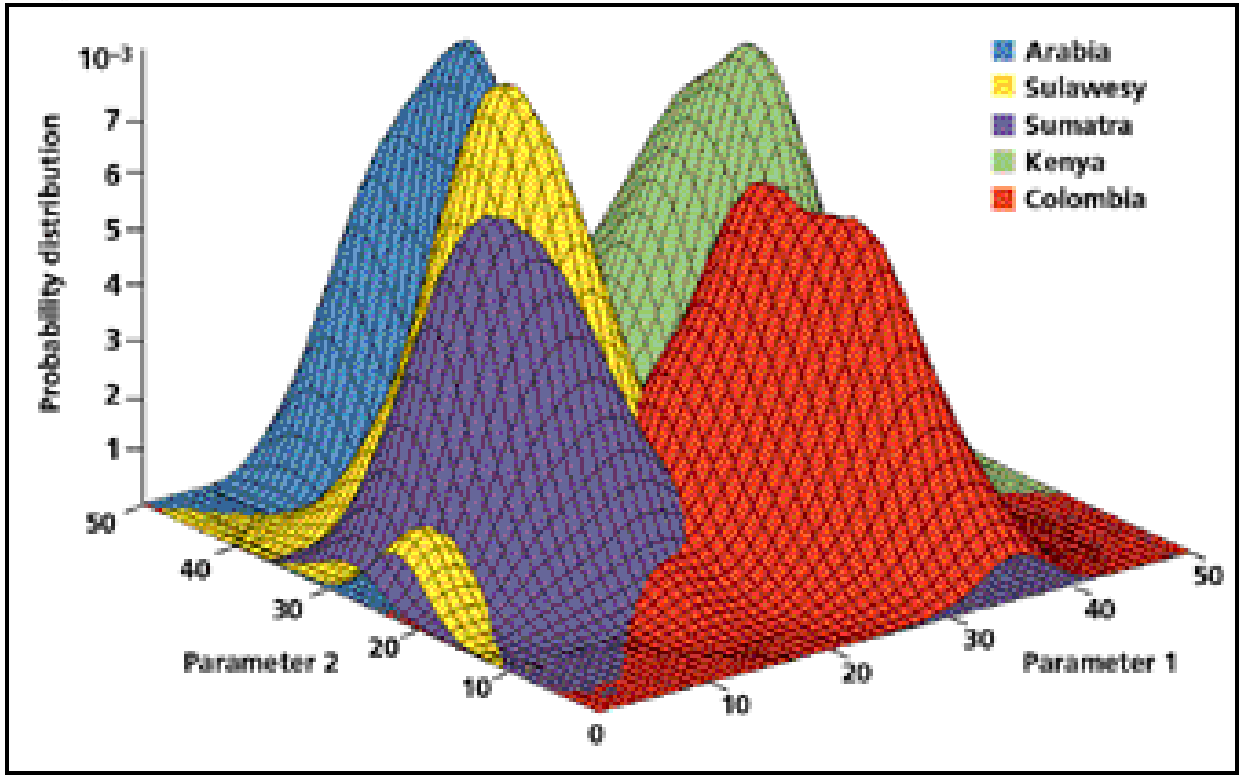
Statistical methods for data processing

- **Exploration**
  - **PCA : *Principal Component Analysis***

- **Qualitative**
  - **DFA : *Discriminent Factorial Analysis***
  - **SIMCA : *Soft Independent Modelling Class Analysis***

- **Quantitative**
  - **PLS : *Partial Least Square***

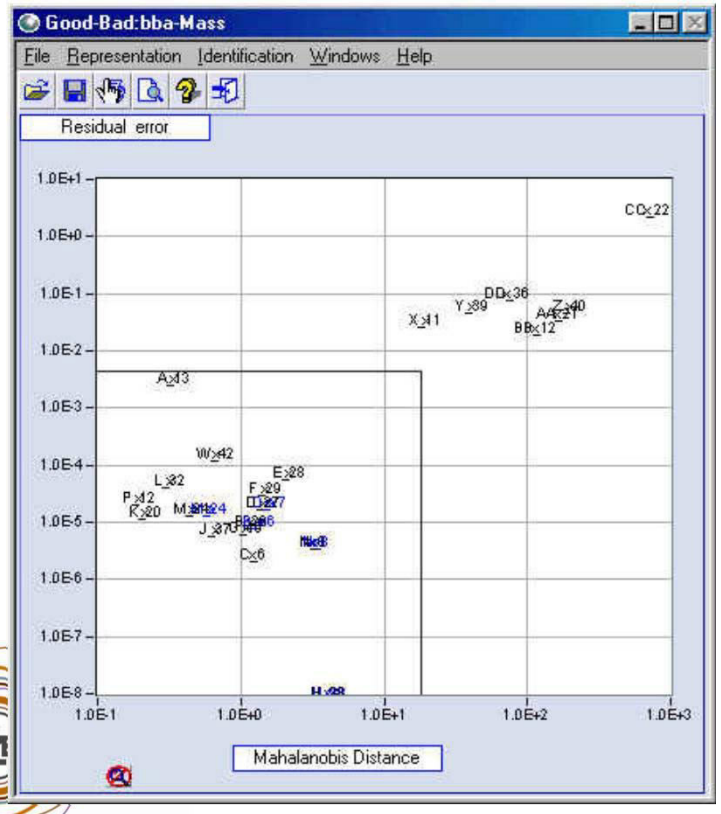
Exemple PCA: Differentiation of the origins of coffees



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SIMCA qualitative analysis : comparison to a reference

- **The SIMCA model defines a confidence zone**
- **Unknown samples are projected on the SIMCA map.**



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Alpha MOS
A range of products

Recherche & Développement
Masse et capteurs
α PROMETHEUS





Recherche & Développement
Contrôle Qualité
α FOX / α KRONOS



Contrôle Qualité production réception
α CENTAURI

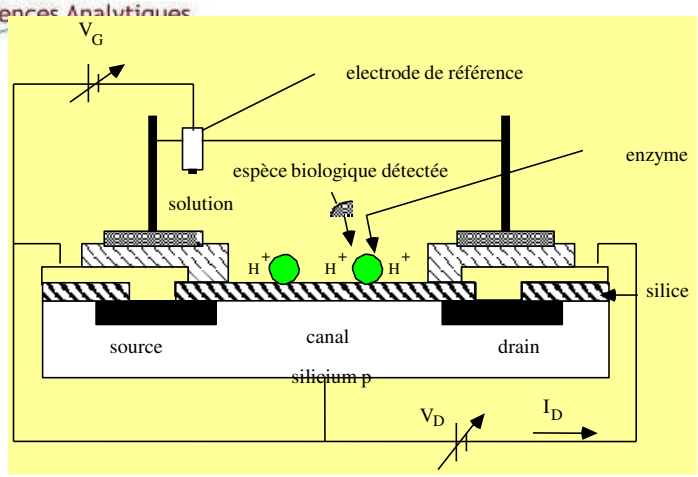


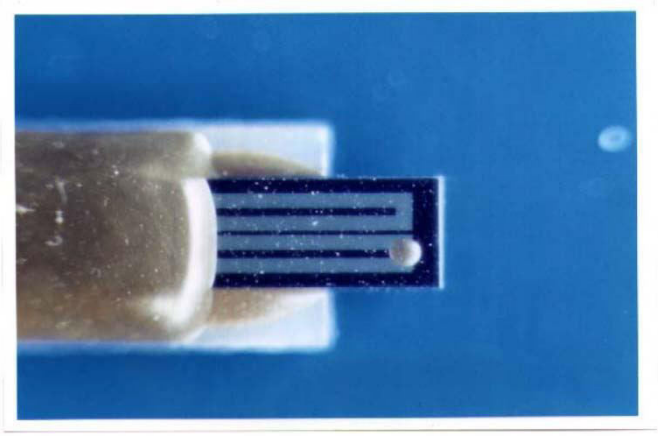


Contrôle Qualité production réception
Comparateur α GEMINI

Electronic Tongue

Gustative impression, in a liquid medium

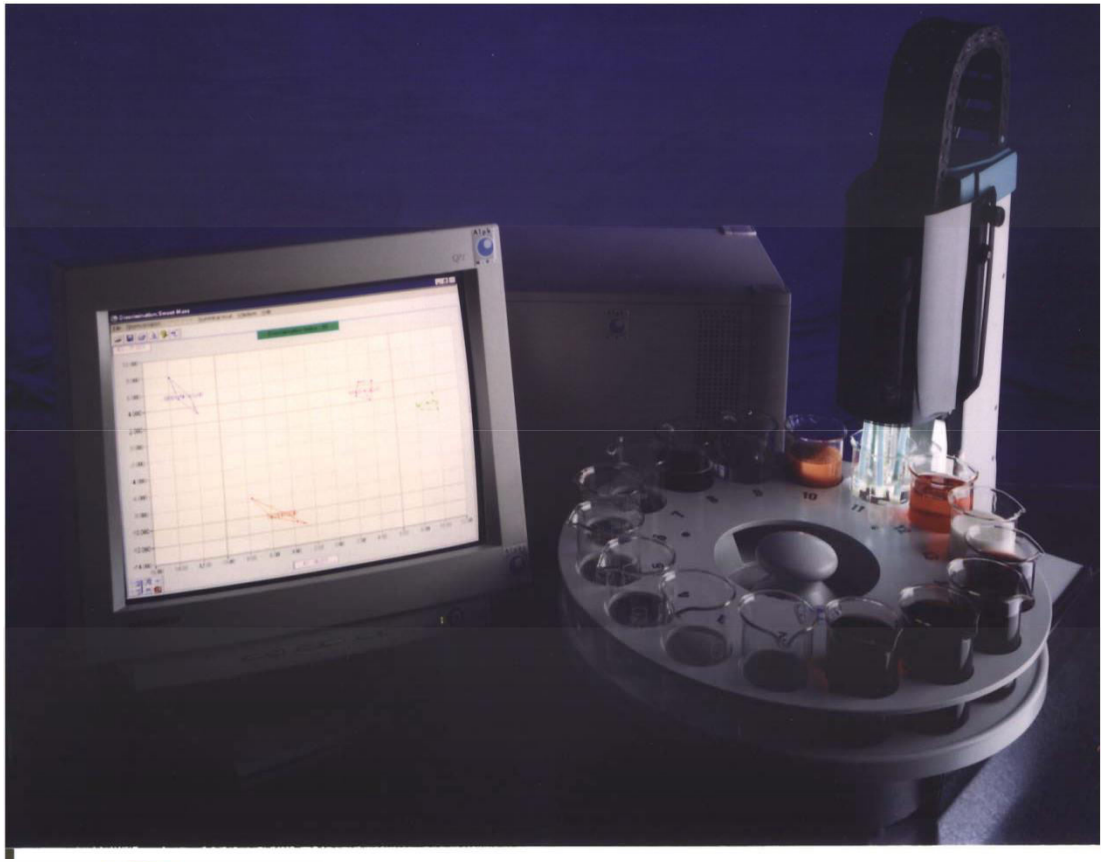




Array of Sensors: Field Effect Transistors

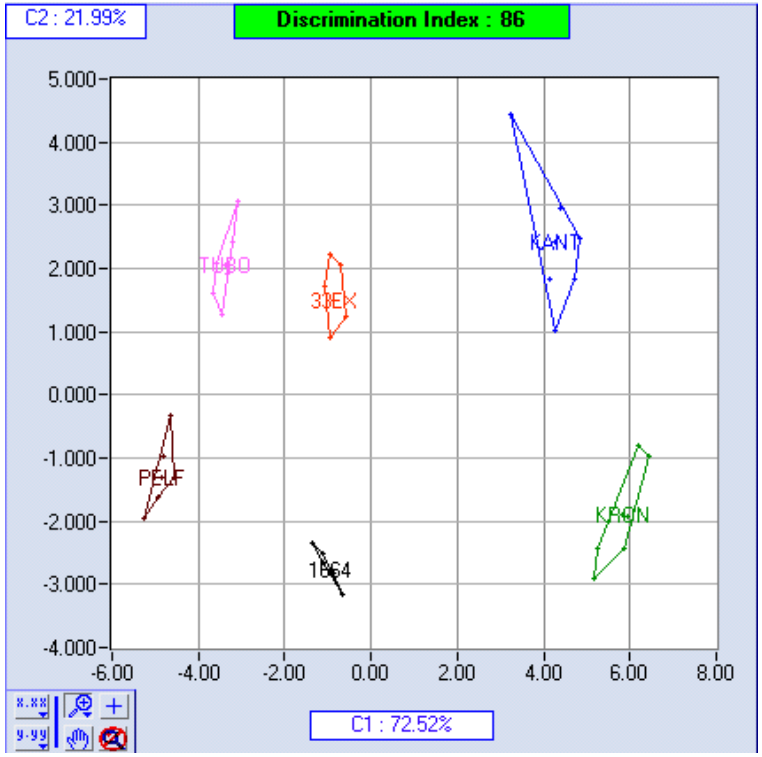
With polymeric membranes including non specific amphiphilic ionophores

Electronic Tongue



Electronic Tongue from Alpha-Mos: α- Astree

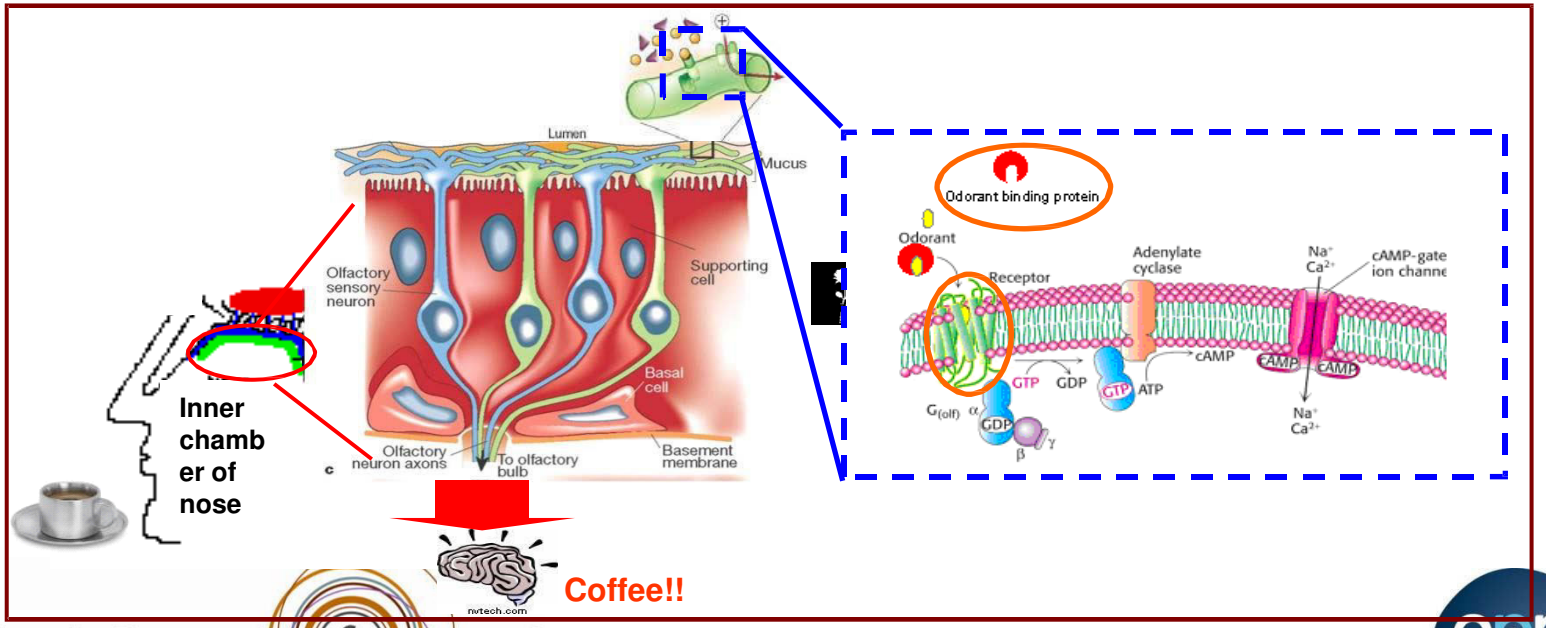
Electronic Tongue



Discrimination of 6 brands of beers with an electronic tongue (AlphaMOS)

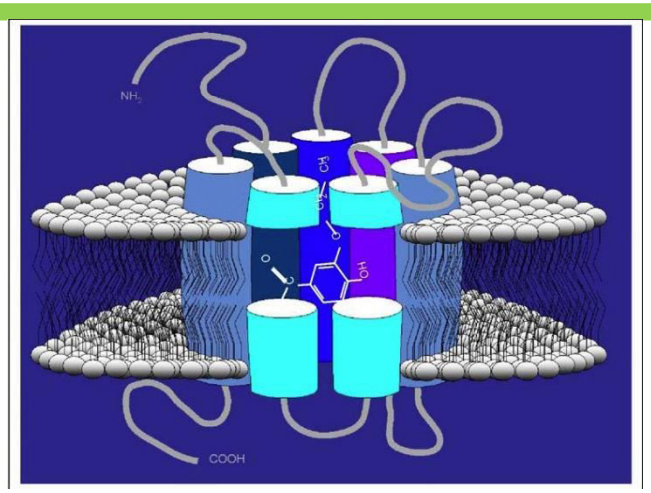
Olfactory Receptors

Replacing these physical or chemical sensing elements with olfactory receptors (ORs) that would provide a new platform with the capacity to overcome these weaknesses, resulting in bioelectronic olfaction devices.



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Olfactory Receptors



Scheme of an olfactory receptor included in the olfactory cell membrane

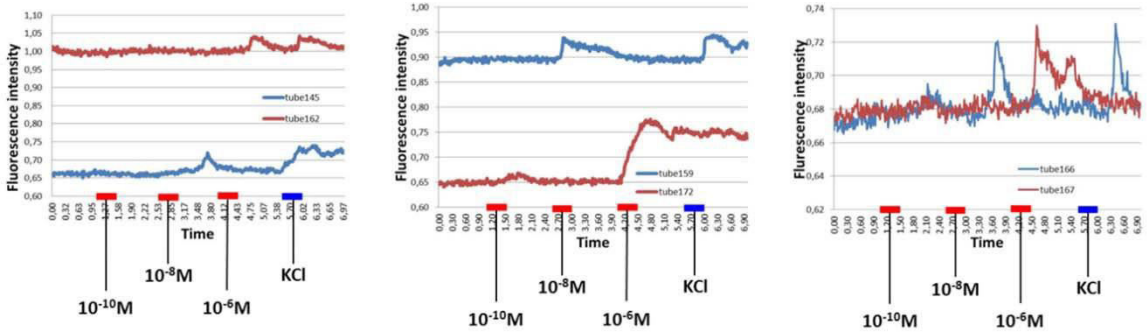
The ORs mediating the perception of odorants, object of the Nobel Prize in Physiology or Medicine 2004, belong to the large super-family of G -protein coupled receptors (GPCRs), themselves object of the Nobel Prize in Chemistry 2012

Each OR can respond to a range of odorants that share specific molecular features and can discriminate slight discrepancies in odorant structure, size or concentration. Moreover, an OR can detect its preferential odorant ligand at a very low concentration, *i.e.*10pM-10nM.

Identification of Olfactory Receptors

The different steps are:

- **ElectroOlfactoGram (EOG) : turbinates of the rat olfactory mucosa best responded to target odorant**
- **Preparation of freshly isolated olfactory cells by chemical dissociation of rat olfactory epithelium**
- **Stimulation of freshly dissociated cells (Calcium imaging)**



- **Recovery of the whole cell content of responsive neurons**
- **Single-cell RNA reverse-transcription (RT) and amplification with specific primers to identify the olfactory receptor expressed by these responsive neurons**

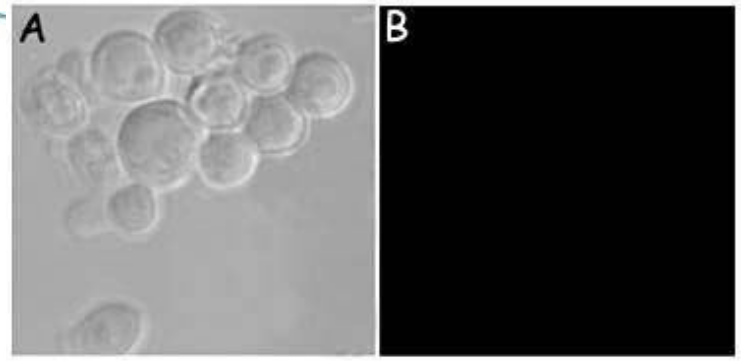
Concentration of olfactory receptors in genetically modified yeasts

In order to be able to immobilise ORs on optical and electrical tranducers, they were expressed in genetically modified yeasts with their 6-His tag, as well.

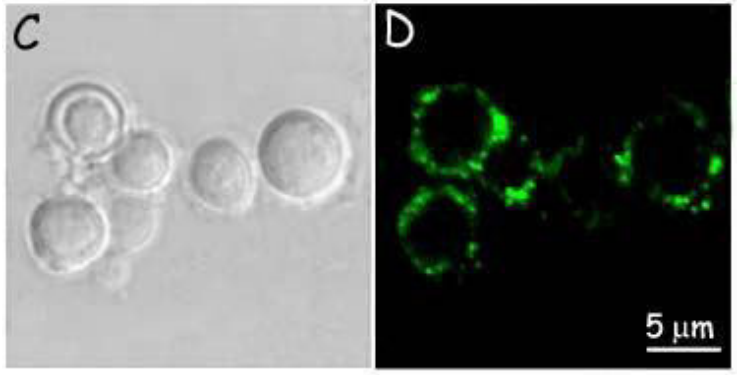
OR 7D4 from chimpanzee related to androstenone

OR 1740 from human unrelated to androstenone

Concentration of olfactory receptors in genetically modified yeasts



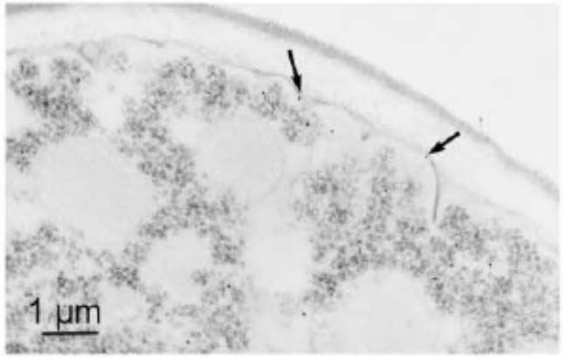
Negative Test



Sacharomyces Cerevisiae **yeast, genetically modified, expressing I7 receptor in their cell membrane (ELISA test)**

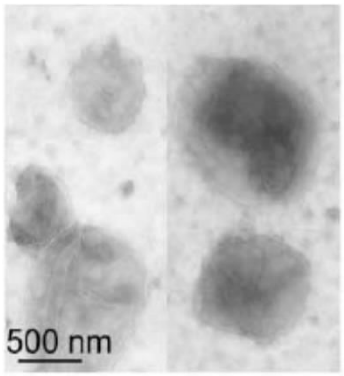
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Olfactory Receptor included in nanosomes

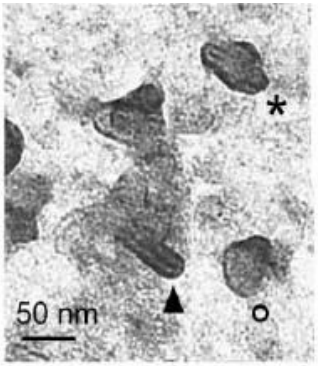


Localization of the olfactory receptors expressed at the yeast cell membrane

Microsome preparation



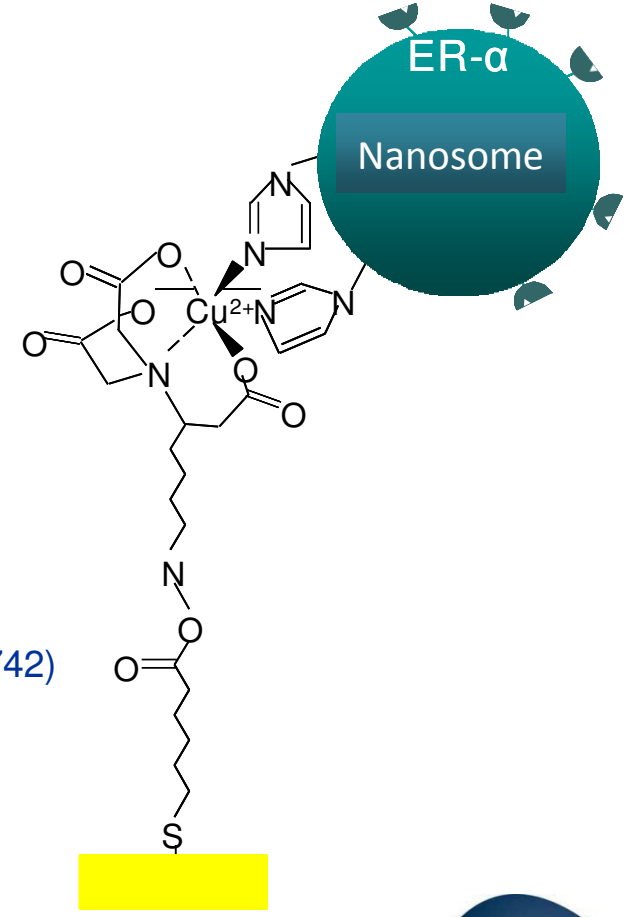
Nanosome preparation



A new approach for the conception of a biosensor for detection of OR/odorant interaction

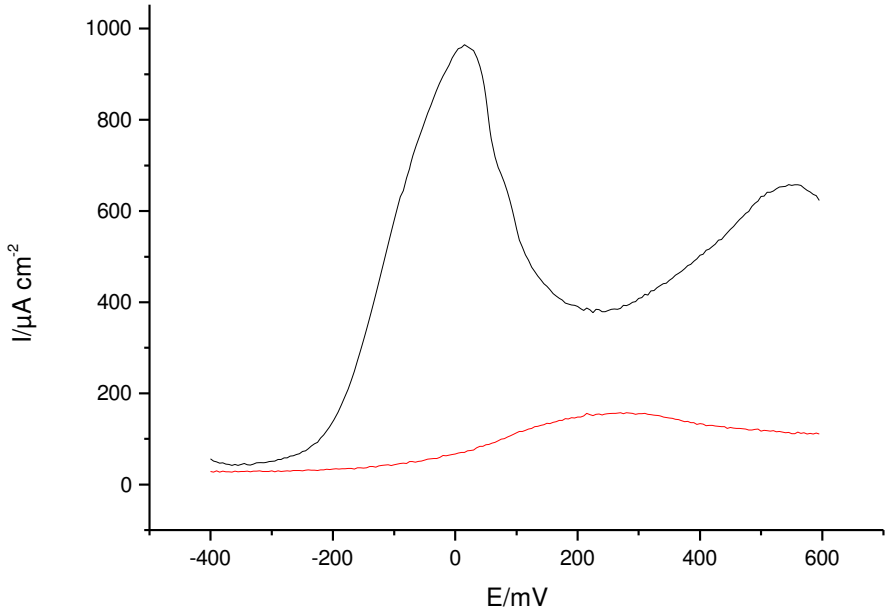
The His tag- OR/nanosome is immobilized on gold electrode using 6His-copper interaction

Intensity of Cu(I)/Cu(II) peak depends on OR conformation



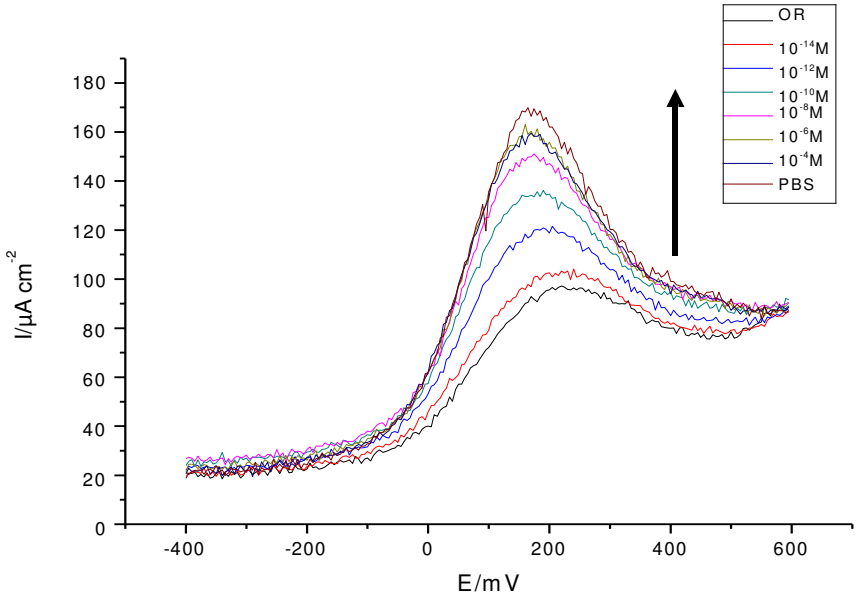
Korri-Youssoufi H. et al, Biosensors and Bioelectronics 26 (2010) 736–742)
17β-estradiol is detected through its oxidation peak using SWV

Electrochemical control of nanosome immobilization
On gold electrode surface



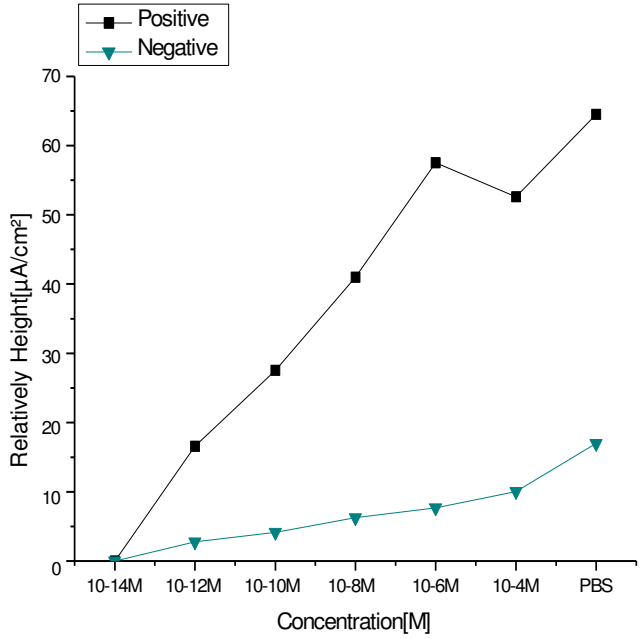
SWV spectra of Cu(I)/Cu(II) peak before and after nanosome immobilization

Electrochemical detection of OR/odorant interaction



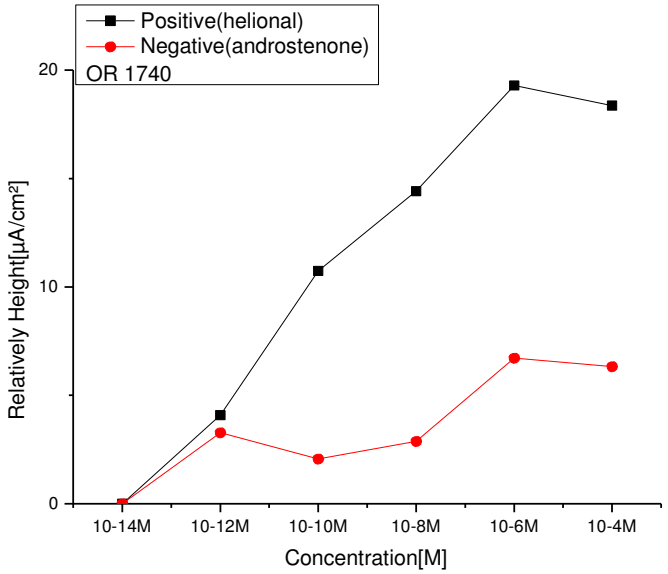
SWV detection of Cu(I) →Cu(II) peak on OR7D4 functionalized electrode- Effect of OR7D4 relative odorant for (androstenone)

Calibration curve for androstenone related OR7D4



Relative variation of copper peak maximum on OR7D4 functionalized electrode for positive test (androstenone) and negative test (helional)

Calibration curve for androstenone unrelated OR1740



Relative variation of copper peak maximum on OR1740 functionalized electrode for positive test (helional) and negative test (androstenone)

Summary and Perspectives

Feasibility of electrochemical detection of androstenone/related OR7D4 interaction has been demonstrated for the first time.
A calibration curve of the OR7D4 biosensor has been obtained and negative tests show the selectivity of androstenone detection.

Perspectives:
Bioelectronic device: multisensor array with multi ORs

People involved in this study

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