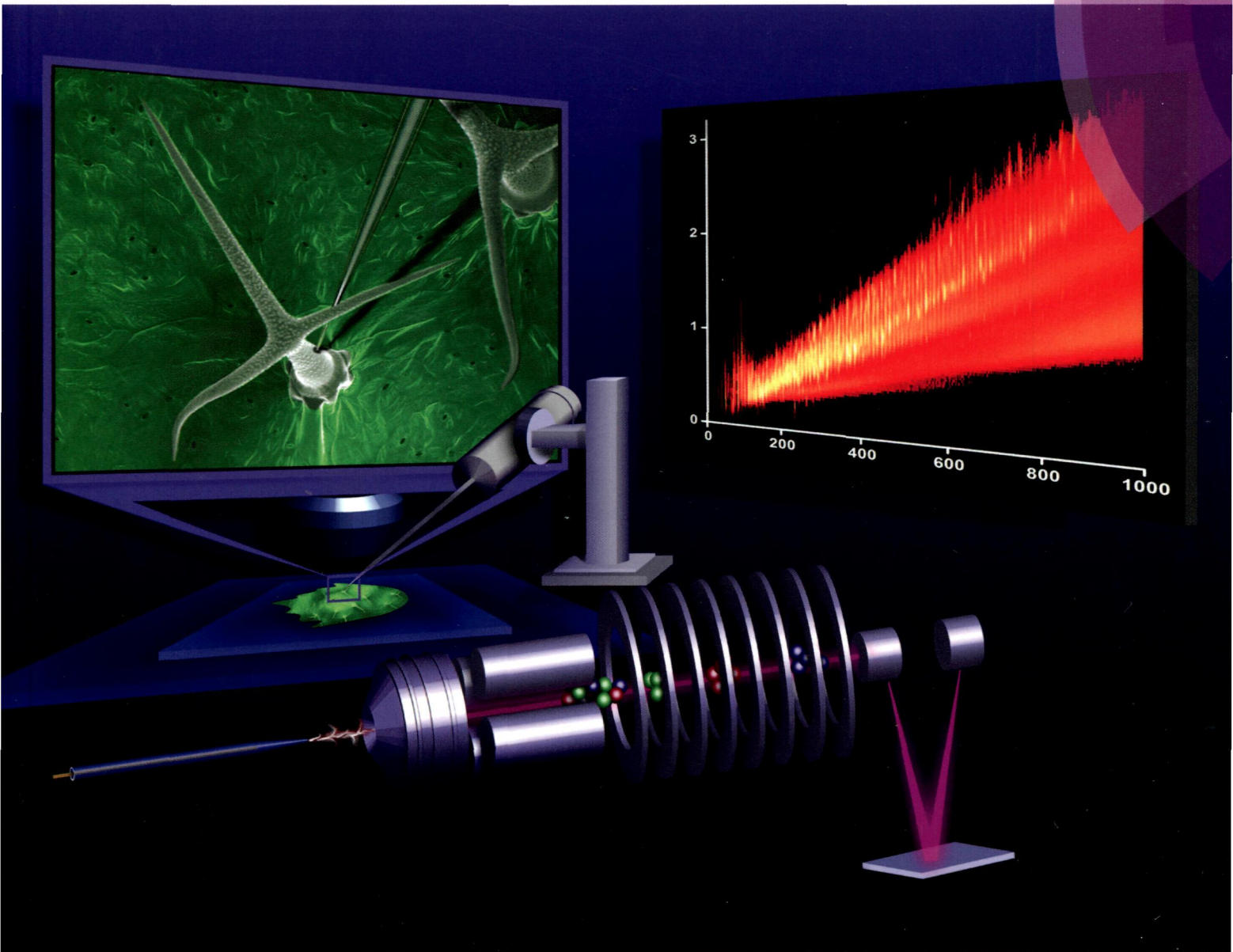
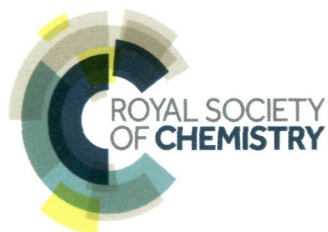


# Analyst

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ISSN 0003-2654



**PAPER**

Akos Vertes *et al.*

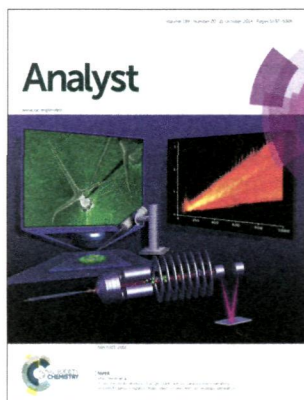
*In Situ* metabolic analysis of single plant cells by capillary microsampling and electrospray ionization mass spectrometry with ion mobility separation

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## IN THIS ISSUE

ISSN 0003-2654 CODEN ANALAO 139(20) 5037–5306 (2014)



### Cover

See Akos Vertes *et al.*,  
pp. 5079–5085.  
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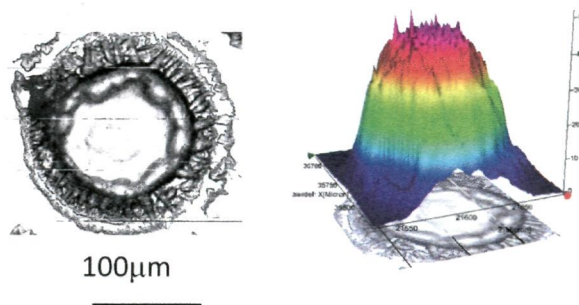
## CRITICAL REVIEW

5049

### Vibrational characterization of female gametes: a comparative study

E. Giorgini, G. Gioacchini, S. Sabbatini, C. Conti, L. Vaccari,  
A. Borini, O. Carnevali and G. Tosi\*

We report the more recent applications of vibrational microspectroscopy to the study of female gametes, in animal and human models, to improve the knowledge on reproductive mechanisms and in ART practices.



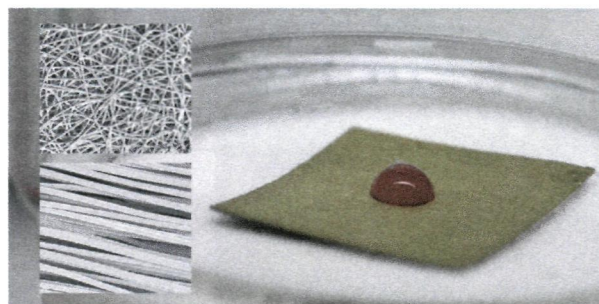
## COMMUNICATIONS

5061

### Electrospun polymer mat as a SERS platform for the immobilization and detection of bacteria from fluids

Tomasz Szymborski,\* Evelin Witkowska,  
Witold Adamkiewicz, Jacek Waluk  
and Agnieszka Kamińska\*

A new class of SERS substrates is presented that allows for the simultaneous filtration of bacteria from any solution (blood, urine, water, or milk), immobilization of bacteria on the SERS platform, and enhancing the Raman signal of bacteria.



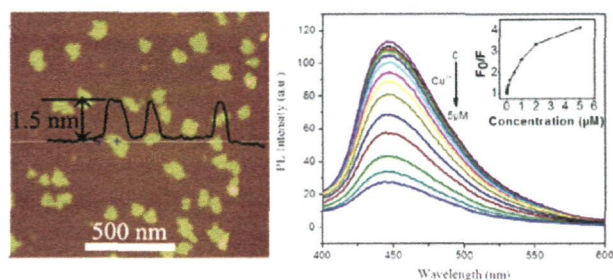
Федеральное государственное  
бюджетное учреждение науки  
Центральная научная библиотека  
Уральского отделения  
Российской академии наук (ЦНБ УрО РАН)

5065

### Graphitic carbon nitride nanosheets: one-step, high-yield synthesis and application for Cu<sup>2+</sup> detection

Ningyan Cheng, Ping Jiang, Qian Liu, Jingqi Tian, Abdullah M. Asiri and Xuping Sun\*

g-C<sub>3</sub>N<sub>4</sub> nanosheets can be rapidly synthesized with high yield by pyrolyzing melamine/KBH<sub>4</sub> mixture under Ar for fluorescent Cu<sup>2+</sup> detection with high sensitivity and selectivity.

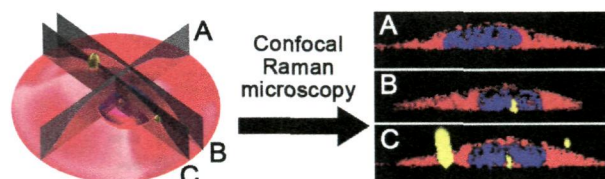


5069

### Label-free *in vitro* visualization of particle uptake into human oral buccal epithelial cells by confocal Raman microscopy

B. Kann, B. J. Teubl, E. Roblegg and M. Windbergs\*

In this study, we present confocal Raman microscopy for chemically selective analysis of a human buccal epithelial cell layer with a focus on label-free visualization of particle uptake into the cells.

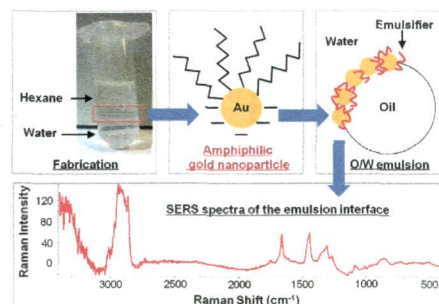


5075

### *In situ* SERS detection of emulsifiers at lipid interfaces using label-free amphiphilic gold nanoparticles

Yue Li, Michael Driver, Thunnalin Winuprasith, Jinkai Zheng, David Julian McClements and Lili He\*

We fabricated amphiphilic gold nanoparticles (GNPs) that can self-assemble at oil–water interfaces, and applied those GNPs for *in situ* SERS detection of interfacial emulsifiers.



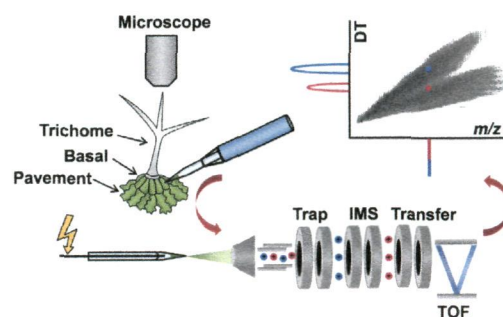
## PAPERS

5079

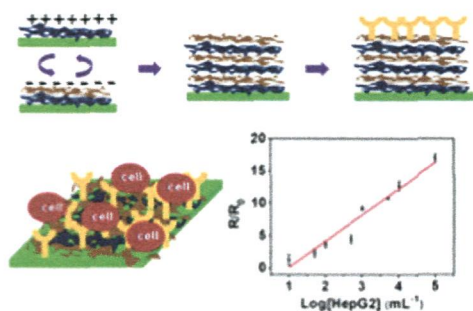
### *In Situ* metabolic analysis of single plant cells by capillary microsampling and electrospray ionization mass spectrometry with ion mobility separation

Linwen Zhang, Daniel P. Foreman, Paaqua A. Grant, Bindesh Shrestha, Sally A. Moody, Florent Villiers, June M. Kwak and Akos Vertes\*

Capillary microsampling combined with electrospray ionization mass spectrometry is demonstrated for the metabolic analysis of single *Arabidopsis thaliana* epidermal cells.



5086

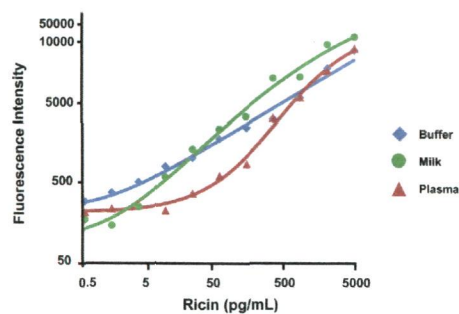


### Construction of carbon nanotube based nanoarchitectures for selective impedimetric detection of cancer cells in whole blood

Yang Liu, Fanjiao Zhu, Wangxia Dan, Yu Fu and Shaoqin Liu\*

A sensitive assay based on carbon nanotube nanoarchitecture is developed for the direct analysis of liver cancer cells without isolation.

5093

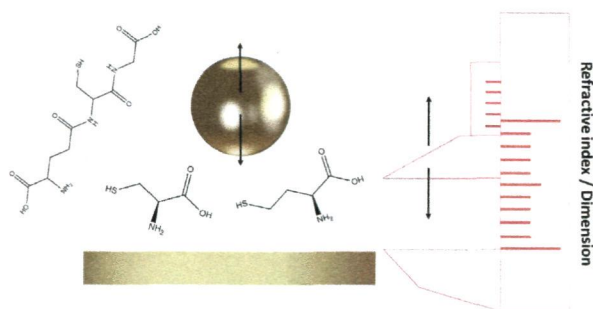


### Development of an ELISA microarray assay for the sensitive and simultaneous detection of ten biodefense toxins

Kathryn L. Jenko, Yanfeng Zhang, Yulia Kostenko, Yongfeng Fan, Consuelo Garcia-Rodriguez, Jianlong Lou, James D. Marks and Susan M. Varnum\*

An ELISA-based protein microarray was developed for the sensitive and simultaneous detection of 10 biodefense toxins.

5103

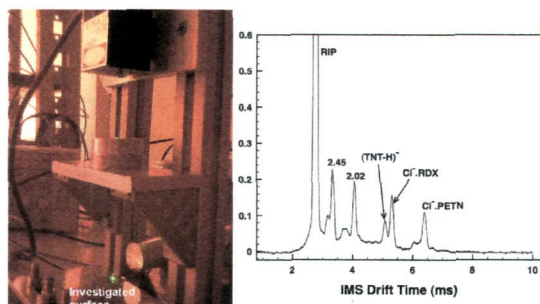


### Plasmonic nanoparticle-film calipers for rapid and ultrasensitive dimensional and refractometric detection

Chen-Chieh Yu, Keng-Te Lin, Yi-Chuan Tseng, Sin-Yi Chou, Chang-Ching Shao, Hsuen-Li Chen\* and Wei-Fang Su

In this study, we develop an ultrasensitive nanoparticle (NP)-film caliper that functions with high resolution (angstrom scale) in response to both the dimensions and refractive index of the spacer sandwiched between the NPs and the film.

5112



### Laser desorption with corona discharge ion mobility spectrometry for direct surface detection of explosives

M. Sabo, M. Malásková and Š. Matejíček\*

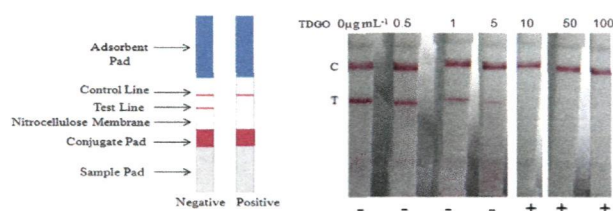
We present a new highly sensitive technique for the detection of explosives directly from the surface using laser desorption-corona discharge-ion mobility spectrometry (LD-CD-IMS).

5118

### Competitive immunochromatographic assay for the detection of thiodiglycol sulfoxide, a degradation product of sulfur mustard

Manisha Sathe,\* Shruti Srivastava, S. Merwyn, G. S. Agarwal and M. P. Kaushik

This is first report, dealing with immunochromatographic detection of thiodiglycol sulfoxide, an important degradation product of sulfur mustard.

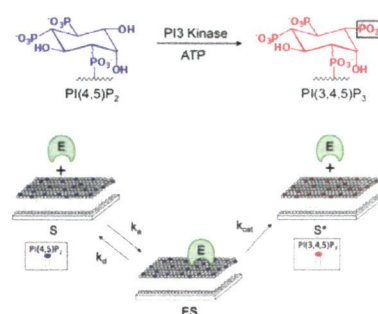


5127

### PI3 kinase enzymology on fluid lipid bilayers

Debjit Dutta, Abigail Pulsipher, Wei Luo and Muhammad N. Yousaf\*

Planar supported fluid lipid bilayers as model substrate for PI3 kinase enzymology.

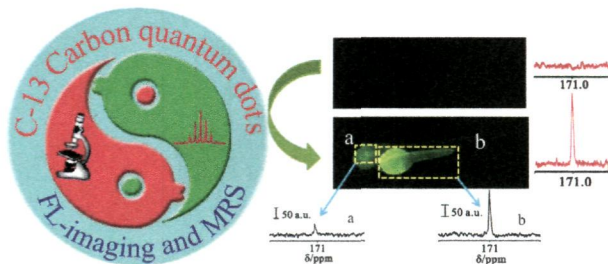


5134

### <sup>13</sup>C-engineered carbon quantum dots for *in vivo* magnetic resonance and fluorescence dual-response

Yang Xu, Yu-Hao Li, Yue Wang, Jian-Lin Cui, Xue-Bo Yin,\* Xi-Wen He and Yu-Kui Zhang

<sup>13</sup>C-engineered carbon quantum dots (<sup>13</sup>C-QDs) were used as magnetic resonance (MR) and fluorescence dual-response probe.

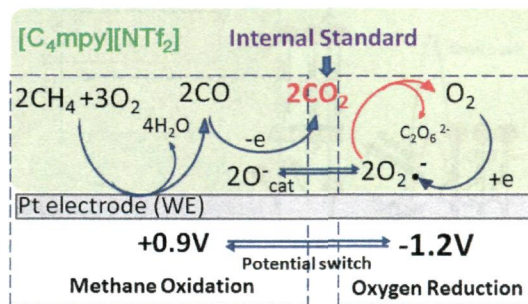


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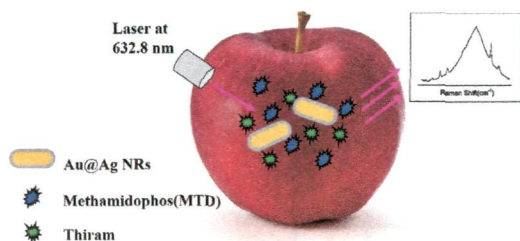
### Methane–oxygen electrochemical coupling in an ionic liquid: a robust sensor for simultaneous quantification

Zhe Wang, Min Guo, Gary A. Baker, Joseph R. Stetter, Lu Lin, Andrew J. Mason and Xiangqun Zeng\*

Current sensor devices for the detection of methane or natural gas emission are either expensive and have high power requirements or fail to provide a rapid response.



5148

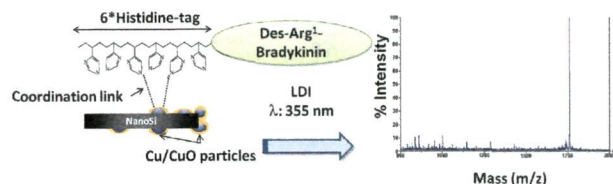


### Rapid simultaneous detection of multi-pesticide residues on apple using SERS technique

Yizhi Zhang, Zhuyuan Wang,\* Lei Wu, Yuwei Pei, Peng Chen and Yiping Cui\*

A rapid and straightforward method was employed to simultaneously detect two pesticides on apple surface.

5155

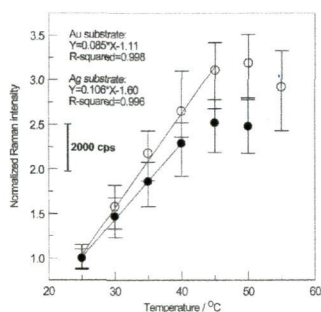


### Decoration of silicon nanostructures with copper particles for simultaneous selective capture and mass spectrometry detection of His-tagged model peptide

Yannick Coffinier,\* Ievgen Kurylo, Hervé Drobecq, Sabine Szunerits, Oleg Melnyk, Vladimir N. Zaitsev and Rabah Boukherroub

MOAC-based affinity silicon-based LDI surface for the capture and the subsequent mass spectrometry detection of specific target.

5164

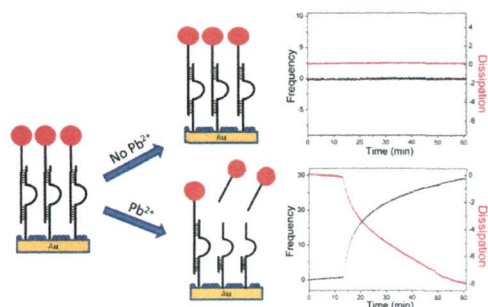


### Room-temperature sensor based on surface-enhanced Raman spectroscopy

Kuang-Hsuan Yang, Fu-Der Mai, Chung-Chin Yu and Yu-Chuan Liu\*

Temperature-dependent intensity is linear with a slope of ca. 430 cps per °C between 25 to 45 °C.

5170



### Highly sensitive and selective detection of Pb<sup>2+</sup> ions using a novel and simple DNAzyme-based quartz crystal microbalance with dissipation biosensor

Hui Boon Teh, Haiyan Li and Sam Fong Yau Li\*

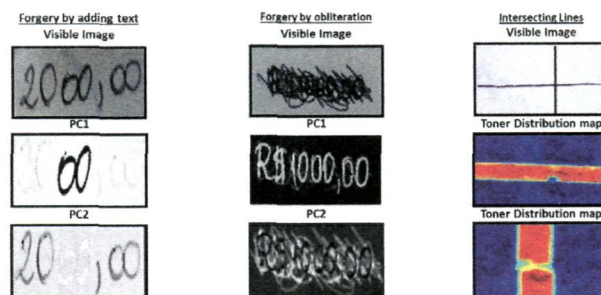
A label-free DNAzyme-based QCM-D biosensor was developed for highly sensitive and specific detection of Pb<sup>2+</sup> ions in drinking water.

5176

### Near infrared hyperspectral imaging for forensic analysis of document forgery

Carolina S. Silva, Maria Fernanda Pimentel,\*  
Ricardo S. Honorato, Celio Pasquini,  
José M. Prats-Montalbán and Alberto Ferrer

A new, fast and nondestructive method to identify the different types of document forgery using NIR hyperspectral images combined with chemometric tools, which makes these analyses less subjective.

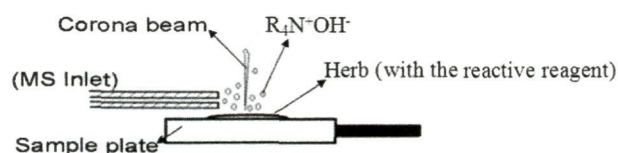


5185

### Direct analysis of quaternary alkaloids by *in situ* reactive desorption corona beam ionization MS

Yulan Hou, Tingting Wu, Yaru Liu, Hua Wang,\*  
Yingzhuang Chen, Bo Chen\* and Wenjian Sun

The developed reactive DCBI-MS technique is simple, rapid and sensitive for rapid qualification and semi-quantification of quaternary alkaloids in herbs.

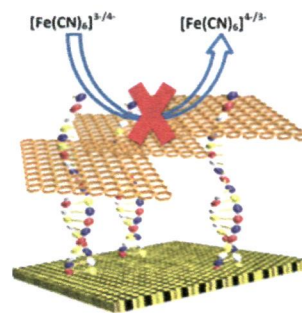


5192

### Dual amplification of single nucleotide polymorphism detection using graphene oxide and nanoporous gold electrode platform

Seyyed Mehdi Khoshfetrat and Masoud A. Mehrgardi\*

In the present manuscript, a strategy to prompt the sensitivity of a biosensor based on the dual amplification of signal by applying a nanoporous gold electrode (NPGE) as a support platform and soluble graphene oxide (GO) as an indicator has been developed.

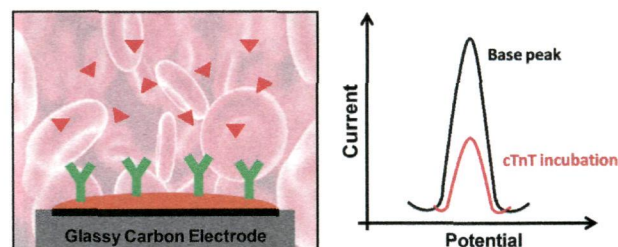


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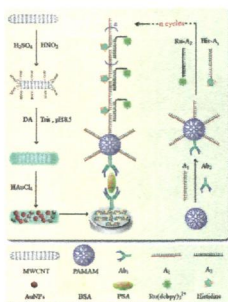
### A label-free electrochemical immunosensor based on an ionic organic molecule and chitosan-stabilized gold nanoparticles for the detection of cardiac troponin T

Daniela Brondani,\* Jamille Valéria Piovesan,  
Eduard Westphal, Hugo Gallardo,  
Rosa Amalia Fireman Dutra, Almir Spinelli  
and Iolanda Cruz Vieira\*

An immunosensor based on an ionic organic molecule and chitosan-stabilized gold nanoparticles was developed for the detection of cardiac troponin T (cTnT).



5209

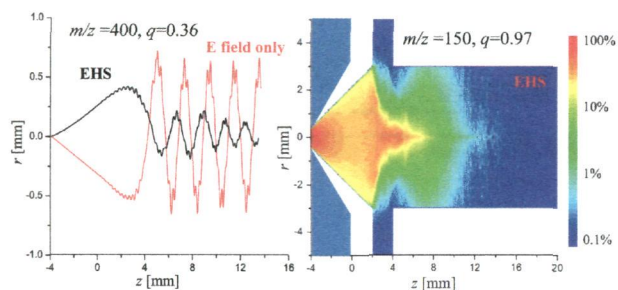


### A supersandwich electrochemiluminescence immunosensor based on mimic-intramolecular interaction for sensitive detection of proteins

Ying He, Yaqin Chai,\* Ruo Yuan,\* Haijun Wang, Lijuan Bai and Ni Liao

An electrochemiluminescence (ECL) immunoassay protocol is developed by integrating ECL luminophore and co-reactant into a supersandwich DNA structure.

5215

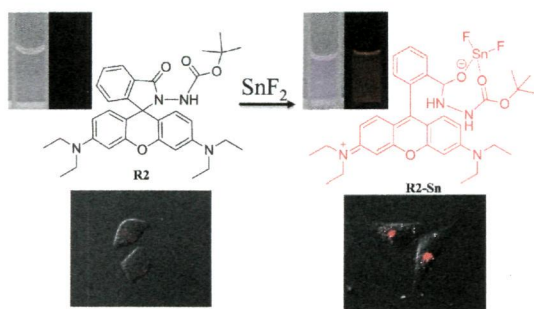


### Flowing gas in mass spectrometer: method for characterization and impact on ion processing

Xiaoyu Zhou and Zheng Ouyang\*

Simulation of ion trajectories with a dynamic gas field.

5223

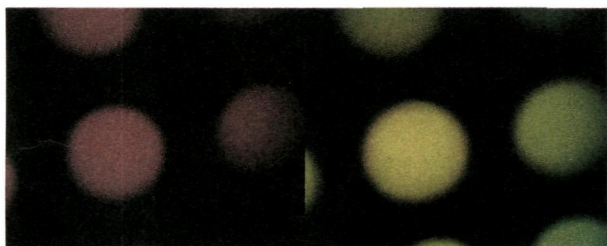


### Fluorescence turn-on detection of Sn<sup>2+</sup> in live eukaryotic and prokaryotic cells

Haichuang Lan, Ying Wen, Yunming Shi, Keyin Liu, Yueyuan Mao and Tao Yi\*

Fluorescence turn-on probes for selective detection of Sn(II) in live eukaryotic and prokaryotic cells were developed.

5230



### Fluorescent sensors for the basic metabolic panel enable measurement with a smart phone device over the physiological range

Becker Awqatty, Shayak Samaddar, Kevin J. Cash, Heather A. Clark and J. Matthew Dubach\*

Platform fluorescent sensors capable of measuring the entire basic metabolic panel using an adapted smart phone.

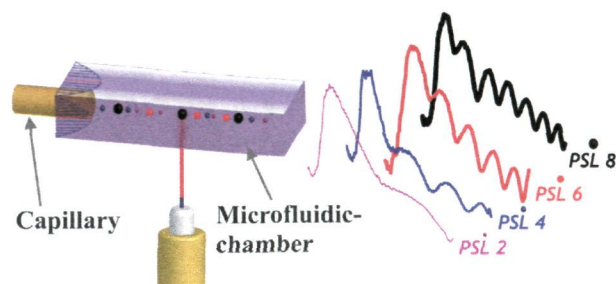


5239

### Multiplex single particle analysis in microfluidics

D. Dannhauser,\* G. Romeo, F. Causa, I. De Santo and P. A. Netti

A method to combine precise particle alignment in-flow and light scattering profile characterization for micrometric sized particles is reported.

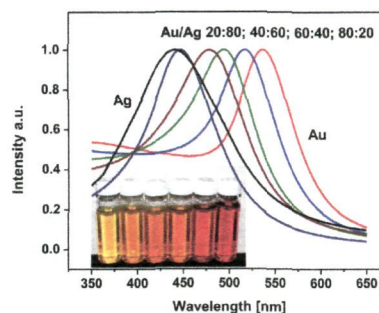


5247

### Hyperspectral reflected light microscopy of plasmonic Au/Ag alloy nanoparticles incubated as multiplex chromatic biomarkers with cancer cells

Sergiy Patskovsky,\* Eric Bergeron, David Rioux, Mikaël Simard and Michel Meunier

We report a hyperspectral reflected light microscopy system for plasmonic nanoparticle (NP) imaging, and compare with a conventional darkfield method for spatial localization and spectroscopic identification of single Au, Ag and Au/Ag alloy NPs incubated with fixed human cancer cell preparations.

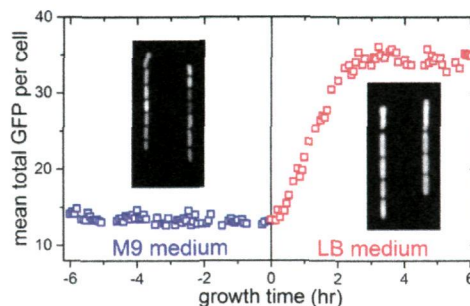


5254

### Measuring bacterial adaptation dynamics at the single-cell level using a microfluidic chemostat and time-lapse fluorescence microscopy

Zhicheng Long, Anne Olliver, Elisa Brambilla, Bianca Sclavi, Marco Cosentino Lagomarsino and Kevin D. Dorfman\*

We grew *E. coli* in a microfluidic chemostat and monitored the dynamics of cell dimensions and reporter GFP expression in individual cells during nutritional upshift or downshift.

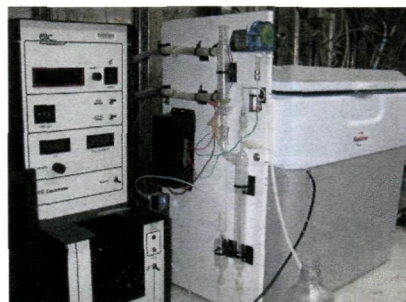


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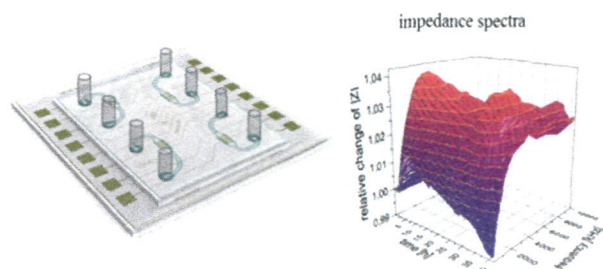
### A simplified coulometric method for multi-sample measurements of total dissolved inorganic carbon concentration in marine waters

Natchanon Amornthammarong,\* Peter B. Ortner,\* James Hendee and Ryan Woosley

A new system with high precision based on a coulometric method requiring greatly reduced operator intervention has been developed for the determination of [DIC] in marine waters.



5273

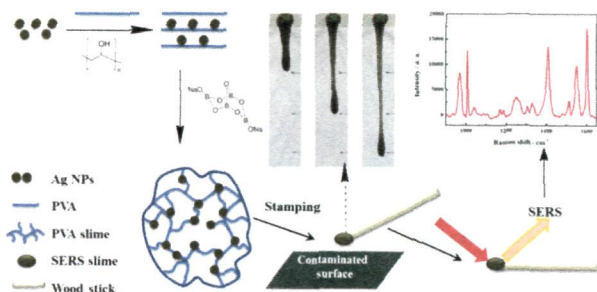


### Monitoring cellular stress responses using integrated high-frequency impedance spectroscopy and time-resolved ELISA

Verena Charwat, Martin Joksch, Drago Sticker, Michaela Purtscher, Mario Rothbauer and Peter Ertl\*

High-frequency impedance spectroscopy combined with time resolved biomarker quantification and multivariate data analysis enables sensitive monitoring of cell population dynamics.

5283

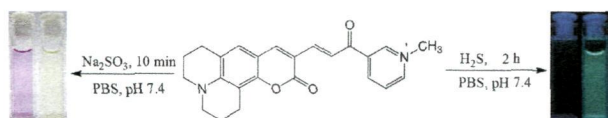


### A silver nanoparticle embedded hydrogel as a substrate for surface contamination analysis by surface-enhanced Raman scattering

Zhengjun Gong, Canchen Wang, Cong Wang, Changyu Tang, Fansheng Cheng, Hongjie Du, Meikun Fan\* and Alexandre G. Brolo\*

A surface enhanced Raman scattering (SERS) hydrogel substrate, capable of extracting small amounts of organic species from surfaces of different types of materials with variable roughness, has been fabricated.

5290

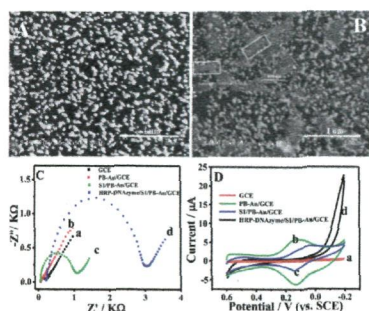


### Colorimetric and fluorescent determination of sulfide and sulfite with kinetic discrimination

Xiaoliang Pei, Haiyu Tian, Weibing Zhang,\* Albert M. Brouwer and Junhong Qian\*

Two fluorescent probes for sulfite and/or sulfide exhibit excellent chromogenic responses with significant fluorescence enhancements toward sulfite and sulfide at different time intervals.

5297



### Prussian blue–Au nanocomposites actuated hemin/G-quadruplexes catalysis for amplified detection of DNA, Hg<sup>2+</sup> and adenosine triphosphate

Guangfeng Wang,\* Ling Chen, Yanhong Zhu, Xiuping He, Gang Xu and Xiaojun Zhang\*

In this paper, horseradish peroxidase-mimicking DNAzyme (HRP-DNAzyme) and Prussian blue (PB)–gold (Au) nanocomposites were designed as versatile electrochemical sensing platforms for the amplified detection of DNA, Hg<sup>2+</sup> and adenosine triphosphate (ATP).