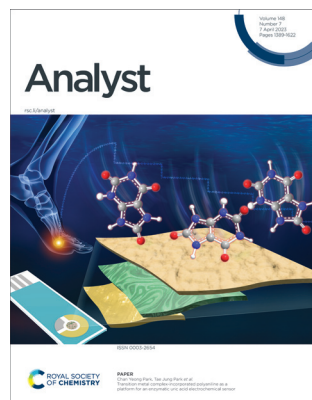


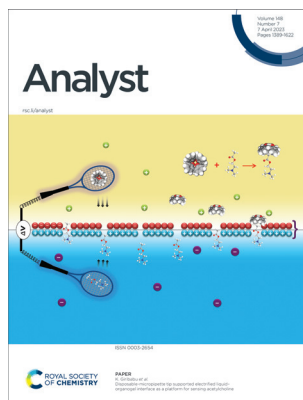
## IN THIS ISSUE

ISSN 0003-2654 CODEN ANALAO 148(7) 1389–1622 (2023)



**Cover**  
See Chan Yeong Park,  
Tae Jung Park *et al.*,  
pp. 1442–1450.

Image reproduced  
by permission of  
Tae Jung Park from *Analyst*,  
2023, **148**, 1442.



**Inside cover**  
See K. Giribabu *et al.*,  
pp. 1451–1459.

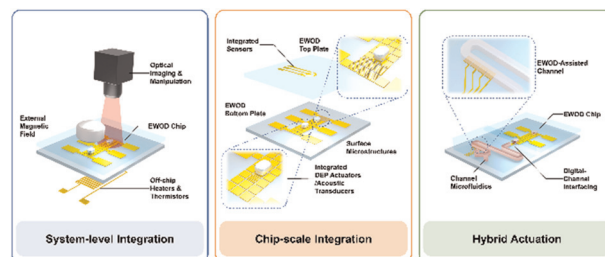
Image reproduced  
by permission of  
K. Giribabu from *Analyst*,  
2023, **148**, 1451.

## CRITICAL REVIEWS

1399

### Combining sensors and actuators with electrowetting-on-dielectric (EWOD): advanced digital microfluidic systems for biomedical applications

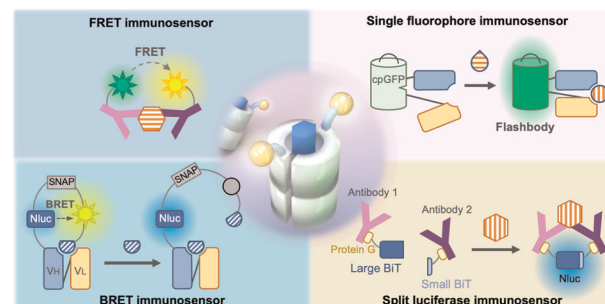
Zhaoduo Tong, Chuanjie Shen, Qiushi Li, Hao Yin and Hongju Mao\*



1422

### Recent progress in homogeneous immunosensors based on fluorescence or bioluminescence using antibody engineering

Abdul Qawee Rani, Bo Zhu, Hiroshi Ueda and Tetsuya Kitaguchi\*



## Editorial Staff

### Executive Editor

Philippa Ross

### Deputy Editor

Alice Smallwood

### Editorial Production Manager

Jason Woolford

### Development Editor

Celeste Brady

### Publishing Editors

Gabriel Clarke, Derya Kara-Fisher, Cara Sutton, Ziva Whitelock

### Publishing Assistant

Andrea Whiteside

### Editorial Assistant

Leo Curtis

### Publisher

Jeanne Andres

For queries about submitted articles please contact Jason Woolford, Editorial production manager, in the first instance. E-mail [analyst@rsc.org](mailto:analyst@rsc.org)

For pre-submission queries please contact

Philippa Ross, Executive editor.

E-mail [analyst-rsc@rsc.org](mailto:analyst-rsc@rsc.org)

Analyst (electronic: ISSN 1364-5528) is published 24 times a year by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, UK CB4 0WF.

All orders, with cheques made payable to the Royal Society of Chemistry, should be sent to the Royal Society of Chemistry Order Department, Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK

Tel +44 (0)1223 432398; E-mail [orders@rsc.org](mailto:orders@rsc.org)

2023 Annual (electronic) subscription price: £2372; US\$4152.

Customers in Canada will be subject to a surcharge to cover GST. Customers in the EU subscribing to the electronic version only will be charged VAT.

If you take an institutional subscription to any Royal Society of Chemistry journal you are entitled to free, site-wide web access to that journal. You can arrange access via Internet Protocol (IP) address at [www.rsc.org/ip](http://www.rsc.org/ip)

Customers should make payments by cheque in sterling payable on a UK clearing bank or in US dollars payable on a US clearing bank.

Whilst this material has been produced with all due care, the Royal Society of Chemistry cannot be held responsible or liable for its accuracy and completeness, nor for any consequences arising from any errors or the use of the information contained in this publication. The publication of advertisements does not constitute any endorsement by the Royal Society of Chemistry or Authors of any products advertised. The views and opinions advanced by contributors do not necessarily reflect those of the Royal Society of Chemistry which shall not be liable for any resulting loss or damage arising as a result of reliance upon this material. The Royal Society of Chemistry is a charity, registered in England and Wales, Number 207890, and a company incorporated in England by Royal Charter (Registered No. RC000524), registered office: Burlington House, Piccadilly, London W1J 0BA, UK, Telephone: +44 (0) 207 4378 6556.

### Advertisement sales:

Tel +44 (0) 1223 432246; Fax +44 (0) 1223 426017;

E-mail [advertising@rsc.org](mailto:advertising@rsc.org)

For marketing opportunities relating to this journal, contact [marketing@rsc.org](mailto:marketing@rsc.org)

# Analyst

rsc.li/analyst

The home of premier fundamental discoveries, inventions and applications in the analytical and bioanalytical sciences

## Editorial Board

### Editor-in-Chief

Norman Dovichi, University of Notre Dame, USA

### Associate Editors

Damien Arrigan, Curtin University, Australia

Ryan Bailey, University of Michigan, USA

Jaebum Choo, Chung-Ang University, South Korea

Karen Faulds, University of Strathclyde, UK

Hideaki Hisamoto, Osaka Metropolitan University, Japan

Baohong Liu, Fudan University, China

Nicole Pamme, Stockholm University, Sweden

Hua-Zhong Yu, Simon Fraser University, Canada

Jun-Jie Zhu, Nanjing University, China

### Members

Susan Lunte, University of Kansas, USA

## Advisory Board

Matthew Baker, University of Strathclyde, UK

Paul W Bohn, University of Notre Dame, USA

Claudia Conti, CNR, Italy

R Graham Cooks, Purdue University, USA

Jeffrey Dick, The University of North Carolina at Chapel Hill, USA

Volker K. Deckert, University of Jena, Germany

Joshua Edel, Imperial College London, UK

Qun Fang, Zhejiang University, China

Facundo Fernandez, Georgia Institute of Technology, USA

Roy Goodacre, University of Liverpool, UK

Duncan Graham, University of Strathclyde, UK

Robert T Kennedy, University of Michigan, USA

Kagan Kerman, University of Toronto, Canada

Christine Kranz, Ulm University, Germany

Annamalai Senthil Kumar, Vellore Institute of Technology University, India

Xiujun Li, University of Texas at El Paso, USA

Lanqun Mao, Institute of Chemistry, Chinese Academy of Sciences, China

Maria Marin, University of East Anglia, UK

Pavel Matousek, Rutherford Appleton Laboratory, UK

Wei Min, Columbia University, USA

Boris Mizaikoff, University of Ulm, Germany

Prakash Chandra Mondal, Indian Institute of Technology Kanpur, India

Howbeer Muhamadali, University of Liverpool, UK

Takeaki Ozawa, University of Tokyo, Japan

Ashley Ross, University of Cincinnati, USA

Muhammad Shiddiky, Griffith University, Australia

Debbie Silvester, Curtin University, Australia

Steven A. Soper, University of Kansas, USA

Dana Spence, Michigan State University, USA

Nick Stone, University of Exeter, UK

Evan Williams, University of California, USA

Chaoyong James Yang, Xiamen University, China

Yilun Ying, Nanjing University, China

## Information for Authors

Full details on how to submit material for publication in Analyst are given in the Instructions for Authors (available from <http://www.rsc.org/authors>). Submissions should be made via the journal's homepage: [rsc.li/analyst](http://rsc.li/analyst)

Authors may reproduce/republish portions of their published contribution without seeking permission from the Royal Society of Chemistry, provided that any such republication is accompanied by an acknowledgement in the form: (Original Citation)–Reproduced by permission of the Royal Society of Chemistry.

This journal is © The Royal Society of Chemistry 2023.

Apart from fair dealing for the purposes of research or private study for non-commercial purposes, or criticism or review, as permitted

under the Copyright, Designs and Patents Act 1988 and the Copyright and Related Rights Regulation 2003, this publication may only be reproduced, stored or transmitted, in any form or by any means, with the prior permission in writing of the Publishers or in the case of reprographic reproduction in accordance with the terms of licences issued by the Copyright Licensing Agency in the UK. US copyright law is applicable to users in the USA.

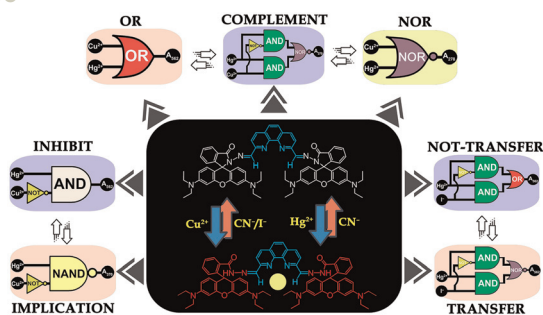
© The paper used in this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

Registered charity number: 207890





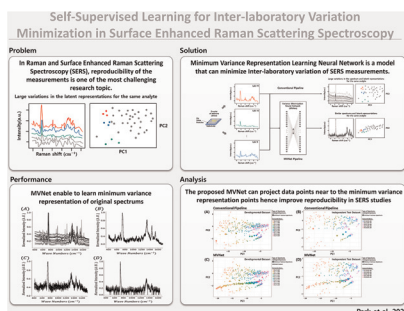
1460



## Differential response for multiple ions: a smart probe to construct optically tunable molecular logic systems

Monaj Karar, Rikitha S. Fernandes and Nilanjan Dey\*

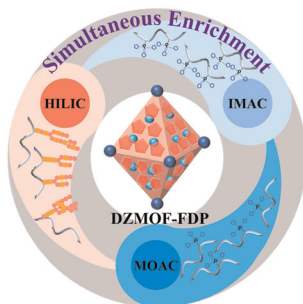
1473



## Self-supervised learning for inter-laboratory variation minimization in surface-enhanced Raman scattering spectroscopy

Seongyong Park, Abdul Wahab, Minseok Kim and Shujaat Khan\*

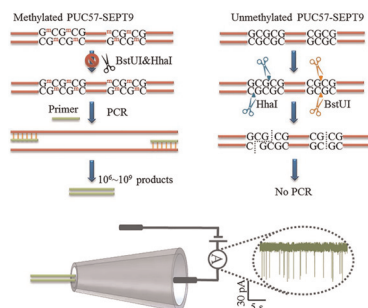
1483



## Simultaneous enrichment optimization of glycopeptides and phosphopeptides with the highly hydrophilic DZMOF-FDP

Xiaoyu Zhou, Hongyan Zhang, Li Wang, Liting Lv and Ren'an Wu\*

1492



## A nanopore counter for highly sensitive evaluation of DNA methylation and its application in *in vitro* diagnostics

Jiahai Wang, Lanfang Chen, Cenlin Gui, Jianji Zhu, Baian Zhu, Zhuobin Zhu, Yunhui Li and Daqi Chen\*

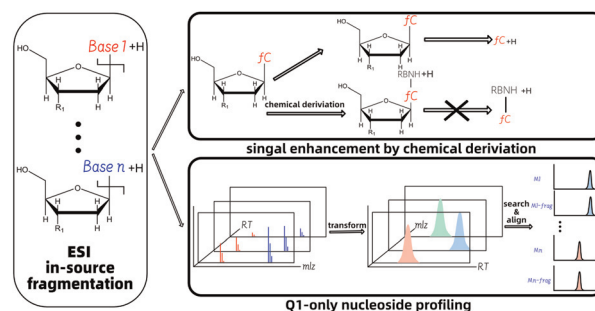


## PAPERS

1500

### In-source fragmentation of nucleosides in electrospray ionization towards more sensitive and accurate nucleoside analysis

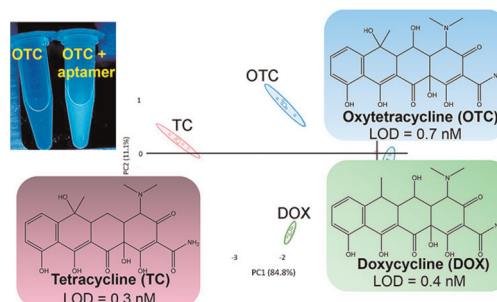
Yu-Nan Chen, Xu-Yang Shen, Yue Yu, Chen-Yu Xue, Ying-Lin Zhou\* and Xin-Xiang Zhang



1507

### An aptamer array for discriminating tetracycline antibiotics based on binding-enhanced intrinsic fluorescence

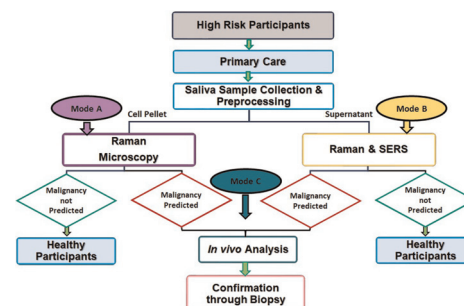
Yichen Zhao, Biwen Gao, Yijing Chen and Juewen Liu\*



1514

### Mobile multi-configuration clinical translational Raman system for oral cancer application

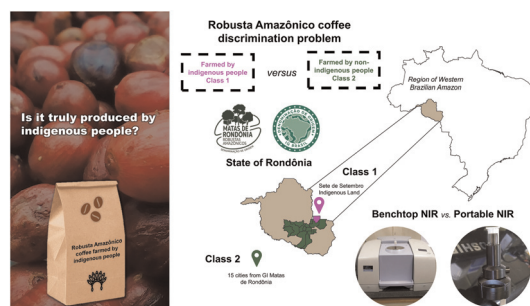
Siddra Maryam,\* Sanathana Konugolu Venkata Sekar, M. Daniyal Ghauri, Edward Fahy, Marcelo Saito Nogueira, Huihui Lu, Flavien Beffara, Georges Humbert, Richeal Ni Riordain, Patrick Sheahan, Ray Burke, Kiang Wei Kho, Rekha Gautam and Stefan Andersson-Engels



1524

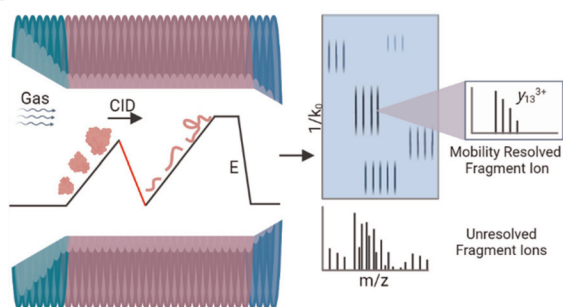
### Discrimination of Robusta Amazônico coffee farmed by indigenous and non-indigenous people in Amazon: comparing benchtop and portable NIR using ComDim and duplex

Michel Rocha Baqueta, Patrícia Valderrama, Enrique Anastácio Alves, Juliana Azevedo Lima Pallone\* and Federico Marini\*



## PAPERS

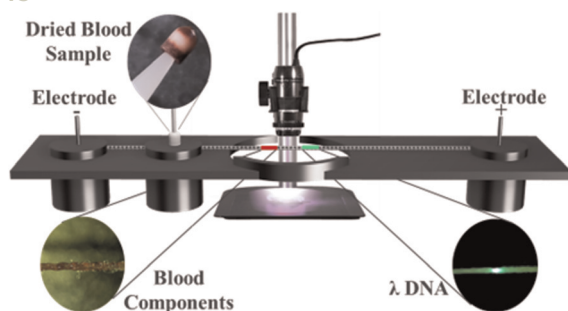
1534



### Characterizing the top-down sequencing of protein ions prior to mobility separation in a timsTOF

Katherine A. Graham, Charles F. Lawlor and Nicholas B. Borotto\*

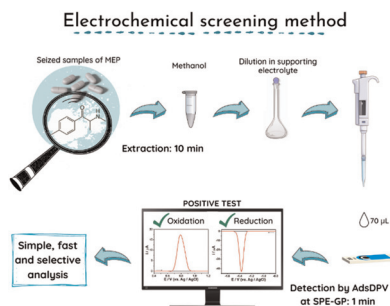
1543



### A thread-based electrofluidic platform for direct transfer, separation, and pre-concentration of materials from sample swabs

Arushi Manchanda, Vipul Gupta,\* Liang Wu and Brett Paull

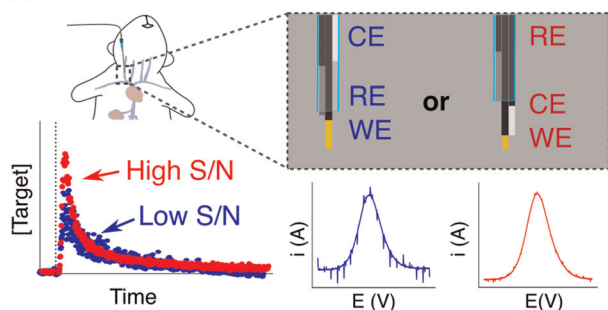
1552



### Electrochemical detection of mephedrone using a graphene screen-printed electrode: a new sensitive and selective approach to identify synthetic cathinones in forensic analysis

Larissa M. A. Melo, Luciano C. Arantes, Izabela F. Schaffel, Lívia M. S. Aranha, Nathália S. Conceição, Camila D. Lima, Pablo A. Marinho, Rafael Q. Ferreira and Wallans T. P. dos Santos\*

1562



### A tight squeeze: geometric effects on the performance of three-electrode electrochemical-aptamer based sensors in constrained, *in vivo* placements

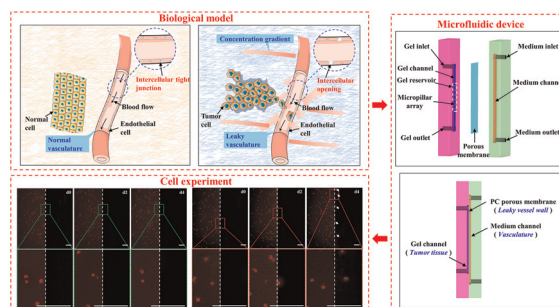
Kaylyn K. Leung, Julian Gerson, Nicole Emmons, Brian Roehrich, Elsi Verrinder, Lisa C. Fetter, Tod E. Kippin and Kevin W. Plaxco\*



1570

## A microfluidic device inspired by leaky tumor vessels for hematogenous metastasis mechanism research

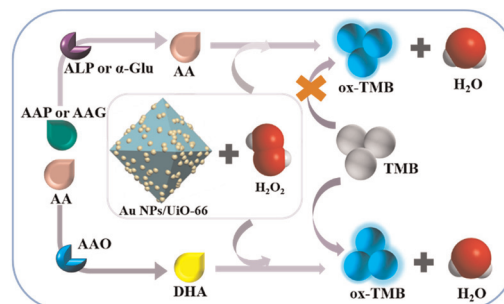
Shuqing Yin, Ruoyu Lu, Yang Li, Dexian Sun, Chong Liu, Bo Liu\* and Jingmin Li\*



1579

## Self-enhanced peroxidase-like activity in a wide pH range enabled by heterostructured Au/MOF nanozymes for multiple ascorbic acid-related bioenzyme analyses

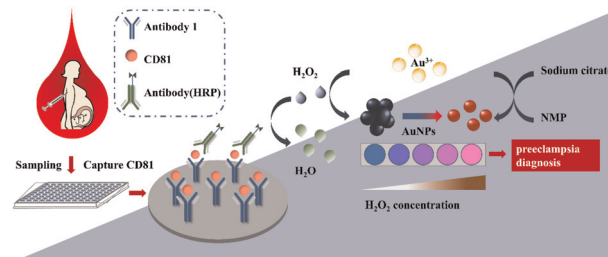
Wendong Liu, Dingding Zhang, Fanghua Zhang, Zhe Hao, Yuyan Li, Mingzheng Shao, Ruizhong Zhang,\* Xiyan Li\* and Libing Zhang\*



1587

## A dichromatic plasmonic ELISA CD81 protein sensor for ultrasensitive detection of preeclampsia

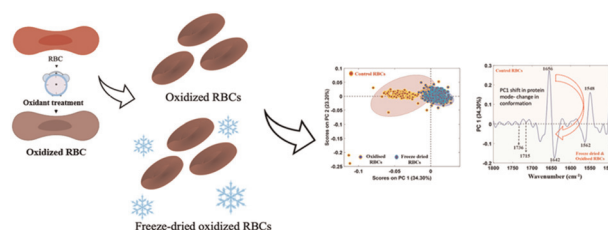
Kexuan Chen, Nan Ma, Haobo Sun, Xueji Zhang and Jinming Kong\*



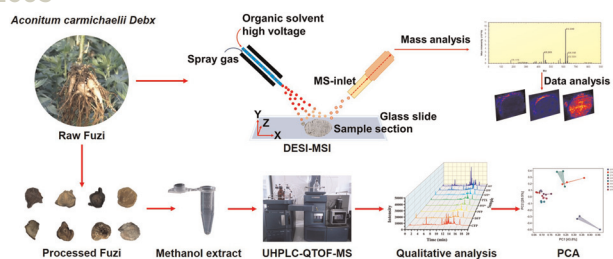
1595

## Characterization of freeze-dried oxidized human red blood cells for pre-transfusion testing by synchrotron FTIR microspectroscopy live-cell analysis

Thulya Chakkumpulakkal Puthan Veettil, Diana Alves, Jitraporn Vongsivut, Rosemary L. Sparrow, Bayden R. Wood\* and Gil Garnier\*



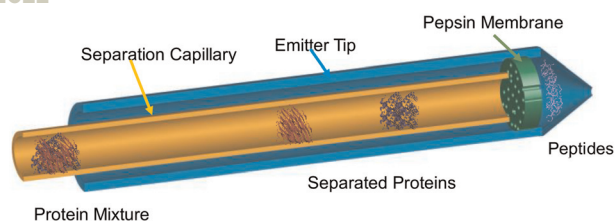
1603



### Spatial distribution and comparative analysis of *Aconitum* alkaloids in Fuzi using DESI-MSI and UHPLC-QTOF-MS

Zhenhui Ren, Huixia Zhang, Liu Yang, Xin Chen, Shuai Zhang, Shiqi Chen, Daowen Li, Cun Li and Haiyang Jiang\*

1611



### Online protein digestion in membranes between capillary electrophoresis and mass spectrometry

Kendall A. Ryan and Merlin L. Bruening\*

