



succidia

# lab & more

Made in Germany

international  
edition

**From Scientists to Scientists worldwide  
in partnership with analytica**

**3.14**

## *Valuable food*

The challenges facing food supplies for tomorrow are staggering. It is expected that by 2050, there will be over 9 billion people on the planet to feed. And as prosperity increases, so too do consumer expectations with regard to the quality of their food, the environment, and a healthy and happy life.

**Pharmacology**

Complex API delivery

**Food Safety**

Mineral oil residues

**Environmental analysis**

Viruses in waters

# ROBU

## VitraPOR® SINTERED FILTERS



The unique porous structure of VitraPOR sintered filters makes them highly flexible and useful for many applications in chemical, pharmaceutical, biological and technical industries.

With pore sizes ranging from under 1 µm to over 500 µm it is highly resistant to most chemicals such as solvents, acids and alkalis.

VitraPOR withstands temperatures up to 540°C.

Whether sensor engineering, bio-diagnostics or chromatography – the experienced **ROBU** team will be pleased to provide you with a tailor-made product.

VitraPOR sintered filter elements are produced and processed in our modern plant under permanent quality control certified according to ISO 9001.

**ROBU** can fabricate sintered porous products in many shapes and sizes. We will work closely with you to create what you need. Try our service and contact us today!



# ROBU®

ROBU GLASFILTER-GERÄTE GMBH  
Schützenstr. 13 · D-57644 Hattert, Germany

Telefon: +49 (0) 2662-8004-0  
Fax: +49 (0) 2662-8004-40  
E-Mail: [info@robuglas.com](mailto:info@robuglas.com)  
Web: [www.robuglas.com](http://www.robuglas.com)

# guest editorial

## Dear Readers,

Modern analysis techniques and scientific quality control have a permanent place in our everyday lives. From clean drinking water, medications and food to consumables such as clothing and cosmetics: In nearly all manufacturing and packaging processes, highly specialized equipment that is standardized for minimal particle sizes guarantee safety and quality. They are used to detect pesticides and contaminants such as heavy metals and dioxins, among other things. Protecting the consumer has top priority!

Now more than ever, food safety is one of the most important topics in the global analysis industry. A product's journey from production to consumption is long, and by the time that product reaches your plate, it should not only taste good, it should also be safe. The quality standard begins as early as the feed given to farm animals and pesticides used in greenhouses. The industry's strict regulations and standards are subject to constant change. Influential factors include scientific progress, demographic developments and social factors that can affect consumer behavior and the resulting demands placed on the product. In addition, environmental disasters such as the reactor accident in Fukushima or contaminants in milk powder underscore the importance of precise, highly sensitive control technologies for substances of all kinds.

analytica China, Trade Fair for Laboratory Technology, Analysis, Biotechnology and Diagnostics, takes place in Shanghai again from September 24–26. It features three exhibition halls with innovative technologies in the sectors for laboratory equipment, measuring and testing technology, instrumental analysis, biotechnology and diagnostics. In addition, the extensive program of events gives visitors a look at scientific research of today and tomorrow. Important topics include food safety, materials analysis and traditional Chinese medicine. There will also be various tutorials on quality control in analytical chemistry, which pertains to all industrial sectors. The



need for quality standards in the People's Republic is high, and so is the resulting demand for superior-quality analysis equipment.

Take a look at the state-of-the-art in science and the industry's latest products and trends.

**We look forward to seeing you and wish you a successful and informative visit to the fair.**

**Sincerely yours,  
→ Susanne Groedl  
Exhibition Director analytica China**

# content

**01** guest editorial  
Susanne Groedel

**04** **internals**

**05** **market view**

**38** **products**

## international network

cooperation  
**06** **Bridge to China**  
Isabelle Harbrecht

## scientific research

pharmacology  
**08** **Complex API delivery**  
Dr Anne Mahringer,  
Prof. Gert Fricker

food safety  
**12** **Focus on mineral oil residues**  
Prof. Dr Reinhard Matissek,  
Dr Marion Raters, Anna Dingel,  
Julia Schnapka

environmental virology  
**18** **Viruses in the water**  
Dr Lars Jurzik, Mats Leifels

biomimetics  
**22** **Tropical pitcher plant and biomimetics**  
Dr Elena V. Gorb, Martina Baum,  
Julia Purtov, Nadine Jacky,  
Prof. Stanislav N. Gorb

interview  
**28** **Brain models in 3D**  
labor&more in conversation  
with Dr Madeline Lancaster

## methods and applications

diagnostics  
**30** **When tuberculosis faces an even stronger opponent**  
Carl Zeiss Microscopy GmbH

analytical chemistry  
**34** **Science we need**  
Prof Dr. Oliver J. Schmitz

profile  
**36** **Shelf life testing of dairy products in China**  
Ina Falkner

profile  
**40** **Economic Cooling**  
Julabo GmbH



## lab&more

### Publisher

succidia AG  
Verlag und Kommunikation  
Rösslerstr. 88 · 64293 Darmstadt  
Tel. +49 6151-360 56-0  
Fax +49 6151-360 56-11  
info@succidia.de · www.succidia.de

### Editor

Jörg Peter Matthes [JPM]<sup>1</sup>

### Scientific Director

Prof. Dr. Jürgen Brickmann [JB]<sup>2</sup>  
brickmann@succidia.de

### Head of Sales & Marketing

Robert Erbdinger  
erbdinger@succidia.de

### Editorial Staff

Claudia Schiller [CS], Management<sup>3</sup>  
schiller@4t-da.de

Prof. Dr. Jürgen Brickmann [JB]  
brickmann@succidia.de

Jörg Peter Matthes [JPM]  
jpm@4t-da.de

Dr Mario Mehmel [MM]  
m.mehmel@aplichem.com

Dr Gerhard Schilling [GS]  
g.j.schilling@t-online.de

### Scientific Advice

Dr Gerhard Schilling [GS]<sup>4</sup>  
g.j.schilling@t-online.de

### Sales & Marketing

Robert Erbdinger, Management<sup>5</sup>  
erbdinger@succidia.de

Timo Dokkenwadel<sup>6</sup>  
dokkenwadel@succidia.de

Natalia Villanueva Gomes<sup>7</sup>  
villanueva@succidia.de

Horst Holler<sup>8</sup>  
holler@succidia.de

### Advertising Management

anzeigen@succidia.de

### Concept, Layout, Production

4t Matthes+Traut Werbeagentur GmbH  
www.4t-da.de

Nathalie Rogowski<sup>9</sup>  
rogowski@4t-da.de  
Tel. +49 6151-8519-89

### Scientific Advisors

Prof. Dr. Philippe A. Bopp,  
Department of Chemistry,  
Université Bordeaux 1, France

Prof. Dr. Horst Hahn,  
Executive Direktor,  
Institute of Nanotechnology,  
Karlsruhe Institute of Technology

Prof. Dr. Rüdiger Kniep,  
Director of Inorganic Chemistry,  
Max Planck Institute for Chemical  
Physics of Solids, Dresden

Prof. Dr. Paul G. Layer,  
Developmental Biology and  
Neurogenetics, Institute of Zoology,  
Technische Universität Darmstadt

Prof. Dr. Dr. h.c. Henning Hopf,  
Institute for Organic Chemistry,  
Technische Universität Braunschweig

Prof. Dr Reinhard Renneberg,  
Full Professor of Analytical Biotechnology  
Hong Kong University of Science and  
Technology (HKUST), Hongkong, China

### Price

Single issue 18 €  
Annual subscription  
Germany: 69 € zzgl. 7% MwSt.

Abroad: 81 €

### Subscription

labandmore@succidia.de

### Print

Frotscher Druck GmbH  
Riedstraße 8 · 64293 Darmstadt  
www.frotscher-druck.de

The magazine and all the articles and illustrations contained herein are copyrighted. Reproduction – in whole or in part – requires prior written permission and explicit reference to the source. The author grants to the publisher an unlimited right of utilization and reproduction of the editorial contribution unchanged or edited for all purposes and in all media. The publisher and the editorial department as well as the agency accept no responsibility for unsolicited illustrations, manuscripts and material submitted to them. The authors bear sole responsibility for the content of their contributions. The editors do not assume any liability for contents produced and provided by the authors.



Der CO<sub>2</sub>-neutrale Versand  
mit der Deutschen Post



succidia  
Verlag & Kommunikation

www.int.laborundmore.de

# Samples are complex. Separating them shouldn't be.

Every breakthrough starts with a challenge. We believe that challenge should be your science, not your instrument. The **Thermo Scientific™ Vanquish™ UHPLC** delivers better separations, more results, and easier interaction than ever before. In 2010 we embraced UHPLC as the standard for all of our liquid chromatography solutions, and we have designed the Vanquish UHPLC as the instrument to solve your chromatographic challenges and achieve that breakthrough.

## Vanquish UHPLC System

• **Discover more at [thermoscientific.com/Vanquish](http://thermoscientific.com/Vanquish)**



© 2014 Thermo Fisher Scientific Inc. All rights reserved. All trademarks are the property of Thermo Fisher Scientific and its subsidiaries.



**Thermo Scientific™  
Accucore™ Vanquish™ Columns**  
1.5 µm solid core particles for  
unmatched resolution and throughput



**Leading Separations for  
Mass Spectrometry**  
Providing that extra level of  
confidence with seamless integration



**Thermo Scientific™ Dionex™ Chromeleon™  
Chromatography Data System**  
Integrated mass spectrometry support for  
single point LC-MS control

# internals

## Success through communication



**Back row, standing:** Jörg Peter Matthes (CEO, Publisher), Claudia Schiller (Editorial Manager), Natalia Villanueva-Gomes (Sales & Marketing), Prof. Dr. Brickmann (Scientific Advisor) **Front row, seated:** Timo Dokkenwadel (Sales & Marketing), Robert Erbdinger (Head of Sales & Marketing), Nathalie Rogowski (Layout), Horst Holler (Sales & Marketing)

In the global marketplace, “Made in Germany” can claim the undisputed title of market leader. Aside from the major players in the various industries, German SMEs in particular rank among the global market leaders – with a share of around 70% – as their highly innovative products are in demand worldwide. Modern technology and innovative manufacturing techniques are the key to development that is both efficient and sustainable. The resulting economic success also helps to give people an improved quality of life. What’s already true for Europe and the US is increasingly true worldwide: modern citizens are enlightened consumers.

Among the emerging economies, news continues to be positive from the People’s Republic of China. The growth of the Chinese economy in the thirty years or so since the economic reforms of 1979 has been one of the wonders of modern economic development. Within this period, China’s growth has been unlike anything seen before. Increased privatisation of formerly nationalised companies has lowered barriers to market entry by Western companies. Indeed, China will soon become the most important market for many Western brands, as a recent analyst report from Ernst & Young makes very clear. “Global players wanting to retain that title 20 years hence must invest heavily in the emerging economies today – especially China,” comments one author.

Our international lab&more issues highlight the entry into these markets with a prodigious future. Since 2007, we have been continuously expanding both our portfolio and our networks worldwide. Our most recent collaboration with Munich Expo for the analytica China event and our recent Chinese-language special issue both aim to meet the latest challenges of a society in the throes of change. We’re blazing a trail into this giant country for German companies and authors. Nor is it a one-way street: Germany is now host to some 27,000 Chinese students – who offer a perfect chance to make contacts for future business.

Sound contacts and good communication are the key to every success story. Come join us, as we set out to explore these new horizons. Our international readers will certainly want to stay informed when in Europe. This issue offers you a number of contacts. Next year, ACHEMA in Frankfurt opens its doors to the world’s biggest event for research, development and processes in the chemicals industry – we look forward to seeing you there.

**Sincerely,  
The lab&more team**

## lab&more Timeline

Developing the best-looking and most eye-catching magazine for research

since 2005



labor&more  
First issue for Biotechnica



2007 first international issues

- 5 labor&more
- 2 lab&more international
- 1 labor&more Russia



2009 & 2010

- 5 labor&more
  - 2 lab&more international
  - 1 labor&more Russia
  - 1 lab&more Orient
- Circulation increased to 21 K



2011

- 1 lab&more Orient
  - 6 labor&more
  - 2 lab&more international
  - 2 labor&more Russia
- Increase in frequency from 1 to 2  
Expansion to Ukraine market



2012

- 1 lab&more Orient
  - 2 lab&more international
  - 2 labor&more Russia
  - 8 labor&more
- Increase in frequency from 6 to 8  
labor&more exclusive partner of LabComplex Ukraine, analytica Expo Moscow



2013

- 1 lab&more Orient
  - 2 lab&more international
  - 8 labor&more
  - 2 labor&more Russia
- labor&more Russia – expansion to Kazakhstan market



2014

- 10 labor&more
  - 4 lab&more international
  - 2 labor&more Russia
  - 1 lab&more Orient
  - 1 lab&more China
- Increase in frequency labor&more to 10; lab&more to 4

2015

.... to be continued and the development continues

# market view

## CEM: High-efficiency peptide synthesis technology secures R&D 100 Award

The Liberty Blue Automated Microwave Peptide Synthesizer from CEM Corp. is a winner of a 2014 R&D 100 Award.

The award is presented on a yearly basis by the editors of R&D Magazine in recognition of the 100 most “technologically significant new products and processes of the year.”

The Liberty Blue is a new, revolutionary technology that dramatically improves peptide synthesis. The system utilizes a new high-efficiency solid phase peptide synthesis (HE-SPPS) process that allows peptides to be synthesized in higher purity up to 25 times faster than con-



Picture: CEM Corporation

ventional systems and 6 times faster than currently available microwave systems.

→ [www.cem.de](http://www.cem.de)

## Shimadzu: i-series – the new driver of i-volution in HPLC analysis

Shimadzu, one of the world leaders in analytical instrumentation, has introduced the i-series integrated HPLC and UHPLC systems (Ultra High Performance Liquid Chromatograph). The i-series concept combines innovation, intuition and intelligence for applications in food, environmental, chemical and pharmaceutical industries. The analyzers are designed to meet the needs of any analytical environment with high speed, outstanding performance, maintainability and economics. The intuitive operation of the systems allows even in



Picture: Shimadzu Europa GmbH

experienced operators to easily obtain high quality data.

→ [www.shimadzu.eu](http://www.shimadzu.eu)

## Gentle evaporation. Vacuum-concentrators from Christ



The **SpeedDry** product family  
for vacuum concentration

Martin Christ  
Gefriertrocknungsanlagen GmbH  
An der Unteren Söse 50  
37520 Osterode am Harz  
Tel. +49 (0) 55 22 50 07-0  
Fax +49 (0) 55 22 50 07-12  
info@martinchrist.de

[www.martinchrist.de](http://www.martinchrist.de)



## Bridge to China

Technische Universität (TU) Darmstadt furthers its connections by opening a new liaison office in Shanghai

Isabelle Harbrecht  
TU Darmstadt, Liaison Office at Tongji University

**International exchange and cooperation are becoming more and more important in the higher education sector; universities are competing globally for the brightest minds. China, one of Germany's most important economic and political partners and a country that traditionally values education, has set the development of its vast human resources as a strategic goal. During the 12th Five-Year-Plan, government reached its goal of spending 4% of the annual GDP on education. Chinese parents are looking for the best education for their offspring and, therefore, China has become an education market that cannot be ignored.**

Following its long history of collaboration with Chinese universities in general and the Tongji University in particular and in coherence with its international strategy to promote mobility of students and researchers and scientific collaboration, TU Darmstadt places an even stronger focus on China. In March 2014 TU Darmstadt, a member of the TU 9 Consortium of German Institutes of Technology, established a liaison office on Tongji University's Siping Campus in the center of Shanghai.

### Focus on technology

In terms of the number of international students, TU Darmstadt belongs to Germany's most international universities. Currently, more than 4,000 students from over 100 different countries are enrolled at TU Darmstadt. TU Darmstadt concentrates on technology – 50% of the students are enrolled in engineering sciences. The university is internationally known for study fields such as mechanical engineering, architecture, and industrial engineering. In

addition, TU Darmstadt specifically strives to provide international leadership in the increasingly important fields of energy and mobility, information and communications, and construction and housing. TU Darmstadt's focus on technology – from the perspectives of engineering, the natural sciences, the humanities and the social sciences – ranges from fundamental research to applications for day-to-day life.

With Tongji University in Shanghai, TU Darmstadt has found a complementary and

**Fig. 1** The presidents Hans Juergen Proemel (left) and Pei Gang strengthen the ties between the two universities.



**Fig. 2** Tongji University's president Pei Gang hands the keys to the new Liaison Office to Isabelle Harbrecht. (In the background: TU Darmstadt's president Hans Jürgen Prömel)



**Isabelle Harbrecht** born 1983, graduated in East-Asian Area Studies from University of Cologne, Germany. During her studies she focused on politics, economics and culture in PR China and has been living in Shanghai for the past years. After working at the Hanns-Seidel-Foundation in Shanghai three years, she is now the Managing Director of the TU Darmstadt Liaison Office at Tongji University. Fluent in German, English and Mandarin, she connects people and projects in Shanghai and Darmstadt. Together with her counterpart at TU Darmstadt, Corinna Caspar-Terizakis, Managing Director of the Strategic Partnership with Tongji University, Isabelle Harbrecht coordinates the different projects, facilitates the communication and establishes the ties with international companies and other stakeholders in Shanghai and China.



**Fig. 3** Ulrich Grothus, DAAD deputy secretary general, Hans Juergen Proemel, president of TU Darmstadt, Pei Gang, president of Tongji University, and Wolfgang Roehr, Consul General of the Federal Republic of Germany (left to right) celebrate the opening of the Liaison Office.

equally strong partner. The two universities share a long history. As early as 1915, the first students from Shanghai arrived in Darmstadt to study. In 1980 the two universities signed a cooperation agreement, thereby establishing a formal partnership – a cooperation with pioneering character as the first partnership between a university in the People's Republic of China and a university of technology in the Federal Republic of Germany. Over the years a broad and deep partnership has evolved which is more vivid today than ever. The cooperation involves student exchanges, summer schools, joint research projects, as well as double degree programs.

Qualified students can earn a Double Master in Mechanical Engineering from TU Darmstadt and Tongji University. The students spend two semesters at their home university and three semesters at the partner university. TU Darmstadt and Tongji University also offer a double doctorate in economical science. This study program is highly individualized; in addition to the general

cooperation agreement, both universities sign an extra agreement specifying the study program for each doctoral candidate.

In 2012, Tongji University officially became a strategic partner of TU Darmstadt. Since March 2013, this partnership is supported by the program "Strategic Partnerships and Thematic Networks" of the German Academic Exchange Service (DAAD) with funds from the Federal Ministry of Education and Research (BMBF). Within the same program, TU also coordinates a thematic network called "Semizentral: Clean Water China and South East Asia", which aims at developing water supply and waste management systems for urban areas.

### **New initiatives to strengthen the partnership**

Within the next years, TU Darmstadt will extend and deepen its partnership with the Tongji University in Shanghai. In particular, TU Darmstadt wishes to broaden its research cooperation by involving

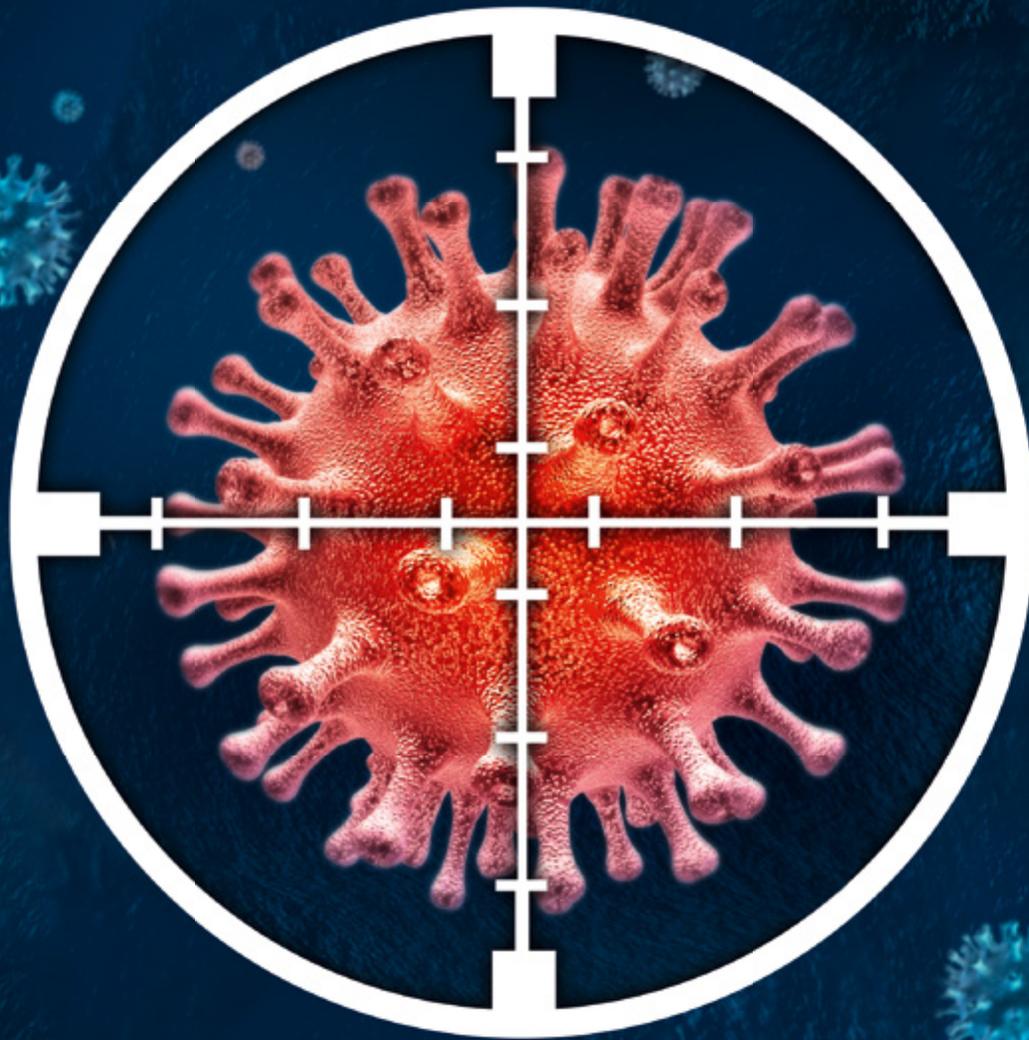
international companies in Shanghai. A three-dimensional cooperation between Tongji University, TU Darmstadt and the market will lead to the development of new technologies in different fields. These new initiatives will also further the exchange of scientific staff and students. A new program called "TU Darmstadt Visiting Chair" allows professors from Tongji University to visit TU Darmstadt for up to 5 months. The Chinese scientist will be involved in research and/or teaching in Darmstadt. The cooperation is no longer restricted to the bilateral relationship between two professors, but now involves the whole institute. Therefore, the Visiting Chair is an excellent measure to strengthen the sustainability of the partnership.

TU Darmstadt's liaison office at Tongji University – the first of its kind on Tongji's campus – is an important element in fostering this partnership.

→ [harbrecht.is@pww.tu-darmstadt.de](mailto:harbrecht.is@pww.tu-darmstadt.de)

*Pictures: © TU Darmstadt*

# pharmacology



## Complex API delivery

Cellular transport proteins and API transport

Dr Anne Mahringer and Prof. Gert Fricker  
Institute of Pharmacy and Molecular Biotechnology, University of Heidelberg

**A medicine's potency often depends on the concentration of its active ingredient (API) at the target site. Medicines are usually delivered remotely to this target site, however. The API must first dissolve and traverse local barriers such as the intestinal wall before it can enter the bloodstream and then reach its target site. For a long time, work in this area was guided by the dogma that API diffusion was the force driving absorption by the body or the cell. Ideally, the API should bear no charge and should be lipophilic, so as to diffuse readily through membranes.**

Today, we now know that the majority of active ingredients – and indeed many nutritional components – are transported across membranes in an ionised form by transport proteins. Transport proteins are proteins integral to a cell membrane that actively or passively mediate the permeation of a substance across the membrane. Unlike free diffusion, transport-mediated permeation has

characteristics of both saturation and inhibition, and can occur both passively along a concentration gradient as well as actively against a concentration gradient by utilising energy. This energy can be consumed either directly by the transport protein itself (primary active transporter) or by the indirect coupling of a transporter with a primary active protein (e.g. an ATPase). We distinguish between uniport systems, which transport substrate molecules in one direction, symport or cotransport systems, which simultaneously transport two or three separate substances in the same direction, and antiport systems, which transport two or three substances in opposite directions (fig. 1). Other components include ion pumps (e.g.  $\text{Na}^+/\text{K}^+$  ATPases), ion channels and water-transporting aquaporins.

The decoding of the genome has led to an internationally binding classification of transport proteins and ion channels by the International Union for Biochemistry and Molecular Biology (IUBMB) in the form of the “Transporter Classification Database” (TCDB), which lists over 600 families of transport proteins. The human transport proteins encompass the superfamilies of the annexins, ATPases, calcium channels, potassium channels, sodium channels, ATP-binding transport proteins and the human solute carriers (SLCs). A list of all genes that code for these proteins can be found on the web page of the HUGO Gene Nomenclature Committee (HGNC) ([www.genenames.org/genefamilies](http://www.genenames.org/genefamilies)).

Today, we estimate that approximately 10% (~2,000) of all human genes code for transporters, while the human solute carriers currently encompass 52 transporter families with 395 genes ([www.bioparadigms.org/slc/intro.htm](http://www.bioparadigms.org/slc/intro.htm)). The nomenclature of this protein group was introduced in 1990 by M. Hediger, who first cloned the  $\text{Na}^+$ /glucose cotransporter in *E. coli*. Wright's research team in 1987 [3]. As a rule, a transporter is assigned to a specific family if at least 20% of its amino acid sequence is identical with that of the other members within the family. The SLC protein and ATP-binding superfamilies are of particular interest, since they participate in the resorption, distribution and excretion of many pharmaceuticals, thus determining their bioavailability. The recognition of candidate compounds by these transport proteins is now routinely investigated during the development and licensing



**Gert Fricker** studied chemistry and medicine at the University of Freiburg. After obtaining his doctorate in biochemistry in 1986, he completed his habilitation in experimental medicine in 1993. Following a postdoc position at University Hospital Zurich, he then joined the Drug Delivery System department at Sandoz AG in Basel in 1988. In 1995, he accepted a position at the Institute for Pharmaceutical Technology and Biopharmacy at the University of Heidelberg. Appointed Director of the new Institute of Pharmacy and Molecular Biotechnology in 2002, he is also managing director of the Heidelberg-based Steinbeis Technology Transfer Centre Biopharmacy and Analytics. His research interests include membrane transport processes, innovative dosage forms and API transport through the blood-brain barrier.



**Anne Mahringer** studied pharmacy at Heidelberg University, receiving her doctorate in 2009 from the Institute of Pharmacy and Molecular Biotechnology. In the course of several overseas positions in the US (NIEHS, MDIBL) and Sweden (University of Uppsala), she acquired specialised knowledge of both *ex vivo* and *in vivo* barrier models and methods for determining pharmacokinetic parameters, with the objective of predicting the blood-brain barrier permeability of drug substances. As a research fellow at the Institute of Pharmacy and Molecular Biotechnology, Anne Mahringer is involved in both teaching and research in the field of ABC transporter regulation mechanisms at the blood-brain barrier and kidneys, and is investigating the endocytotic transport processes of larger peptide molecules in the vascular endothelium in connection with Parkinson's.

of new APIs, and has led to the publication of corresponding regulatory guidelines by the FDA and EMA.

### Drug interactions at the transporter level

Numerous drug substances are capable of inhibiting transport proteins and consequently modifying the pharmacokinetics of other transport substrates. In some cases, this has even led to the drug's withdrawal from the market. One noted example is cerivastatin, an HMG-CoA reductase inhibitor, whose ingestion has led to fatal myotoxicity in a number of cases. An analysis showed that some patients had simultaneously been taking the antihyperlipidemic agent gemfibrozil, resulting in as much as a 4.4x increase in the plasma concentrations of cerivastatin [1]. The root cause was an inhibition of CYP2C8-mediated metabolism and an inhibition of the hepatic absorption of cerivastatin by gemfibrozil glucuronide as mediated by OATP2 (organic anion transporting protein 2, OATP2/OATP1B1:SLC21A6) [2]. To prevent repeat occurrences of such cases, the FDA issued the guideline “Drug Interaction Studies, Study Design, Data Analysis, Implications for Dosing, and Labelling Recommendations” in 2012. In the same year, the EMA finalised its “Guideline on the Investigation of Drug Interactions”, which devoted particular

attention to the discussion of transporter-mediated drug-drug interactions.

### ATP-binding proteins

A characteristic common to the ABC (ATP binding cassette) transporter superfamily is its capacity for binding and hydrolysing ATP, and thus obtaining the energy required for substrate translocation. ABC transporters act unidirectionally either as import or export proteins and can be found in both simple and complex organisms. While ABC export proteins are expressed by both prokaryotes and eukaryotes, ABC import proteins have previously been detected exclusively in prokaryotes. With an estimated 80 systems, ABC transporters constitute the most extensive protein family in *E. coli* and represent about 5% of the bacterial genome. In humans, 48 ABC transporters have now been described in seven families. In modern nomenclature, the seven gene families coding for these transporters are termed ABCA to ABCG. These transporters are involved in lipid and cholesterol transport, in antigen presentation, in mitochondrial iron homeostasis, in ATP-dependent regulation of ion channels and in resistance to chemotherapeutic agents. The ABC export pumps P-glycoprotein (MDR1, P-GP; BCB1) and breast cancer resistance protein (ABCG2) have especial significance at the blood-brain

# pharmacology

barrier, where they form a key component of the barrier for the protection of the central nervous system. Unfortunately, this means many CNS disorders are difficult to treat, since many potentially powerful active ingredients therefore cannot pass into the brain. This becomes especially clear in the process of treating brain tumours or metastases, where the use of cytostatic drugs is generally ineffective. As one example, the mitotic inhibitor paclitaxel (Taxol), used successfully in the treatment of breast and ovarian cancers, cannot be deployed for glioblastomas, since it is a P-glycoprotein substrate and is therefore unable to traverse the blood-brain barrier. Animal experiments in rats with implanted human glioblastomas have

impressively demonstrated that the inhibition of P-glycoprotein in the blood-brain barrier by simultaneous administration of a blocker can lead to a drastic elevation of paclitaxel concentration in the brain (fig. 2) and, consequently, to a significant reduction in tumour volume [4].

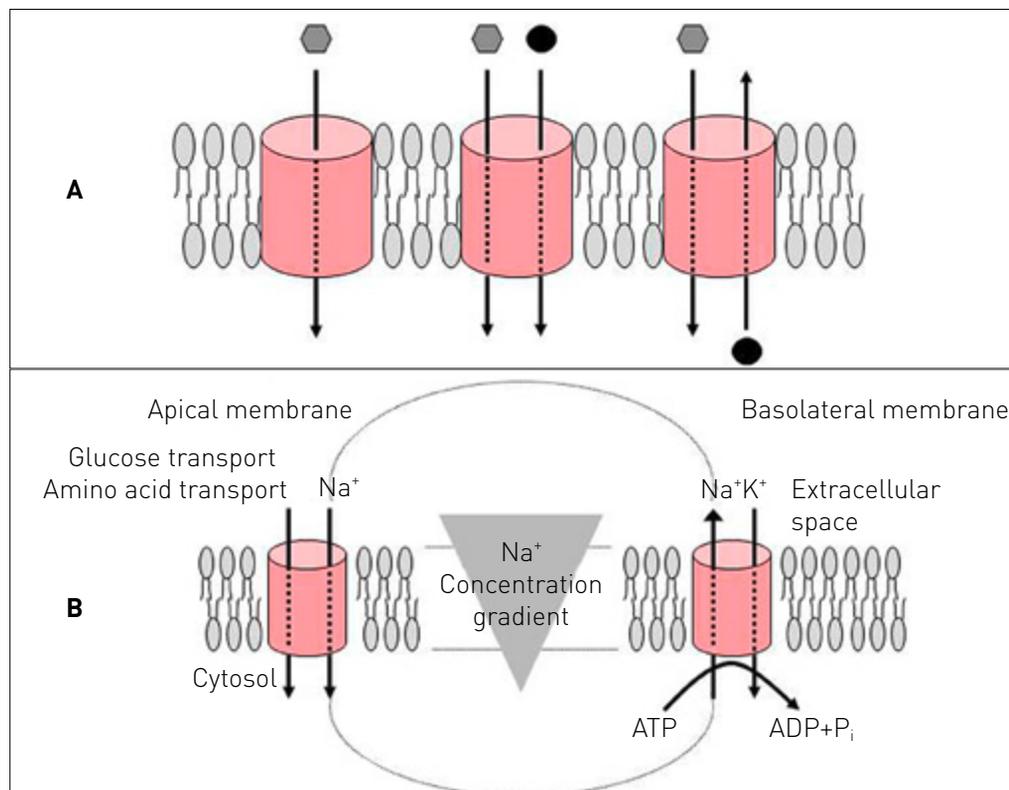
## Transport proteins and disease

Transport proteins may also be directly involved in disease, and transporter defects may also be the cause of illness. The glucose transporter SLC2A2 (GLUT-2) is expressed predominantly in the liver, pancreas, small intestine and kidneys, and enables insulin-dependent glucose transport. Mutations in the SLC2A2 gene cause the rare Fanconi-

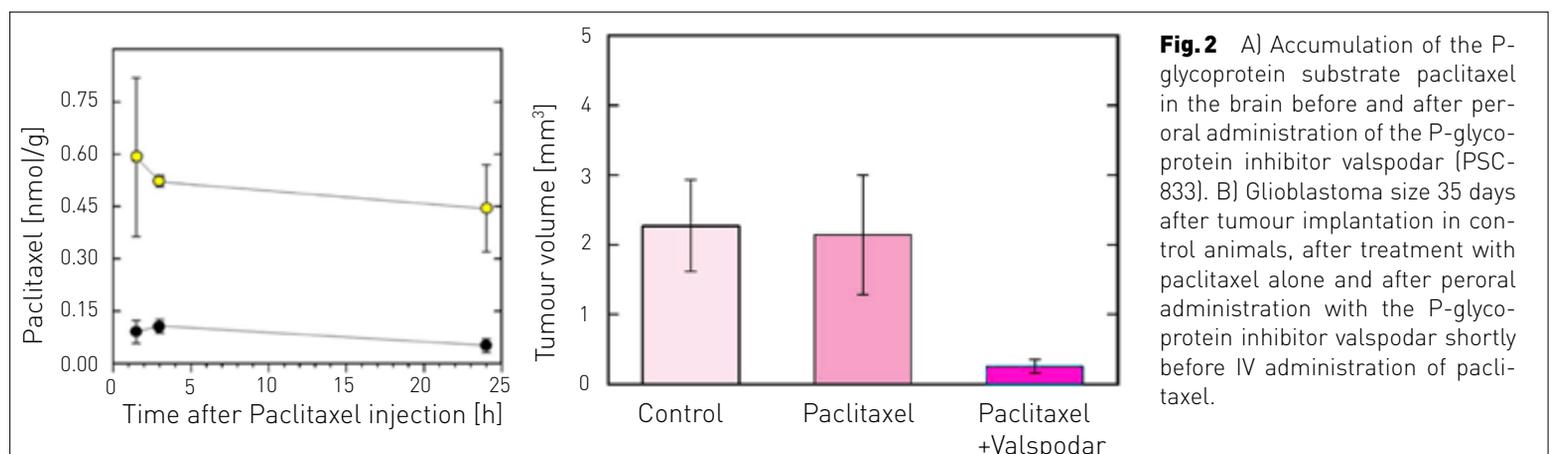
Bickel syndrome, a glycogen storage disease. The glutamate transporters SLC1A2 and SLC1A3 are also suspected of pathogenic involvement in amyotrophic lateral sclerosis, Alzheimer's, autism and schizophrenia. Members of the family of SLC13 transporters (Na<sup>+</sup>-coupled di-/tricarboxylate/sulphate transporters) – namely SLC13A2 (NaDC1) and SLC13A3 (NaDC3) – are also suspected of involvement in the formation of kidney stones and the pathogenesis of the metabolic disorders glutaric acidemia type 2 and Canavan disease [5]. The anion transporter SLC26A4 is ascribed a role in deafness, SLC31A1 and SLC31A2 a role in the copper storage disorder Wilson's disease.

One of the most well-studied genetic diseases is cystic fibrosis (also known as mucoviscidosis), whose cause is ascribed to mutations on the long arm of chromosome 7. Cystic fibrosis is the second most common congenital metabolic disease for light-skinned populations, in which disease incidence is around 1 in 2,000 newborns. The affected gene codes for CFTR (Cystic Fibrosis Transmembrane Conductance Regulator (ABCC7)), a chloride channel that is a member of the ABC transporters. Disruptions to this channel mean that secretions produced by the bronchia, pancreas, liver and small intestine do not contain enough water: these then become viscous, resulting in a wide range of malfunctions in the affected organs. To date, over 1,000 separate mutations are known for the CFTR gene. The commonest mutation for this gene, ΔF508, causes a deletion of phenylalanine at position 508 in the protein and is present in seven of ten people with cystic fibrosis.

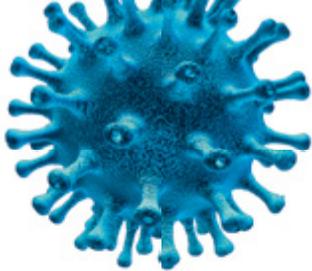
Another – although much rarer – hereditary disorder that can be traced to an ABC transporter defect is Tangier disease. This is a lipid metabolism disorder whose underlying cause is a defect in the ABCA1



**Fig. 1** A) Unidirectional transport, cotransport, antiport system. B) Secondary active transport: coupling of an Na<sup>+</sup> amino acid or glucose transporter in an apical membrane to an Na/K ATPase in the basolateral membrane. The energy necessary is provided by hydrolysis of ATP by the ATPase (from "Biopharmacology", VCH-Wiley; with permission of the publisher).



**Fig. 2** A) Accumulation of the P-glycoprotein substrate paclitaxel in the brain before and after peroral administration of the P-glycoprotein inhibitor valsopodar (PSC-833). B) Glioblastoma size 35 days after tumour implantation in control animals, after treatment with paclitaxel alone and after peroral administration with the P-glycoprotein inhibitor valsopodar shortly before IV administration of paclitaxel.



gene that codes for a cholesterol transporter. This results in reduced formation of high-density lipoproteins and elevated levels of cholesterol storage.

More well-known is the autosomal recessive Dubin-Johnson syndrome, which arises from a mutation in the gene for multidrug resistance-related protein 2 (MRP2, ABCC2). The protein causes ATP-modulated secretion of glucuronidated (conjugated) bilirubin to the gallbladder by the liver. If the protein is non-functional, then bilirubin cannot be transported into the gallbladder capillaries: this leads to accumulation in the liver and to a backflow of conjugated bilirubin into the blood. Fortunately, prognosis is good for the disease and treatment is usually not necessary.

Mutations in the ABCB1 gene, which codes for the best-characterised ABC transporter P-glycoprotein (ABCB1), are believed to increase susceptibility to a sub-type of inflammatory bowel disease (inflammatory bowel disease 13). Quite possibly, the export pump is also involved alongside ABCG2 (breast cancer resistant protein, BCRP), ABCC1 (multidrug resistance-related protein 1, MRP1) and the cholesterol transporter ABCA1 in the pathogenesis of Alzheimer's disease, since these proteins help in the clearance of amyloid- $\beta$  from the brain. Isolated cases are also known from veterinary medicine. Collies, shelties and bobtails must not be treated with the anti-parasitic agent ivermectin, since defects in the ABCB1 gene have often been observed in these dog breeds. As a P-glycoprotein substrate [6], the neurotoxin ivermectin can traverse the blood-brain barrier in dogs lacking the P-glycoprotein function and lead to the death of the animals so treated. On account of its formidable role in the body's defences against toxic substances and the development of resistance to chemotherapy, P-glycoprotein has often been the target of recent experiments that have attempted to block the compound and thus also achieve clinical reversal of cytostatic resistance. Yet results to date have been disappointing.

An interesting phenomenon is observed in the treatment of epilepsy. Therapeutic resistances are a frequent result of prolonged treatment with anti-epileptic drugs, probably due to an induction of ABC export proteins in the vicinity of epileptic foci, which in turn decreases the concentration of the anticonvulsant [7].

Even this handful of examples clearly illustrates the decisive role that transport proteins play in physiology, pathophysiology, toxicology and the effects of medications. While our knowledge of these proteins has increased immensely over the last two decades, many questions still remain unanswered. How does their recognition of substrates work, for example? Which signal cascades regulate them and how can findings about the structure of these proteins be used for rational drug design? Answering these questions will improve our understanding of the proteins' physiological role, further illuminate the pathomechanisms of disease and help develop new strategies in drug discovery.

→ [gert.fricker@uni-hd.de](mailto:gert.fricker@uni-hd.de)

→ [mahringer@uni-hd.de](mailto:mahringer@uni-hd.de)

#### Bibliography

- [1] Backman, JT. et al. (2002) *Clin Pharmacol Ther.* 72,685–691
- [2] Sbitara, Y. et al. (2004) *J Pharmacol Exp Ther.* 311, 228–236
- [3] Hediger, MA. et al. (1987) *Proc Natl Acad Sci U S A.* 84, 2634–2637
- [4] Fellner, S. et al. (2002) *J Clin Invest.* 110, 1309–1318
- [5] Bergeron, MJ. et al. (2013), *Mol Aspects Med.* 34, 299–312
- [6] Nobmann, S. et al. (2001) *Br J Pharmacol.* 132, 722–728
- [7] Potschka, H. (2010) *Pharmacogenomics.* 11, 1427–1438

Picture: ©panthermedia.net | lightwise

## Thirsty for better water testing solutions? Discover the new Spectroquant® test kits.

Whether for testing drinking water, cooling and boiler water, or wastewater, our latest Spectroquant® test kits are clearly superior:

- The first COD cell tests with unlimited chloride tolerance.
- The most sensitive chloride, silicate and sulfate tests.
- The easiest manganese and volatile organic acid tests.

Tap into the future of water analysis on [www.merckmillipore.com/water-analysis](http://www.merckmillipore.com/water-analysis)



# food safety

## Focus on mineral oil residues

MOSH/MOAH food contamination



Prof. Dr Reinhard Matissek,  
 Dr Marion Raters, Anna Dingel,  
 Julia Schnapka

Food Chemistry Institute (LCI)  
 of the Association of the German  
 Confectionery Industry (BDSI)

**Mineral oils are almost universally present in our environment. Their constituents can infiltrate foods of both plant and animal origin in many different ways. From the perspective of their chemical structure, the main compounds of interest are mineral oil saturated hydrocarbons (MOSH) and – to a proportionally lesser extent – mineral oil aromatic hydrocarbons (MOAH).**

Both types are easily absorbed by the human body from food, and can accumulate in body fat and in some organs. As no studies examining the substances' effects on humans are currently available, toxicological assessments are based on animal experiments. According to the Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung, BfR), ingestion of MOAH should be avoided entirely, since it cannot be ruled out that carcinogenic compounds are also present in this fraction.

The food industry itself is not the primary source of mineral oil contamination in foodstuffs. If we consider the ubiquitous occurrence of mineral oils, the various sources of MOSH/MOAH food contamination, the demanding nature of analysis and the many stakeholders involved, it can be seen that this is a highly complex topic.

**What does MOSH/MOAH stand for?**

Mineral oils are essentially composed of two chemically and structurally discrete types of fraction. The primary fraction (proportion: 75% to 85%) is made up of MOSH (Mineral Oil Saturated Hydrocarbons), while the secondary fraction (proportion: 15% to 25%) is composed of MOAH (Mineral Oil Aromatic Hydrocarbons). Both fractions consist of carbon chains having generally fewer than 25 carbon atoms (<C25).

MOSH are saturated and paraffin-like – i.e. open-chained, generally branched and naphthenic (cyclic) – hydrocarbons with low to medium viscosity. In contrast, MOAH are a numerous and diverse class of aromatic hydrocarbon compounds, generally composed of one- to four-ring systems and 97% of which are alkylated [1].

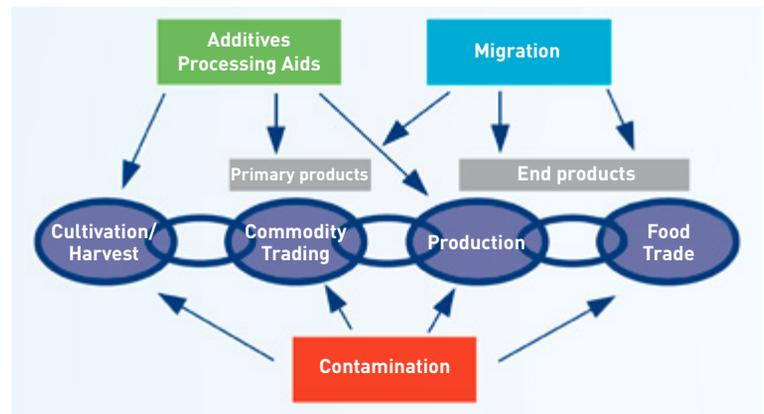


Fig.1 MOSH/MOAH contamination sources in the food chain.

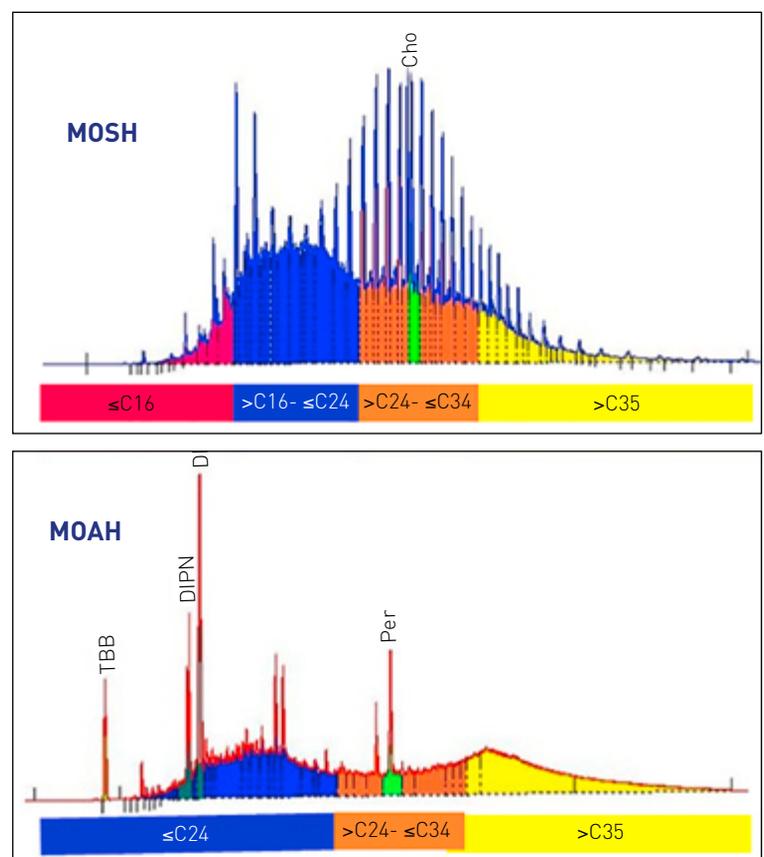


Fig.2 Diagram illustrating the chromatographic “humps”

**How do mineral oil components contaminate food?**

Mineral oils are widely present in our environment and there are a number of ways in which their components can find their way into food. Raw food materials are exposed to “background contamination” with mineral oil hydrocarbons from combustion processes (including petrol engine exhaust fumes, emissions from energy production and industrial facilities, forest fires, and so on) and particulate matter from asphalted streets, for example. Contamination from pesticides or harvesting machinery lubricants/hydraulic oils may also occur before or during the harvest. Later handling of the harvest may also involve mineral oil products – e.g. anti-foaming/anti-caking agents, binders (anti-dusting agents) for rice or shine improvers (applied by spraying).

# food safety



**Reinhard Matissek** first completed training as a chemical lab technician before studying food technology and food chemistry in Berlin. After obtaining his doctorate at the former Federal Health Office (Bundesgesundheitsamt (BGA), Berlin) in partnership with TU Berlin (TUB) under Professor Werner Baltes, he then completed his habilitation in the discipline of food chemistry. In 1989, he was appointed Director of the prestigious Cologne-based LCI, the BDSI's service centre for the natural sciences. Since 1990, he has also been Adjunct Professor at the Institute for Food Technology and Food Chemistry in the Faculty of Process Sciences at TU Berlin. He holds the Hans F. Dresel Memorial Award from the PMCA (International Association of Confectioners, Pennsylvania/USA) and the FINCKE Prize for Science and Technology from the BDSI (Bonn), and is a member of numerous organisations and committees.



**Marion Raters** is a state-certified food chemist and studied food chemistry at the Westphalian Wilhelms University in Münster. Joining LCI in 1999, she obtained her doctorate here in 2008 under Professor Matissek on the topic of "Mycotoxins in Cocoa". She is the Institute's Deputy Director, and her work focuses primarily on the application of LS-MS/MS to process contaminant analysis.

Mineral oil components can also leach into raw goods during transportation from transport packaging contaminated with mineral oils. Examples of such packaging include impregnated jute or sisal sacks [2].

In addition, foodstuffs may also be contaminated by mineral oils during production, e.g. from exposure to oiled machine parts or greases that are applied during maintenance or cleaning work [3].

One well-studied exposure route is contamination via cardboard packaging, whereby cartons made from recycled cardboard may contain printer inks from the original cardboard stock. This is why most food packaging is now manufactured from virgin fibre. Yet this does not alter the fact that the secondary packaging used for carriage or packaging – as stored near food in transit, at the retailer or in the household – may also contain mineral oil components capable of migrating into foodstuffs. There are proven cases where food has left the manufacturer's premises with no MOSH/MOAH contamination and where it has subsequently been contaminated with mineral oil components during transportation or while in storage.

Aside from the mineral oils contained in recycled cardboard packaging, mineral oil-based printer inks can also be a source of contamination with mineral oil components when used to print product packaging. At least in the case of food packaging, this source has been largely eliminated, as the food industry has mostly switched to using printer inks with low or zero mineral oil content for product packaging. Packaging production processes using adhesives containing mineral oils could also present a possible route whereby mineral oil components leach into foodstuffs. Figure 1 shows a range of potential contamination routes for foodstuffs as found along the food chain.

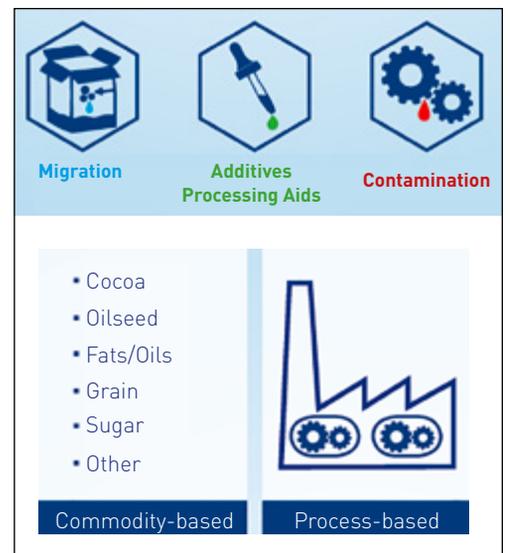
For dry goods stored at room temperature, the migration of components into food occurs via evaporation, transport in the gas phase and recondensation within the foodstuff. Accordingly, this is possible only for mineral oil components with a certain vapour pressure (e.g. hydrocarbons <C25). Interior packaging made from paper, polyethylene (PE) or polypropylene (PP) retards migration but cannot prevent it entirely. For example packaging containing aluminium or polyethylene terephthalate

(PET) has been shown to act as a "functional barrier" and thus block migration [5, 6]. This introduces other problems, however: The process of manufacturing aluminium foil for inner pouches or cardboard liners not only requires a lot of energy but is problematic in terms of its recycling process and impact on the environment. Moreover, the use of foils impermeable to water vapour can also promote the growth of microbes within the foodstuff [5]. While innovative specialist foils have now been developed, they are likely to be of use only in specific packaging systems.

## MOSH/MOAH analysis: complex and still non-standardised

The determination of mineral oil content in foodstuffs is a particularly demanding analytical procedure, not least because it involves a complex mixture that must be quantified as the sum of all of its components. An analysis of individual components is impossible, due to the sheer number of compounds involved. For this reason, the analysis of complex mineral oil mixtures using gas chromatography yields very broad signals instead of sharply-defined peaks. A result of this kind is described as a chromatographic "hump" (or "Unresolved Complex Mixture" (UCM); see fig. 2) by analytical chemists.

Using the most advanced technology available, the simplest approach to MOSH/MOAH analysis is to use on-line coupled



**Fig. 3** Schematic diagram of the toolbox for MOSH/MOAH minimization/prevention

liquid chromatography-gas chromatography-flame ionization detection (LC-GC-FID). Until now, no standardised reference procedure verified with a proficiency test is available for the analysis of mineral oil components. Analysis is also made considerably more difficult by the presence of polyolefin oligomeric saturated hydrocarbons (POSH) that can migrate into foodstuffs from polyethylene (PE) or polypropylene (PP) foils, as the analysis procedure cannot distinguish these substances from MOSH/MOAH compounds.

### LCI research as part of the BDSI Minimization Plan

Potential contamination of food by mineral oil components is not an issue specific to the confectionery sector but affects the food industry as a whole. Acting in accordance with preventive consumer health protection, the Association of the German Confectionery Industry (Bundesverband der Deutschen Süßwarenindustrie, BDSI) launched a three-year research project on July 1 2013 to investigate the topics of analysis, contamination sources and prevention strategies. The LCI's research aims are to prevent MOAH contamination in confectionery and savory products, and to reduce MOSH contamination to the greatest extent possible. Equipped with state-of-the-art apparatus for on-line coupled liquid chromatography-gas chromatography-flame ionization detection (LC-GC-FID) and comprehensive gas chromatography-mass spectrometry (GCxGC-TOF), the LCI is addressing the following tasks in particular:

- ▶ Development and establishment of analysis methods.
- ▶ Investigation of samples from raw materials, packaging materials and foodstuffs at all stages within processing and storage, for the targeted discovery of MOSH/MOAH contamination sources.
- ▶ Development of a toolbox for minimization MOSH/MOAH contamination by employing a research approach focusing on raw materials and processes (fig. 3). The structure of this toolbox is oriented on the various contamination

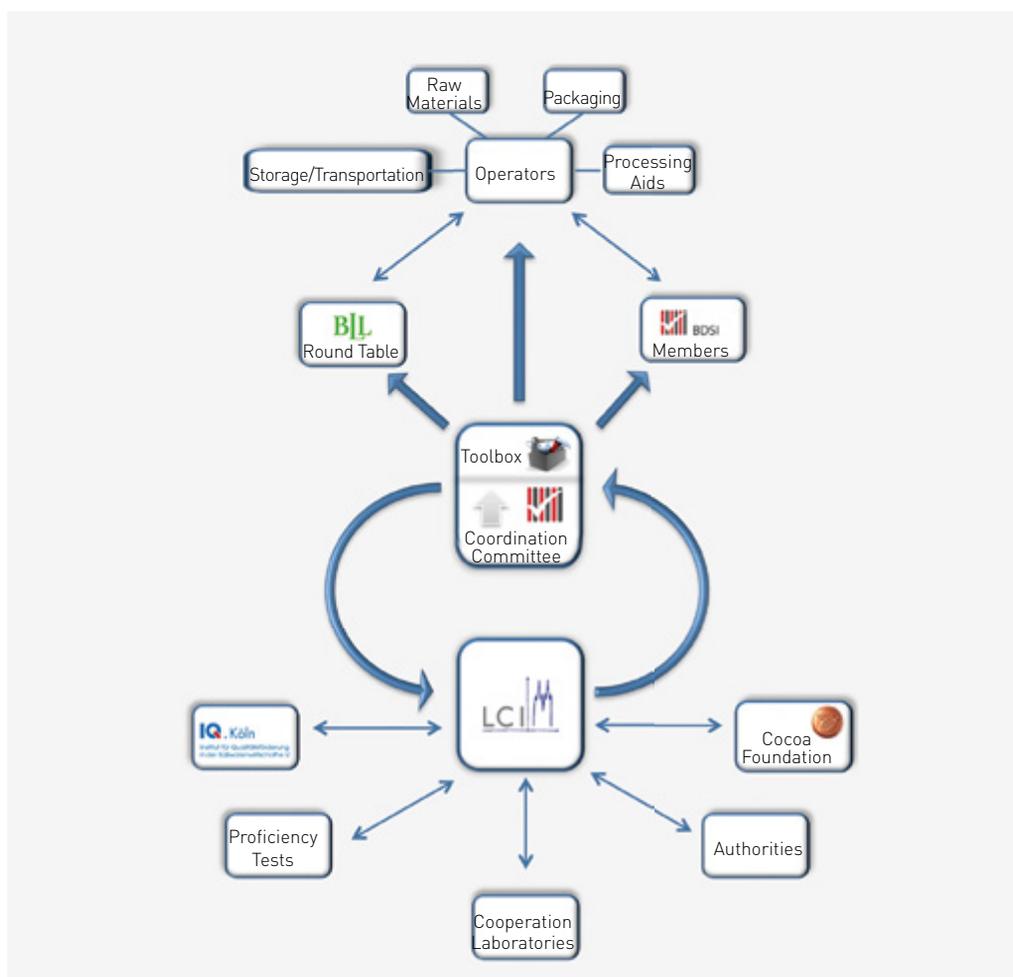


Fig.4 Flowchart from the LCI/BDSI project for MOSH/MOAH minimization/prevention



WE CREATE SOLUTIONS FOR HISTO-PATHOLOGY LABS

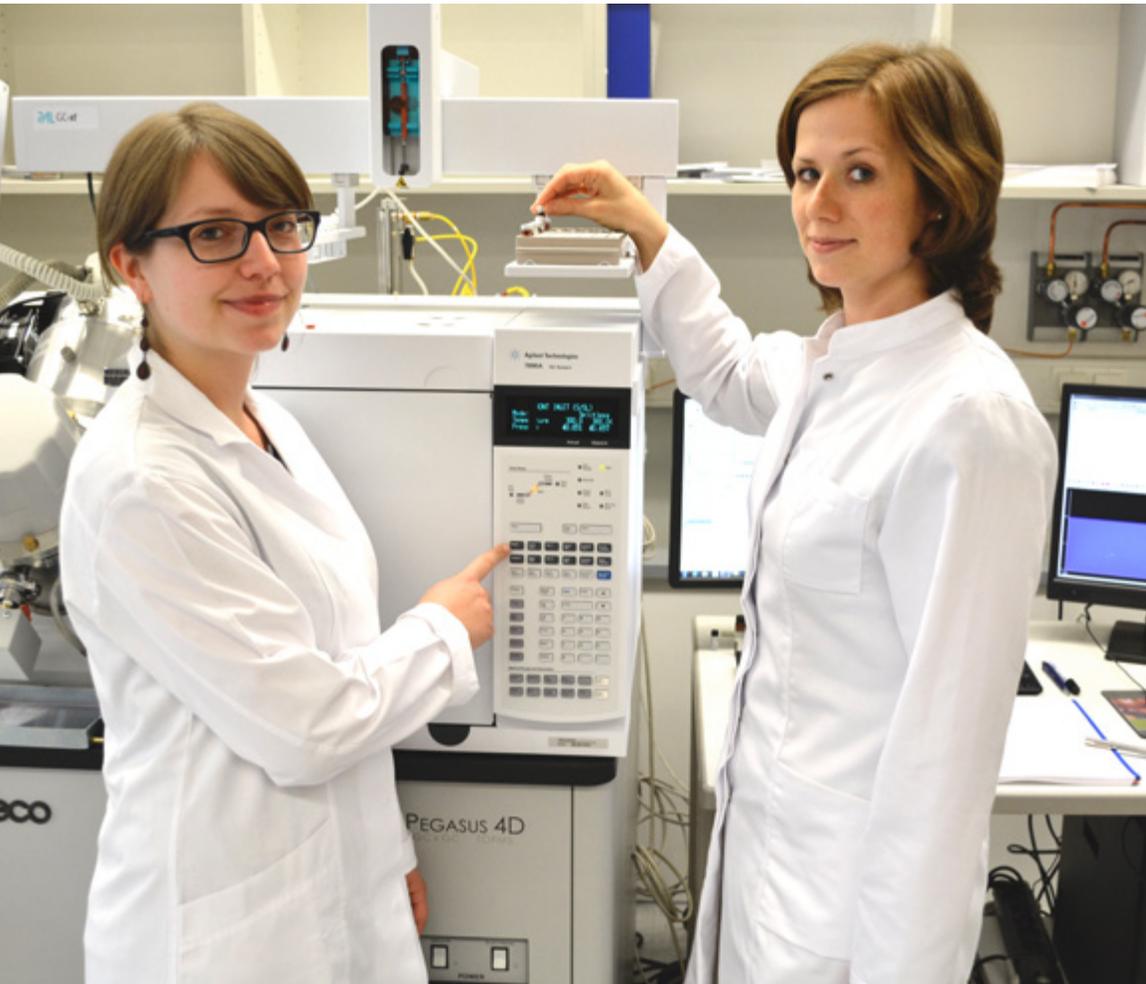
MADE IN GERMANY

**KUGEL medical GmbH & Co. KG**  
Hermann-Köhl-Straße 2a  
DE-93049 Regensburg  
Germany

Phone +49 (0) 9 41/20 86 48-0  
Fax +49 (0) 9 41/20 86 48-29  
E-Mail [info@kugel-medical.de](mailto:info@kugel-medical.de)  
Web [www.KUGEL-medical.de](http://www.KUGEL-medical.de)

**KUGEL**  
medical

# food safety



**Julia Schnapka** (left) is a state-certified food chemist. She studied food chemistry at the University of Wuppertal, completing the practical part of her professional training in 2013. Following this, she then commenced her research work at LCI, focusing on the analysis of MOSH/MOAH in confectionery and savory products using methods such as GCxGC-TOF.

**Anna Dingel** (right) is a state-certified food chemist. After studying food chemistry at the University of Bonn, she was appointed lead researcher for gas chromatography at LCI in 2010. Here, she is responsible for managing research activities within the BDSI research project "Minimization/Prevention of MOSH/MOAH in Confectionery and Savory Products".

routes themselves: migration, additives/processing aids, contamination.

- ▶ Creation of a database that can be used to trace both contamination with mineral oil components and the sources of contamination.
- ▶ Identification of various factors influencing the migration of mineral oil components into foodstuffs.

## Coordination Committee/ Stakeholder Cooperation

To accompany the project, a BDSI-internal coordination committee has been set up, staffed with experts from member companies.

As these issues (potentially) affect any type of foodstuff, the BDSI and LCI are supplementing their coordination committee activities by maintaining close contact with all stakeholders in the food chain. In establishing suitable analysis methods for quantifying MOSH/MOAH, the LCI is also participating in proficiency tests and cooperating with other labs (see fig. 4).

## Summary

Together with its own research laboratory LCI and its member companies, the BDSI is conducting a wide-ranging project for MOSH/MOAH minimization and/or prevention that has made a highly successful start. The project focuses in particular on analysis and sources of contamination (and thus to extending the knowledge base) and on promising and practical prevention strategies for industry. Results obtained by the confectionery sector will also be used as input for discussions held with stakeholders throughout the food chain [7, 8].

→ [marion.raters@lci-koeln.de](mailto:marion.raters@lci-koeln.de)

## Bibliography

- [1] Biedermann, M. et al. (2009) *J. Agric. Food Chem.* 57, 8711–8721
- [2] Grob, K., et al. (1993) *Z.Lebensm.Unters.Forsch.* 197, 370–374
- [3] European Food Safety Authority (EFSA) (2012) *EFSA Journal* 10, 2704
- [4] European Food Safety Authority (EFSA) (2004) *EFSA Journal* 162, 1–6
- [5] Bundesinstitut für Risikobewertung (BfR) (2010) URL: [http://www.bfr.bund.de/cm/343/uebergaenge\\_von\\_mineraloel\\_aus\\_verpackungsmaterialien\\_auf\\_lebensmittel.pdf](http://www.bfr.bund.de/cm/343/uebergaenge_von_mineraloel_aus_verpackungsmaterialien_auf_lebensmittel.pdf) (accessed 18/06/2013)
- [6] Lütjohann, J. (2011) *DI.Lebensmitt.-Rundsch.* 107, 566–573
- [7] Matissek, R. (2013) *Moderne Ernährung heute*, WPD 2/2013
- [8] Matissek, R. (2014) *FOOD-LAB international* 1/14, 6

Picture: © istockphoto.com | RapidEye

# Tasked to work faster & more efficiently?

## The solution is «NIR»!

Metrohm NIRSystems, to be exact. Precision near-infrared technology & expert applications support cover your entire spectrum of pharmaceutical testing – from raw materials inspection to in-process monitoring to final product quality control.

- **Proven technology & expertise**  
50 years & 50 patents give you confidence in our systems – and your results
- **Best signal-to-noise ratio**  
For precise and reproducible spectra
- **Easy to operate**  
User-friendly software with cascading libraries simplifies material identification

[www.metrohm-nirs.com](http://www.metrohm-nirs.com)

 **Metrohm**  
NIRSystems



environmental viro

# Viruses in the water

Detection and analysis of human viral pathogens in surface waters

Dr Lars Jurzik and Mats Leifels  
Dept. of Hygiene, Social- and Environmental Medicine,  
Ruhr-University Bochum

**Alongside the development of methods for quantifying human viral pathogens in surface and waste waters, a key role is also played by the analysis of the resultant data. While drinking water supplies must be safeguarded on the one hand, the public must also be able to pursue water-related recreation activities without fearing health risks.**

## Reducing viruses in waters of the Ruhr

Within the Ruhr region, drinking water for an estimated 5.13 million people is supplied by the Ruhr, a tributary of the Rhine. It is also used by many of the region's residents for leisure and recreation activities. Located in western Germany, the Ruhr region is the fifth-largest urban agglomeration in Europe. Home to major cities such as Dortmund, Essen, Duisburg and Bochum, it has a population density of over 1,100 people per square kilometre. The region's high population density gives rise to significant contamination with anthropogenic substances and pathogenic organisms, the latter category including both bacteria and parasites as well as human pathogenic enteric viruses. For surface waters, potential contamination routes include diffuse sources and urban drainage systems. While current research is investigating options for reducing viral and bacterial load in treatment plants, there is a lack of usable data about the role played by treatment plants and diffuse sources – such as arable field and grassland run-off – in the contamination of surface waters with microorganisms. That said, the detection of enteric viruses at sites several kilometres downstream of the treatment plant has been confirmed under conditions of 15°C and less. As over 60 treatment plants discharge waste water that is treated but still contaminated with viruses along the length of the river, these highly persistent viral loads can accumulate over the course of the river at low temperatures. The hygienisation of treatment plant effluent is therefore of particular importance. One method investigated is ozonation, which has mainly been used by drinking water facilities. Yet adapting this technique to sludge treatment is not entirely straightforward, since the effectiveness of reducing the microbiological load is crucially dependent on ozone concentration and dosage, temperature and pH values. One must also bear in mind that the ozone concentration was controlled via SAC 254 in the treatment plants investigated, i.e. both the dose and input mode were selected to ensure no residual ozone was detectable in effluent. Under these conditions, viral detection via PCR is especially problematic, since the ozone first damages the viral capsid before damaging the genome. Accordingly, false positive results may be gener-

ated, since the methods for quantifying viral DNA do not take into account the possibility of viral capsids suffering damage – which corresponds to a loss of infectivity [1].

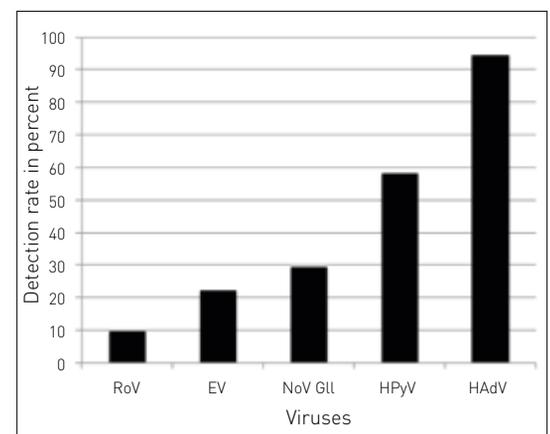
### Method of investigation

In recent years, increased interest has been shown in the enteric viruses – e.g. noroviruses, rotaviruses and enteroviruses – from both a scientific and public health perspective. While drinking water facilities can efficiently reduce those viruses, water sports enthusiasts in particular still face a previously unconsidered risk of infection. Unlike bacteria, the abovementioned non-enveloped enteric viruses are characterised by being both highly infectious and highly stable in the environment. As few as 10–100 viral particles are sufficient to cause infection. In a project funded by the German Federal Ministry of Education and Research (BMBF), 180 samples from eight different locations around Lake Baldeney in Essen were tested and the concentrations of five human enteric viral pathogens were determined using quantitative real-time PCR – the current method of choice for detecting and quantifying enteric viruses in water – and methods from molecular biology. Since viral concentrations in surface waters are too low to be detected directly, the environmental samples – typically 10 to 60 litres – first needed to be concentrated using the „Virus Absorption and Elution“ (VI-RADEL) method [2]. This specialised filtration method utilises a filter membrane that is charged either electropositive or electronegative. Since the viral capsid and the filter membrane carry opposing charges, the viruses are captured effectively and thus retained. The advantage of this filtration method derives from the fact that the viruses can be eluted by utilising a specialised buffer solution, whereby the viruses are concentrated in 100ml. In the next step, the eluate is again reduced to a maximum of 5 ml, ready for subsequent quantification following DNA/RNA extraction by utilising techniques from molecular biology. To be able to make statements about the danger to health present for sports enthusiasts and bathers using the Ruhr, however, it is necessary to determine the concentration of infectious viruses using cell cultures. In this process – which is time-consuming and not available for all viruses – monolay-

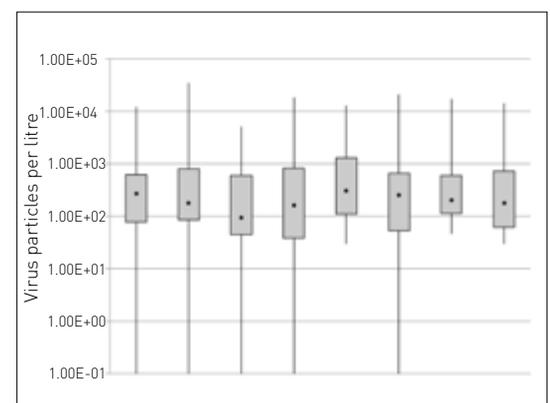
er cultures of animal cells are applied to nutrient media under sterile conditions and then inoculated with environmental samples. Viruses that are infectious proceed to infect the cells: the magnitude of the infection can be used to quantify the concentration of infectious viral pathogenic organisms contained in the water sample [3].

### Risk assessment for viral incidence

Key findings from the testing of Ruhr water for enteric viruses are that the noroviruses (family: Caliciviridae, genus: Norovirus), enteroviruses (family: Picornaviridae) and rotaviruses (family: Reoviridae, genus Rotavirus) are of especial significance from



**Fig.1** Detection rates of human viral pathogens in percent: adenoviruses and polyomaviruses are detected in Ruhr water samples in over 90% and over 50% of cases, respectively. Noro-, rota- and enteroviruses are more significant in terms of pathogenicity.  
**Legend:** HAdV – human adenoviruses; HPyV – human polyomaviruses; NoV GII – GII noroviruses; EV – enteroviruses



**Fig.2** Concentration of adenoviruses at the 8 sampling sites: no significant variance is observed in adenovirus concentration among the individual sampling sites.  
**Legend:** Points – median; box: 25th to 75th percentiles; whiskers – minimum and maximum values



**Lars Jurzik** studied biology at Ruhr-University Bochum. After obtaining his doctoral degree from University Hospital Regensburg, he then returned to Ruhr-University Bochum, where he has worked as a research assistant at the Department of Hygiene, Social- and Environmental Medicine since 2005. His activities include work as a project lead/lead researcher in environmental virology and water microbiology.



**Mats Leifels** also graduated in biology from Ruhr-University Bochum and has been active in the fields of molecular virology and environmental medicine since 2012. He currently holds the positions of research assistant and doctoral candidate at the Dept. of Hygiene, Social- and Environmental Medicine.

the perspective of pathogenicity, although detected in samples comparably less often than the adenoviruses and polyomaviruses (fig. 1).

Unlike the other viruses measured, adenoviruses and polyomaviruses cause latent infections, and are excreted continuously from infected individuals. As a result, these viruses are detectable in surface waters without significant seasonal fluctuations. For rota-/noroviruses (principally found in water during the cold months of the year) and enteroviruses (primarily found in water during the warm months), the situation is different (fig. 2).

In considering the ramifications for health of the viral load present in surface waters, a quantitative microbial risk assessment (QMRA) is a useful analytical tool. QMRA calculations are based on parameter-specific

**Tab.** Comparison of average quantity of water ingested while bathing. As they are more physically active, boys swallow more water than girls and children/adolescents swallow more water than adults [6].

| Category of individuals | Quantity of water ingested (ml)/60 min |
|-------------------------|--|
| Adults                  | 21                                     |
| Children/Adolescents    | 49                                     |
| Male                    | 55                                     |
| Female                  | 33                                     |
| Boys                    | 60                                     |
| Girls                   | 40                                     |
| Men                     | 29                                     |
| Women                   | 16                                     |

dose-response curves that can be mathematically described using equations 2 and 3. For the project described, the dose is calculated from the time spent swimming, the quantity of water ingested and the pathogen concentration in water (equation 1).

$$D = C \times T \times R \quad \text{(Equation 1)}$$

$$P_{inf} = 1 - \exp(-k \times D) \quad \text{(Equation 2)}$$

$$P_{inf} = 1 - \left[ 1 + d/N_{50} \left( 2^{1/\alpha} - 1 \right) \right]^{-\alpha} \quad \text{(Equation 3)}$$

**D – dose; C – pathogen concentration;  
T – exposure time;  
R – water quantity ingested;  
k and α – specific constants;  
N50 – median infectious dose**

Note that this risk assessment does not supplant the efforts of the World Health Organisation as regards its Water Safety Plan [4], which requires a preventive approach to risk minimisation to safeguard a high level of drinking water quality. Instead, this form of risk assessment could be considered in the future for use in a risk management model that can be applied when evaluating new conditions (e.g. construction of new waste water facilities, changes to land use, etc.). This could have implications both for drinking water production and for the use of a watercourse as a local recreational area. Moreover, the QMRA could also be deployed to establish microbial threshold limits for microbiological parameters not yet taken into account by legislative measures.

Complex diagnostic procedures mean viruses have little value as routine parameters. In the EU Bathing Water Directive (2006/7/EC), quantification of the faecal indicators E. coli and enterococci are stipulated as a quality criterion. Since bacteria are less resistant and persistent, they are unsuited for use as indicators of viral load. For detection of the phage φX174 with E. coli as host, a DIN-certified detection method would be available – a method that would even permit statements to be made about its infectivity. Since no correlation exists between the occurrence of these phages and other enteric viruses, however, the former does not constitute a reliable indicator for human viral pathogens [5].

→ [jurzik@hygiene.rub.de](mailto:jurzik@hygiene.rub.de)

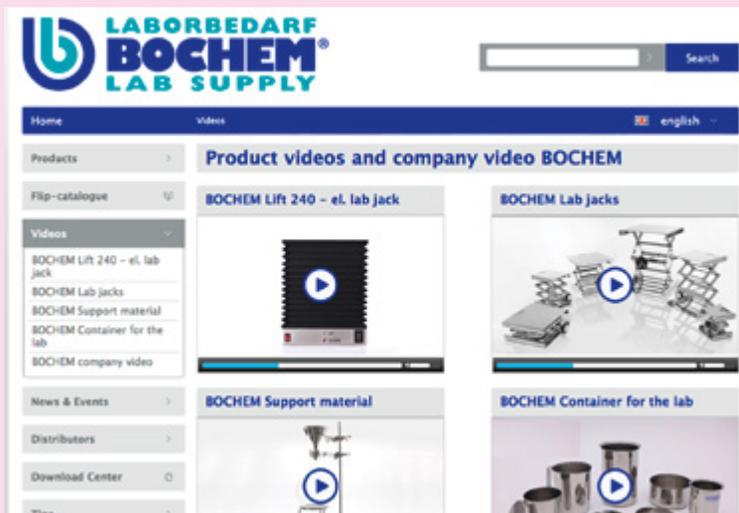
#### Bibliography

- [1] N.N. 2014. *Elimination von Arzneimitteln und organischen Spurenstoffen: Entwicklung von Konzeptionen und innovativen, kostengünstigen Reinigungsverfahren. Abschlussbericht zur Phase 2. „Elimination von Arzneimittelrückständen in kommunalen Kläranlagen“*. 354
- [2] Hamza, IA. et al. (2009) *Detection of human viruses in rivers of a densely-populated area in Germany using a virus adsorption elution method optimized for PCR analyses*. *Water Res* 43:2657–68
- [3] Hamza, IA. et al. (2011) *Methods to detect infectious human enteric viruses in environmental water samples*. *Int J Hyg Envir Heal* 214:424–36
- [4] WHO. 2005. *Water Safety Plans – Managing drinking-water quality from catchment to consumer*. pp. 1–225. Geneva: Davison, A.; Howard, G.; Stevens, M.; Callan, P.; Fewtrell, L.; Deere, D.; Bartram, J.
- [5] Jurzik, L. et al. (2010) *Chemical and microbiological parameters as possible indicators for human enteric viruses in surface water*. *Int J Hyg Environ Health* 213:210–6
- [6] Dufour, AP. et al. (2006) *Water ingestion during swimming activities in a pool: a pilot study*. *Journal of Water and Health* 4:425–30

Picture: © panthermedia.net | knape

from the industry

## Bochem Increasingly Using New Media



**Bochem Instrumente GmbH presents sections of its overall product spectrum in various new videos. The recently finished productions provide a compact overview of the product groups of lab jacks, electrical lifts, containers as well as stands and clamps. They can be found on the company's website where a dedicated navigation point guides users directly to the videos (<http://www.bochem.com/en/Videos.html>).**

For international website visitors, English variants are available in addition to the German language versions. The production of a further video has already been scheduled: By autumn, interested persons will also be able to receive information on Bochem's gas burner portfolio from a video.

### "Expanding the use of modern media"

"We started the year 2014 with this goal", states Bianca Bochem who is responsible for the marketing of the Weillburg-based lab specialist. "We are convinced that the videos are particularly suitable for quickly providing information. This is why we do not only employ them on our own and our partner websites, such as chemie.de. Recently, we showed them at Analytica in Munich. Needless to say that they will also be used at the approaching lab supply exhibitions in Gelsenkirchen and Dresden. In addition, we are planning to upload them to our own Youtube channel soon. Our long-term expectation is to continue to improve our image and, of course, obtain new contacts. After all, YouTube has become the world's second biggest search engine after Google", explains the marketing manager, indicating her motivations.

→ [www.bochem.com](http://www.bochem.com)



# Mix with the world of (bio)pharma, products, people and solutions

Join the world's leading pharmaceutical event

Register today for free

Use media code: NDWW1671  
[www.cphi.com/register](http://www.cphi.com/register)



Biopharma

CPhI Worldwide hosts over 34,000 visiting (bio)pharma professionals, 2,200 exhibitors from 140 countries and more than 100 free industry seminars, covering every pharmaceutical sector under one roof. With a dedicated area for biopharma product and service providers, CPhI Worldwide facilitates easy access to all your biopharma needs!



APIs



Generic APIs



Custom Manufacturing



Fine Chemicals



Intermediates



Finished Dosage



Excipients/  
Formulation



Ingredients

## CPhI worldwide

Co-located with

icse

P-mec

InnoPack

7-9 October 2014

Paris Nord Villepinte • France

Register today for free  
Use media code: NDWW1671

Join the conversation  
@cphiww using #cphiww

Organised By:



UBM

biomimetics

# Tropical pitcher plant and biomimetics

Hierarchical anti-adhesive surfaces by mimicking insect traps

Dr Elena V. Gorb, Martina Baum, Julia Purto, Nadine Jacky, Prof. Stanislav N. Gorb  
Department of Functional Morphology and Biomechanics,  
Zoological Institute, Kiel University  
Dr Gopalakrishnan.T. Rengarajan, Anna Volf, Prof. Martin Steinhart  
Institute of Chemistry of New Materials, University of Osnabrueck

**Carnivorous plants, among them tropical pitcher plants (*Nepenthes spp.*), have always fascinated people due to their remarkable ability to feed on animals and have constantly drawn the attention of researchers as soon as new species were discovered. During past decades, different aspects of *Nepenthes* biology, among them the structure and functions of trapping organs (pitchers), particularly with respect to their trapping efficiency, have been the focus of numerous field observations and structural and experimental studies.**

Very recently, these plants are also used as model systems for various biomimetic applications. The current cooperative project between the Zoological Institute at the Kiel University and the Institute of Chemistry of New Materials at the University of Osnabrueck aims at the development of hierarchical anti-adhesive materials by mimicking the slippery zone in *N. alata* pitchers.

### Catch and trap

Carnivorous (animal eating) plants represent an unusual group of organisms, which grow in habitats with very poor soils and

rely on nutrients derived from captured animals, mostly insects. In their evolution, these plants have turned some of their leaves into specialised organs, which fulfil the trapping function. These trapping organs, being extremely diverse, all serve for attracting, trapping and retaining animals, digesting them and absorbing prey-derived nutrients. Some traps use different movements to capture animals, as for example in the venus fly trap (*Dioneae muscipula*) acting very fast or in sundews (*Drosera spp.*) with slowly moving tentacles. Another group of carnivorous plants have passive trapping organs, which employ no move-

ment for capturing animals and work like a simple pitfall, lobster pot or fly paper.

Pitcher-shaped trapping organs, which are produced at the tips of tendrils and use a passive pitfall mechanism for capturing, are characteristic for carnivorous plants from the genus *Nepenthes* (Fig. 1). These pitchers consist of several structural and functional zones having specialised macro- and micromorphological features and serving different functions. The slippery zone, situated in the upper part inside the pitcher (Fig. 2), was recognised long ago as an important structure for insect trapping and retention, due to its particular moon-shaped cells called lunate cells and an epicuticular three-dimensional wax coverage.

### Slipperiness perfected

Intensive micromorphological studies performed in our group during last several years revealed that in the model species *N. alata*, this zone contains three distinct levels of hierarchically arranged surface structures: (1) anisotropic lunate cells (length scale of several dozens microme-



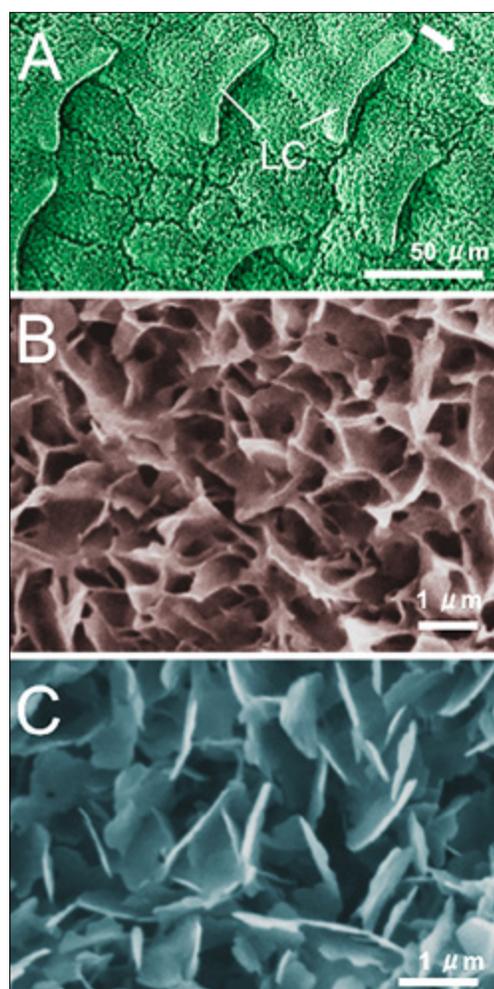
**Fig. 1** Pitchers from several *Nepenthes* species. **A.** *N. alata*. **B.** *N. fusca*. **C.** *N. macrophylla*. **D.** *N. mirabilis*. **E.** *N. rafflesiana*. **F.** *N. dicksoniana*. **G.** *N. ventricosa*. **H.** *N. veitchii*. **I.** *N. bicalcarta*. The dashed lines show the length of the slippery zone.



**Fig. 2** Longitudinal section through a pitcher of *Nepenthes*.

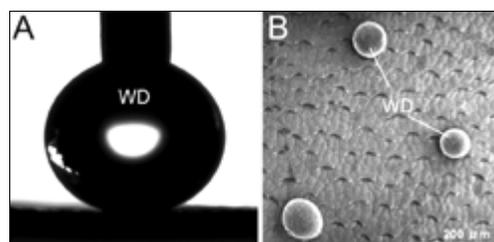
ters); (2) the lower wax layer composed of interconnected microscopic wax crystals and (3) the upper wax layer consisting of separate microscopic plate-like wax crystals (Fig. 3). These structural hierarchical levels play different roles in the reduction of insect attachment to the slippery zone due to different physical mechanisms.

Although the potential role of downward-directed lunate cells in hindering



**Fig. 3** Hierarchically aligned surface structures in the slippery zone of *Nepenthes alata* pitchers (scanning electron microscopy).

**A.** Pitcher surface with lunate cells (LC) and wax coverage. The arrow indicates the location of the pitcher floor. **B.** Lower wax layer. **C.** Upper wax layer.



**Fig. 4** Superhydrophobic properties of the slippery zone in *Nepenthes alata* pitchers.

**A.** Contact angle of water.  
**B.** Surface after wetting with water (cryo-scanning electron microscopy).  
WD = water drops.

insect attachment by preventing claw interlocking was first suggested nearly a century ago by Knoll, his experiments could not show an anisotropic effect on insect locomotion. We have recently performed the experimental study estimating attachment forces of ladybird beetles *Coccinella septempunctata* on pitchers of the model plant species *N. alata* and demonstrated for the first time that the particular shape and distribution of lunate cells cause anisotropic frictional properties of the surface. Tests on pitcher samples and their polymer replicas revealed that just claws were responsible for attachment enhancement in the downward pitcher direction, where inverted lunate cells served as anchorage sites for claws. Moving in an upward direction, as in a natural situation, when insects try to escape from the trap, they are unable to employ their claws, because of the downward orientation of overhanging edges of lunate cells.

Two superimposed wax layers presenting the second and third hierarchical levels of the slippery zone differ not only in their structure, but also in chemical composition and mechanical properties. The lower layer resembles foam, composed of interconnected membrane-like platelets protruding from the surface at some acute angles, and is rather stable mechanically. The upper layer consists of separate irregular platelets that are located not like roof tiles as suggested previously, but more or less perpendicular to the subjacent layer. Upper crystals are connected to the lower layer through long slim stalks, which can break very easily. Although waxes from both layers are composed of the same compound classes, the latter occur in different proportions. Chain length distributions in aliphatic compounds also differ in extracts from the lower and the upper layers. Both wax layers demonstrate superhydrophobic properties (Fig. 4) and are almost equally unwettable by polar liquids (water and ethylene glycol). However, contact angles of non-polar fluid diiodomethane (both  $>100^\circ$ ) show a significant difference between layers. When unstructured, these waxes exhibit similar material properties (elasticity modulus and hardness), but in native structured state, the lower layer is harder and stiffer than the upper one. Moreover, crystals of the upper layer are rather brittle and may be easily exfoliated or broken into tiny pieces.

## Ladybird traction tests

Both wax layers prevent insect adhesion. We carried out force tests with two species of ladybird beetles, *Adalia bipunctata* and *Coccinella septempunctata*, and found a dramatic force reduction on the waxy surface compared to reference substrates such as glass and wax-free pitcher surfaces or their polymer replicas. Interestingly, the comparison of force values between two wax layers showed no significant difference: thus, both hierarchical levels based on wax crystals have similar impact on insect attachment. On these surfaces due to the fragile and brittle nature of wax crystals and their small dimensions, insects cannot apply their claws for interlocking with crystals in order to climb up the pitcher wall. The adhesion by means of adhesive pads is minimized using different mechanisms: via reduction of the real contact area caused by surface microroughness (lower layer) and contamination of insect adhesive pads by wax crystals (upper layer). This was found out after examination of beetles' pads just after force tests: the upper layer caused pad contamination with wax material (Fig. 5), whereas the lower layer did not.

Adhesive properties of two wax layers are very recently studied by applying a novel method for adhesion measurements on anti-adhesive surfaces. For this purpose, we used half-spheres made of tacky polydimethylsiloxane as probes and measured pull-off forces. Keeping applied force in the range corresponding to pressure caused by small insects, we obtained the lowest adhesion force on the upper wax layer compared to both the lower wax layer and reference microrough polymer surface having similar roughness parameters as the slippery zone. Like in our previous experiments with beetles, we observed strong contamination of adhesive half-spheres by wax crystals, detached from the upper layer and adhering to the half-spheres during tests, whereas no contaminating effects were detected for other test surfaces.

## New anti-adhesive synthetic surfaces

Inspired by the complex structure of the *N. alata* pitcher, we are designing bio-inspired anti-adhesive surfaces for techni-



**Prof. Stanislav Gorb** and his team, working on projects about plant-insect interactions, visit the *Nepenthes* collection in the greenhouse of the Botanical Garden at the Kiel University. From left to right: Martina Baum, Elena Gorb (front row), Julia Purtov, Stanislav Gorb, Nadine Jacky (back row).

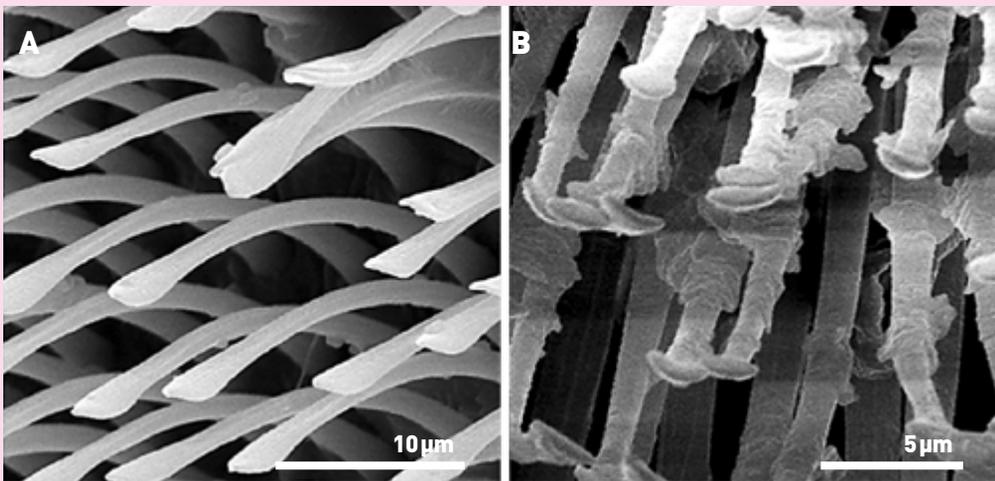
The research conducted by Stanislav Gorb and his department is mainly focused on various biological surfaces specialized for enhancement or reduction of friction and adhesion. "Plant" group examines the effect of different structures occurring on a plant surface on attachment ability of insects. Emphasis is on surfaces exhibiting anti-adhesive properties, such as surfaces covered with three-dimensional epicuticular waxes. Carnivorous plants

from the genus *Nepenthes* with a range of insect-related surfaces are among model plants. The group of Martin Steinhart deals with mesoscopic structure design of low-dimensional systems. Using self-ordered anodic aluminum oxide as inorganic model matrix, dynamics and elastic properties of soft matter, crystallization of pharmaceuticals and microphase separation of block copolymers in nanopores are studied, often in collaboration with other groups. More-

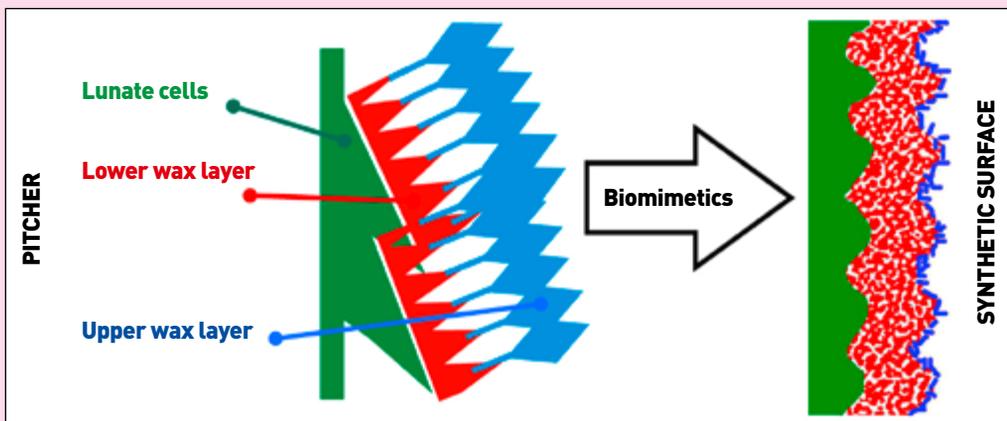
over, functional nanostructured and microstructured surfaces consisting of block copolymers, nanorod arrays and microspheres are prepared and investigated. Examples include patterned polymeric surfaces with specific adhesive properties and nanorod arrays used as sensor elements, substrates for tissue engineering and imprint moulds.



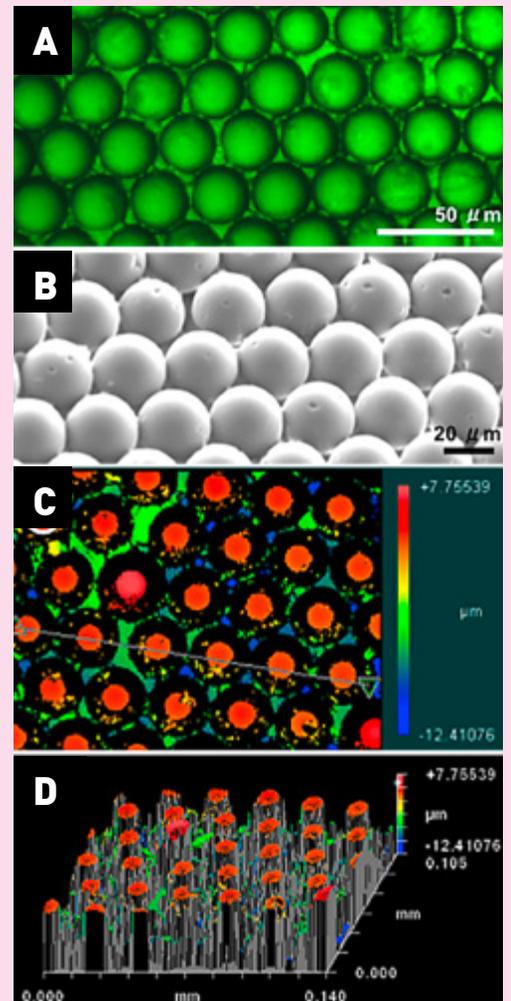
**Prof. Martin Steinhart** and Anna Volf investigate synthetic anti-adhesive surfaces with the aid of scanning electron microscopy.



**Fig. 5** Contamination of insects' adhesive organs by wax crystals from the upper layer of the slippery zone from *Nepenthes alata* pitchers (scanning electron microscopy). **A.** Functional adhesive structures of *Adalia bipunctata* beetles **B.** Adhesive structures after contact with the slippery zone.



**Fig. 6** A biomimetic approach: Development of hierarchically organised anti-adhesive materials that imitate the complex structure of the slippery zone in *Nepenthes alata* pitchers.



**Fig. 7** Biomimetic structure of the first hierarchical layer, developed by replication of polystyrene microspheres with a diameter of 25 μm. **A.** Light microscopy with backlight. **B.** Scanning electron microscopy. **C.** 2D image using white light interferometer. **D.** 3D image using white light interferometer.

cal applications (Fig. 6). Such surfaces might pave the way for novel types of artificial surfaces that repel dust, sticky dirt, moisture and insects. Strategies to produce bioinspired anti-adhesive surfaces should allow up-scaling so that high-throughput production of large areas is possible. To meet these requirements, the first biological level (lunate cells) is mimicked by self-assembled monolayers of microspheres with sizes ranging from a few micrometers to several tens of micrometers (Fig. 7), assuming that the anisotropy of the biological model is not required for most technical applications. The challenge is rather to minimize the contact area between the anti-adhesive surface and any kind of counterpart surface. To this end, we have at first developed a method for the high-throughput replication of the microsphere monolayers. A large number of master moulds is accessible by a two-step replication process from one microsphere monolayer, serving as sacrificial primary template. Each

master mould can in turn be replicated many times. The next step is to minimize adhesion of the anti-adhesive surfaces to rigid counterpart surfaces forming contact only with tips and protrusions as well as to soft, elastic counterpart surfaces. At the moment, several types of surface topographies are tested with respect to their anti-adhesive properties to rigid and elastic counterpart surfaces. Moreover, the implementation of biological levels 2 and 3 is on the way. Level 2 will be introduced by embossing the microspheres with nanoporous alumina moulds accessible by special anodization procedures or by replication of the microspheres with nanoporous materials, having bicontinuous morphology. These nanoporous materials can be obtained via phase separation processes. Level 3 will be implemented by dispersing waxy nanorods, which can be made using the above mentioned nanoporous alumina moulds, on combined artificial level1/level2 structures.

→ [egorb@zoologie.uni-kiel.de](mailto:egorb@zoologie.uni-kiel.de)

→ [martin.steinhardt@uni-osnabrueck.de](mailto:martin.steinhardt@uni-osnabrueck.de)

This work was partly supported by the German Science Foundation DFG (Priority Programme 1420 "Biomimetic Materials Research: Functionality by Hierarchical Structuring of Materials", research grants GO 995/9-1, GO 995/9-2, STE 1127/12-1 and STE 127/12-2).

#### Bibliography

E. Gorb, K. Haas, A. Henrich, S. Enders, N. Barbakadze, S. Gorb (2005) Composite structure of the crystalline epicuticular wax layer of the slippery zone in the pitchers of the carnivorous plant *Nepenthes alata* and its effect on insect attachment. *J. Exp. Biol.* 208: 4651–4662.

E. Gorb, S. Gorb (2009) Functional surfaces in the pitcher of the carnivorous plant *Nepenthes alata*: A cryo-SEM approach. In: *Functional surfaces in biology*, Vol. 2, edited by S. Gorb, Dordrecht, Heidelberg, London, New York: Springer, 205–238.

E. Gorb E., S. Gorb (2011) The effect of surface anisotropy in the slippery zone of *Nepenthes alata* pitchers on beetle attachment. *Beilstein J. Nanotechnol.* 2: 302–310.

M.J. Benz, E.V. Gorb, S.N. Gorb (2012) Diversity of the slippery zone microstructure in pitchers of nine carnivorous *Nepenthes* taxa. *Arthropod-Plant Interactions* 6: 147–158.

G.T. Rengarajan, L. Walder, S.N. Gorb, M. Steinbart (2012) High-throughput generation of micropatterns of dye-containing capsules embedded in transparent elastomeric monoliths by inkjet printing. *ACS Appl. Mater. Interf.* 4: 1169–1173.

Picture: © pantbermedia \ cbenjasuwan



**Julia Myronova** is a director of International Forum Complex Support of Laboratories, Kiev, Ukraine.  
→ [j.mironova@lmt.kiev.ua](mailto:j.mironova@lmt.kiev.ua)

## New Trends and Prospects of the Ukrainian laboratory market

From Julia Myronova

Despite the conflict situation in Ukraine, many international and Ukrainian experts predict growth of the Ukrainian economy. On the one hand, the Association agreement with the European Union signed in 2014 puts obstacle to Ukrainian export of products to the EU, on the other hand, it contributes to the construction of the correct production process in accordance with the EU requirements. At first instance, it involves quality control and food safety, general laboratory monitoring, as well as new product certification rules. In this regard, many Ukrainian food enterprises are considering modernization of production, including modernization of production laboratories. Question of modernization also referred to the state laboratories, which put into practice quality control and product safety and issue the corresponding certificates. Ministry of Agrarian Policy and Food of Ukraine works out special programs concerning upgrading of laboratories that,

whereas, gives a new perspective to suppliers of laboratory equipment and expendable materials for the food industry and the agricultural sector.

In view of the transition to the new European standards similar trends are observed in the pharmaceutical and chemical industries in Ukraine.

Decline in production of mining and metallurgy caused a decrease in sales of laboratory equipment for these industries.

In connection with the government's support of scientific research and hi-tech technology in the field of defense technology and aerospace industry it has been seen the upgrading and expansion of research laboratories of national standing.

In general, Ukrainian market of laboratory equipment includes 92% of distributors and representatives of leading trademarks of laboratory equipment and innovative technology solutions for laboratories, furniture, supplies, and only 8% of the market

is its own production, mainly consumables and furniture. Many distributors have previously worked through the main representative offices of worldwide brands, which are mostly located in Russia. Due to the open conflict between Russia and Ukraine, as well as significant reduction in trade and economic relations, many Ukrainian companies have started to reconsider cooperation with Russian partners and negotiate independently with foreign producers for the purpose of opening representative offices in Ukraine. These are the most correct steps in the current situation, which will only lead to increase the share of laboratory market in Ukraine down the line.

You can gain familiarity with the latest trends of laboratory market in Ukraine at the VII International Forum "Complex support of laboratories", which will be held in Kiev (Ukraine) on October 14–16, 2014.

→ [www.labcomplex.com/en/](http://www.labcomplex.com/en/)

Held inside **Life Science World 2015**

Asia's largest

# BIotech Japan 2015

14th Int'l Bio Technology Exhibition & Conference

PARTNERING

CONFERENCE

EXHIBITION

Dates

May 13<sup>[Wed]</sup> – 15<sup>[Fri]</sup>, 2015

Venue

Tokyo Big Sight, Japan

Organised by

Reed Exhibitions Japan Ltd.

### Partnering



Join the network involving Academics, Biotech and Pharma Companies

### Conference



Total 250\* presentations

### Exhibition



Asia's LARGEST with 650\* exhibitors

(\*expected, including the concurrent shows)

Participate in this big event, where new business and innovation are born!

>>> Find more exhibiting information at [www.bio-t.jp/en/](http://www.bio-t.jp/en/)

## Brain models in 3D

labor&more in conversation with Dr Madeline Lancaster,  
winner of the Eppendorf Award for Young European Investigators 2014

**US research scientist Dr Madeline A. Lancaster (Marie Curie Postdoctoral Research Fellow, Juergen Knoblich lab, Institute for Molecular Biotechnology (IMBA) at the Austrian Academy of Sciences in Vienna) has been presented with the Eppendorf Award for Young European Investigators 2014 in recognition of her outstanding achievements in research.**



Worth €15,000, this highly prestigious international award has been presented annually since 1995 to research scientists working in Europe aged 35 and under. Prizewinners are chosen by an independent jury chaired by Prof. Reinhard Jahn (Max Planck Institute for Biophysical Chemistry, Göttingen).

Madeline Lancaster's recent work attracted considerable media attention far outside her specialised scientific field, since her pioneering research has now made it possible to model human brain structures in a three-dimensional stem cell culture. Madeline Lancaster was able to demonstrate how these "cerebral organoids" can be utilised to reproduce brain conditions resulting from developmental disorders in vitro.

**labor&more:** *Dr Lancaster, we'd first like to congratulate you on your receipt of this award. And we can't deny that we're particularly pleased about your success, since we highlighted the potential of 3D cultures in our cover story back at the beginning of the year. In his article "From 2D to 3D: A technology comes of age" (L&M 2/14), labor&more's Scientific Advisor Professor Paul G. Layer discussed the implications of your work as recently published in Nature (Lancaster et al., 2013, DOI: 10.1038/nature12517). In your work at the Knoblich lab, you were able to grow "mini-brains" from stem cells for the*

*first time – causing a worldwide sensation. What does this achievement mean to you personally?*

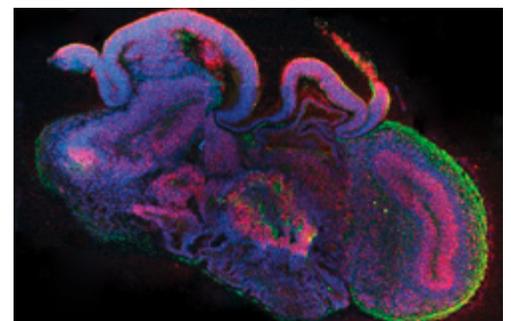
**Dr Madeline Lancaster:** It's a great honour. I must admit that we had not been expecting such a large-scale reaction to our work at all, and I think the response has been simply amazing. We have been approached by researchers from a huge range of disciplines and have even received enquiries from members of the public who were simply fascinated by the potential of our work. For someone working in scientific research, I think it's the highest accolade of all when your work is recognised by the general public and when people start becoming enthusiastic about science.

*In a world first, the cerebral organoids you developed at IMBA have made it possible to mimic structures of probably the most complex organ that nature has ever produced, in its early stages of development. Which regions of the brain do they represent?*

The mini-brains we have developed can on average reproduce the formation of brain structures until up to the ninth week of pregnancy, and have the astonishing faculty of being able to assume the identity of a range of different brain regions. These regions include

the cerebral cortex – and thus the largest part of the human brain – the retina, the hippocampus, which is responsible for learning and memory, and the plexus choroideus, which is the region that is responsible for the production of cerebrospinal fluid. These various regions are all regions that are critical for the brain's proper function and can be affected by a range of brain disorders. We can now use the cerebral organoids to investigate these disorders.

*Your work uses induced pluripotent stem cells (iPS cells), whose discovery by Japanese researcher Shinya Yamanaka was recognised by a Nobel Prize in Medicine in 2012. What role does this type of cell play in organ culture*



Cross-section of a complete cerebral organoid with various brain regions. Cells are shown in blue, neuronal stem cells in red and neurons in green.

Photo: © IMBA/Madeline A. Lancaster



**Madeline A. Lancaster** studied biochemistry at Occidental College in Los Angeles, graduating with a B.A. in 2004. Undergraduate research at institutions including the Department of Chemistry at the University of Utah followed in 2002–2004. After receiving her doctorate in biomedical sciences from the Howard Hughes Medical Institute at the University of California in San Diego in 2010, she joined Juergen Knoblich’s team at IMBA (Vienna) as a Marie Curie Post-Doc Fellow. Madeline Lancaster has published numerous articles in prestigious academic journals. She has most recently led research into the development of three-dimensional brain models, for which she was awarded the Eppendorf Award for Young European Investigators 2014.

*and how do you utilise iPS technology in your studies?*

The method used to develop mini-brains starts with iPS cells. Essentially, these are mature cells that have been reprogrammed back to the state at which they were minimally differentiated. In terms of organoid development, the advantage of using such cells is that iPS cells can also be harvested from patients with brain diseases, so as to create mini-brains that reproduce these disorders in vitro. There’s also a potential therapeutic use for iPS cells in the repair or replacement of diseased organs: the advantage here is that they wouldn’t be rejected by the individual, since they originate from the same patient being treated.

*Although it led something of a shadowy existence at first, three-dimensional cell culture technology has been in use for decades, and has now been placed centre-stage by your work. What potential does spheroid technology have for your work, and what are its limits?*

As you say, three-dimensional cultures have actually been in use for many years now.

a great many other labs in which research teams have also recognised the enormous potential offered by 3D systems. There are of course limits to this work, and this kind of system will never enable us to reconstruct the context of a complete organism in vitro. As one example, these 3D systems of course lack the blood vessels that would normally be present in a complete organ in vivo.

*You have deployed the cerebral organoids as a model for the simulation of microcephalies, i.e. brain development disorders that lead to a significantly smaller brain and associated intellectual disabilities. What have you discovered here?*

This is where the potential of iPS technology has really come into its own. We have been able to present microcephaly in model form by utilising iPS cells from patients with this disorder. We observed a truly surprising reduction in the size of the organoid, corresponding to the reduction in brain size seen in the respective patient. Further investigation revealed that this is conditional on a premature transition of neuronal stem cells to the production

“The human brain exhibits tremendous potential in the course of its biological development, a process that has been difficult to investigate using traditional animal models. In order to gain insight into these unique processes, my work utilises three-dimensional tissue grown in vitro, which models embryonic brain development.”  
*Madeline Lancaster*

Accordingly, our work has also been influenced by a large number of studies that have shown how some cells – such as epithelial cells – can form highly complex structures if they are permitted to grow in the right culture and in three dimensions. I think that our work will continue to be influenced by the work of

of neurons: these cells become exhausted too soon, ultimately resulting in fewer neurons being produced.

*Your work has also triggered criticism arising from concerns about brains created in the laboratory. What is your position on this topic?*

I think that most of the criticism directed at the concept of growing a brain in a Petri dish won’t really present much of a problem. What we’ve created is a piece of brain tissue with no interconnections and no sensation. Without these elements, it’s impossible for functional circuits to form: in my opinion, there’s therefore no real danger of this technique being used to create a brain capable of thought. And that’s also something that we’re not even remotely interested in pursuing, since it would be certain to raise some serious ethical objections. My research work focuses instead on understanding aspects of the brain

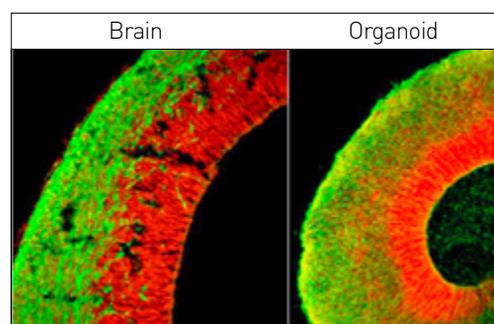


Figure showing a side-by-side comparison of a cerebral organoid (right) and the developing brain of a mouse (left). Both figures show neuronal stem cells in red and neurons in green.

Photo: © IMBA/Marko Repic and Madeline A. Lancaster

in its early development and the creation of neurons in particular.

*What would be your advice to your younger colleagues who are about to embark on a career in scientific research?*

I firmly believe that students considered in pursuing scientific research as a profession should never forget the reasons why they decided to be a research scientist, even at later stages in their career. I’ve always been an inquisitive person by nature and, as I see it, science continues to pose such an amazing number of interesting questions that are worthy of investigation. Time and again, I’m fascinated by some new angle or other, and I take the liberty of simply pursuing this approach, wherever it may take me. I think it’s important to retain that child-like sense of wonder.

*Thank you for the interview, and we wish you every success for the future!*

(Interview: Claudia Schiller)

# diagnostics

## When tuberculosis faces an even stronger opponent

Detecting tuberculosis – contribution to the battle against infectious diseases

Carl Zeiss Microscopy GmbH, Jena, Germany

**In 1905, Robert Koch (1843 – 1910) received the Nobel Prize for his research and discoveries in the field of tuberculosis.**

Picture: © www.rki.de

Tuberculosis (TB) is second only to HIV/AIDS for the dubious distinction of being the world's greatest killer. TB is a bacterial disease caused by a single infectious agent, *Mycobacterium tuberculosis*, which most commonly affects the lungs. It is transmitted from person to person via droplets from the throat and lungs of people who have the active respiratory disease.

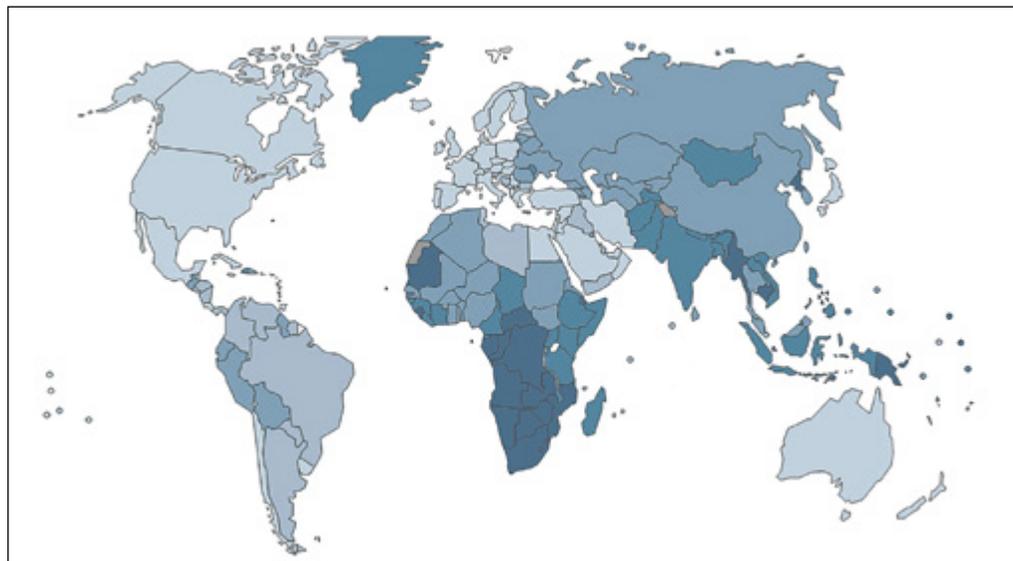
As late as 2012, some 8.6 million people fell ill with TB and 1.3 million of them died. In that same year, an estimated 530,000 children contracted TB and 74,000 HIV-negative children died of it. Over 95% of deaths occur in low- and middle-income countries, and it is among the top three causes of death in women aged 15 to 44. Yet, on a more positive note, the TB death rate dropped by 45% between 1990 and 2012. Each year the estimated number of people falling ill with tuberculosis is also declining – although very slowly.

While about a third of the world's population is infected with tuberculosis bacteria (Fig. 1), only a small proportion of those infected will become sick with the full-blown disease. The symptoms of active TB of the lungs are coughing, sometimes with sputum or blood, chest pains, weakness, weight loss, fever and night sweats. In healthy people, however, infection with the pathogen often causes no symptoms at all since the person's immune system rallies to fight against the bacteria.

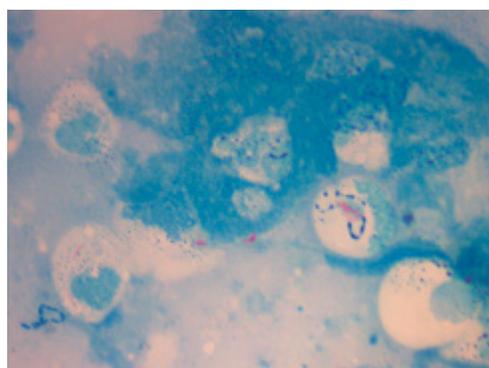
Tuberculosis is normally treatable with a six-month course of antibiotics, but diagnosis is crucial. The presence of acid-fast bacilli (AFB) on a sputum smear or other specimen often indicates TB disease. Acid-fast microscopy is easy and quick, but it does not automatically confirm a diagnosis of TB because acid-fast bacilli are not necessarily *M. tuberculosis*. Therefore, all initial samples should be followed up by a culture which, if positive for *M. tuberculosis*, will verify the diagnosis.

### Where the fight started

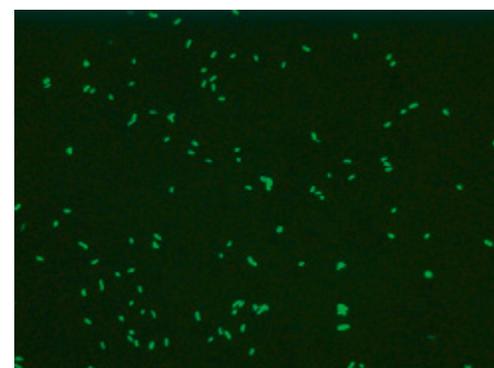
At ZEISS, the battle against this killer disease dates back to 1882 and Robert Koch's groundbreaking discovery of the *M. tuberculosis*. The celebrated German physician and microbiologist used a ZEISS Microscope VII for his discovery and to this day, the company continues to set the standard with commitment and expertise in the



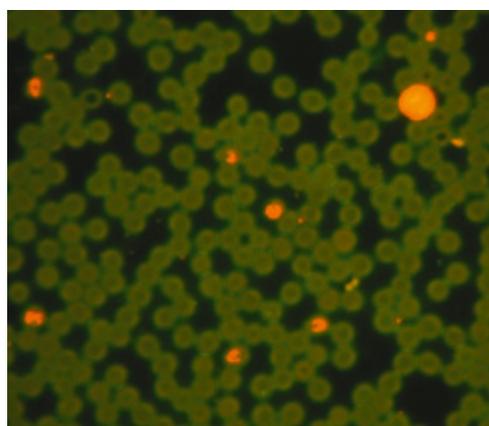
**Fig. 1** Heatmap of the tuberculosis distribution around the world  
Copyright: Adapted from WHO data



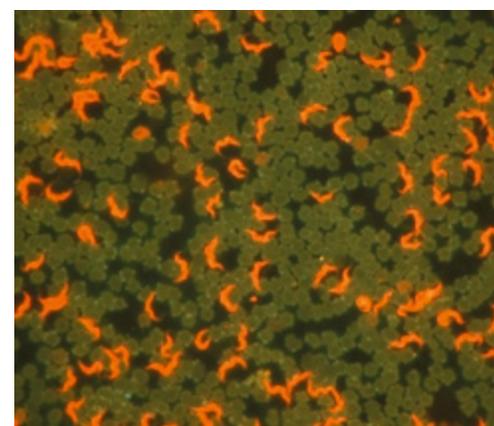
**Fig. 2** Conventional Ziehl-Neelsen staining of *Mycobacterium tuberculosis*, brightfield application image  
Courtesy: Dr. med. Harald Hoffmann, IML Gauting, Germany



**Fig. 3** Auramine staining of *M. tuberculosis*, counterstaining Methylene blue fluorescence application image  
Courtesy: Dr. med. Harald Hoffmann, IML Gauting, Germany



**Fig. 4** Malaria parasites (small orange structures) inside red blood cells (green) of a baboon experimentally infected with *Plasmodium knowlesi* and stained with acridine orange. White blood cells also stain orange.  
Courtesy: Dr. Maina Ngotho, Institute of Primate Research, Nairobi



**Fig. 5** A thin blood smear stained with acridine orange showing *Trypanosomas brucei*, the African sleeping sickness pathogen (orange) alongside red blood cells (green), using fluorescence contrast.  
Courtesy: ZEISS

# diagnostics

struggle against deadly infectious diseases. TB is curable if properly diagnosed and even over a century later microscopy is still the method of choice.

However, budgets and access to microscopes are limited in most of the countries that are most heavily burdened by tuberculosis. In partnership with “Stop TB” ZEISS has joined the collective force that is transforming the fight against TB in more than 100 countries. The “Stop TB Partnership” housed by the World Health Organization (WHO), is determined to forge the path to a world without tuberculosis.

ZEISS is also cooperating with the Foundation for Innovative New Diagnostics (FIND), sponsored by the Bill and Melinda Gates Foundation. Through the targeted promotion of diagnostic innovations, the Swiss foundation has set itself the objective of combating the spread of dangerous infectious diseases.

Together with FIND, ZEISS has developed Primo Star iLED, the LED-based fluorescence microscope designed specifically for tuberculosis test applications. This microscope brings together all of ZEISS’ experience in light microscopy and has been specially adapted to detect tuberculosis under extreme conditions, even in areas without a power supply. Public health service customers in the most highly burdened countries are eligible to receive this microscope at a special discounted price.

## No place to hide

Primo Star iLED is the flexible solution for tuberculosis test applications, using LED fluorescence transmitted light brightfield illumination. It enables the precise test of tuberculosis with Ziehl-Neelsen staining in brightfield (Fig. 2) or, alternatively, uses fluorescence excitation with Auramine O dye (Fig. 3). Fluorescence excitation speeds up detection times by a factor of up to 4 compared to brightfield illumination. Switching between the two modes is simple with Primo Star iLED. Images will show excellent contrast, especially when one is working with specimens stained with auramine-rhodamine. What’s more, Primo Star iLED is equally effective for investigating other infectious diseases such as malaria (Fig. 4) and sleeping sickness (Fig. 5).

## Precise results in every environment

Thanks to the LED illumination, technicians don’t need time to warm up or cool down or to align the illumination when working with fluorescence. The microscope’s long operating life saves costs while it also consumes comparatively little energy. Field operators have the option of working with a mirror and sunlight. Ergonomic eyecups keep ambient light out so they can achieve high-contrast fluorescence images even without a darkroom. In remote areas with fluctuating electricity or none at all, the battery pack is especially handy, and despite the uncompromising quality of its performance the Primo Star iLED can be transported conveniently and safely in its own practical carrying case.

## Fighting disease on all fronts

ZEISS is directly supporting aid and health agencies globally by donating fluorescence microscopes to ensure access to the effective diagnosis of tuberculosis. Among the latest institutions to receive ZEISS microscopes are Malteser International, the worldwide relief agency of the Sovereign Order of Malta, and Morija, a non-profit organization working in Burkina Faso, Togo, Chad and Cameroon. Other beneficiaries include Projekt Regenzeit e.V., a civil association advocated to help and protect Latin Americas rainforest and its indigenous people, and the German Leprosy and Tuberculosis Relief Association (DAHW), a non-governmental organization that supports medical and social relief programs focusing on the needs of people with leprosy, tuberculosis and other socially excluding diseases and handicaps.

→ [microscopy@zeiss.com](mailto:microscopy@zeiss.com)

For more information, please visit:



→ [www.zeiss.com/primostariled](http://www.zeiss.com/primostariled)



In this video tutorial Dr. Harald Hoffmann, M.D. and Head of the WHO Supranational Reference Laboratory IML in Gauting, Germany, demonstrates how to stain smear preparations for diagnosis of tuberculosis using fluorescence microscopy and ZEISS Primo Star iLED.

→ [bit.ly/auramine-staining](http://bit.ly/auramine-staining)



Dr. Silvia Zenner-Gellrich, Product Manager at ZEISS in Germany, is introducing ZEISS Primo Star iLED.

→ [bit.ly/primostar-iled-product-trailer](http://bit.ly/primostar-iled-product-trailer)

## Fast and efficient testing

- ▶ Reflected-light fluorescence
- ▶ Rapid switching from fluorescence excitation to brightfield illumination
- ▶ Economical LED concept
- ▶ Battery pack for operation without a main power supply
- ▶ Special eyecups to eliminate the need for a dark room during a tuberculosis test
- ▶ Simple to operate
- ▶ Durable and robust
- ▶ Tried-and-tested ZEISS optics made from high-quality glass
- ▶ High-quality materials
- ▶ Worldwide support from ZEISS
- ▶ Transport case, dust and water protected

# fairs

Further growing demand

## Exhibitor numbers at analytica China 2014 exceed expectations



From September 24 to 26, 2014 analytica China is held at the Shanghai New International Expo Center (SNIEC) with an exhibition space of 30,000 square meters. Three exhibition areas – Hall N1 for Life Sciences, Biotechnology and Diagnosis, Hall N2 for Analysis and Quality Control, and Hall N3, newly-added for Laboratory Equipment and Technology – will feature the trade show. The number of confirmed exhibitors for analytica China 2014 has exceeded 650, which means a considerable increase of around ten percent compared to the final results of 2012.

As the influence and recognition of analytica China increase, many new exhibitors are going to participate. They are also from new areas such as life sciences, diagnosis, material analysis, food analysis, biotechnology services and third-party testing. Further, the high level of interest from outside China is

underlined by the strong participation of exhibitors at the German pavilion. The exhibition space of the joint stand amounts to more than 500 square meters which consequently makes it the biggest German pavilion in the history of analytica China.

Based on the international analytica network and its influence worldwide, analytica China is attracting exhibitors of analysis, diagnosis, laboratory technology and biotechnology from all major industrial countries in the world. Today, analytica China has become the biggest sector event in China. Moreover, the analytica China Conference organized along with the exhibition is also a focus of the industry. The conference program offers an important opportunity for knowledge exchange between research and commerce.

→ [www.analyticachina.com](http://www.analyticachina.com)

The professionals for routine laboratory

### SONOPULS

Ultrasonic Homogenizers

- Degassing
- Emulsifying
- Cell disruption
- Homogenizing
- Sample preparation

New!

### SONOREX DIGIPLUS

Ultrasonic Baths

- Cleaning
- Degassing
- Emulsifying
- Homogenizing
- Sample preparation



[www.bandelin.com](http://www.bandelin.com)

**BANDELIN**  
The Ultrasound Company

### analytica China 2014



New International Expo Centre, Shanghai

BANDELIN, hall N1, booth 1140

Our partner in China: OSTC, hall N1, booth 1358

FURTHER INFORMATION AT  
[WWW.VACUUBRAND.COM](http://WWW.VACUUBRAND.COM)



## Have you heard...?

THE NEW REMOTE CONTROL VACUU·CONTROL™



- for vacuum pumps and pumping units
- network-based remote control or monitoring
- for tablet, smartphone, notebook or PC



VACUUBRAND GMBH + CO KG  
Alfred-Zippe-Straße 4 · 97877 Wertheim · Germany  
T +49 9342 808-5550 · F +49 9342 808-5555  
info@vacuubrand.com · www.vacuubrand.com

Technology for Vacuum Systems

# analytical chemist

## Science we need

**The analytica China Conference offers solution approaches for contamination of all kinds**



**The People's Republic of China faces a number of challenges such as in the production and packaging of food, the quality control of drugs, air pollution in large cities, and diseases of modern society such as diabetes mellitus. These and other topics will be the focus of this year's analytica China Conference, the title of which is "Analytical chemistry – Science we need". The conference takes place in Shanghai at the same time as analytica China, i.e. from September 24 – 26, 2014.**

At the analytica China Conference, scientists from Australia, China, Germany, Japan, Poland, South Korea, Switzerland and the United States will give lectures on various fields in analytical chemistry. Besides a plenary lecture with a panel of prominent speakers representing various disciplines, there will also be five additional lecture sessions. They cover topics such as drugs and traditional Chinese medicine, food safety, proteomics and metabolomics, separation techniques and mass spectrometry, environmental analysis and bioanalysis. The program of events will also be rounded out by four several-hour seminars on topics such as quality control, gas chromatography, multidimensional liquid chromatography and HPLC column selection.

### Science we need

While visitors who walk through the exhibition halls get a look at state-of-the-art technology in the sectors for analysis, laboratory technology and biology, those who attend the analytica China Conference have a chance to discover the latest findings in analytical chemistry in two plenary sessions. Examples include the use of ambient ionization methods (e.g. SESI) for breath analysis by Prof. Renato Zenobi (ETH Zurich) or the mechanisms of photoionization in atmospheric pressure mass spectrometry by Prof. Thorsten Benter (University of Wuppertal). Prof. Benter will also report on the latest developments in the field of photoionization and chemical ionization in capillaries. Based on these findings, Prof. Oliver Schmitz will introduce a new photo-ionization source for coupling gas chromatography with an

atmospheric pressure orbitrap mass spectrometer in a session on Separation Techniques and Mass Spectrometry. This new type of ion source, which was developed by the Prof. Benter Working Group and the company iGenTraX, stands out because of its outstanding sensitivity. For example, the detection limit for toluene is 100 attograms on column. Many other substances can be reliably quantified in the range of 10 to 20 femtograms on column. This ionization method is only limited by the fact that the components must be amenable to GC analysis (vaporizable without decomposing) and the ionization potential must be below 10 or 10.6 electron volts because the APPI lamp does not emit VUV light at wavelengths of 123.9 and 116.5 nanometers. In the same session, Jack Syage, who developed atmospheric pressure photoionization (APPI) independently of Andries Bruins, will compare electrospray ionization (ESI) using APPI—in each case coupled with HPLC—with regard to ion suppression for drug samples in urine.

New types of ionization methods will also be the focus of a series of lectures on food safety. For example, Prof. Heiko Hayen (Westfälische Wilhelms-Universität Münster) will give a presentation on dielectric barrier discharge microplasma ionization, which he helped to develop, for analyzing pesticides in food.

Besides these more equipment-oriented presentations, there will also be lectures that deal intensely with theoretical issues and questions that are motivated by applications. For example, visitors attending the conference can find out more about traditional Chinese medicine and the



### Prof Dr. Oliver J. Schmitz

Applied Analytical Chemistry  
Faculty of Chemistry  
University Duisburg-Essen, Germany  
Chair analytica China Conference

ingredients in Chinese medicinal plants. There will also be several lectures that deal with the latest developments in sample preparation (sample-taking and preconcentration). The extent to which sample preparation influences subsequent metabolome analysis will also be examined. In many cases, complex samples such as those used in environmental or metabolome analysis are processed using two-dimensional gas chromatography (GCxGC). This analysis method will be introduced in two lectures including one from one of the pioneers of GCxGC, Prof. Philip Marriott (Monash University, Australia).

Besides chromatography and mass spectrometry methods, other new types of techniques will also be discussed. For example, Prof. Kazuhiko Fujiwara from Akita University in Japan will explain the potential of a new plasma resonance sensor chip based on gold nanoparticles in a series of lectures on environmental analysis and bioanalysis. In the same lecture series, Prof. Albert Sickmann (ISAS) will report on the varying degrees of hydrolysis efficiency of various trypsin qualities in proteomics.

A total of 63 English lectures are on the agenda for the analytica China Conference, which is being organized by Messe München International and the Chinese Chemical Society (CCS). The analytica China Conference is also represented by its Chairmen, Prof. Erkang Wang (Changchun Institute of Applied Chemistry, Chinese Academy of Science), Prof. Oliver J. Schmitz (University of Duisburg-Essen), and the Executive Chair, Prof. Jin-Ming Lin (Tsinghua University, Peking).

→ **Additional information is available online at [www.analyticachina.com](http://www.analyticachina.com)**



analytica China Conference: gathering of analytical science

Picture: © Fotolia.com | kantver

## Shelf life testing of dairy products in China

Ina Falkner, Journalist Rednitzhembach/Germany

**China has discovered milk. In order to meet the demand of more than 1.3 billion people, companies such as Bright Dairy & Food build state-of-the-art production facilities. In this report, we pursued the question of why the Chinese have started drinking milk a long time after Europeans; a visit was also paid to the Bright Dairy & Food quality assurance lab. In the laboratory, a Memmert Peltier cooled incubator is used for microbiological testing and shelf life testing.**

### China encourages people to drink milk

For the most part, the Chinese traditionally bred cattle for meat consumption. Due to calcium deficiency in children, schools in

China started to hand out free milk in the 1990ies. Food from abroad found its way into the supermarkets and this is how dairy products became an integral part of the Chinese diet.

### Product quality is top priority

In 2011, Bright Food, the Shanghai-based parent company of Bright Dairy & Food that goes back more than 50 years, was the second largest food company in China. In addition to increasing its production capacities for milk, yogurt, ice cream, cheese and other dairy products, excellent product quality is the company's top priority. In research and development, as well as in production, the main focus is put on safety, freshness and nutrient content of Bright foods, as well as on consumer health. The Chinese government is accelerating the implementation of strict stan-

dards such as batch traceability or an unbroken cold chain during transport. For this reason, it goes without saying that the quality assurance facilities at Bright Dairy & Food use state-of-the-art technology.

Since 2012, the food safety team at Bright Dairy & Food has been using a Memmert Peltier cooled incubator IPP for microbiological testing and shelf life testing. Microbiological testing on fungal colonies is done at 20°C for a duration of 3 to 5 days. During shelf life testing, the microbiological status of a product is, however, continuously tested over the entire shelf life period. In this case, test duration and temperature in the cooled incubator vary from sample to sample. To obtain valid results, an exact temperature distribution and the smallest possible temperature deviations in the interior are essential. In addition to the simple user interface, long-term stability, energy efficiency as well as environmental friendliness were the reasons why the Memmert Peltier cooled incubator IPP was chosen.

→ [www.memmert.com](http://www.memmert.com)

→ [falkner@mond-online.com](mailto:falkner@mond-online.com)



## KOREA LAB 2014, shows the state of the art lab-tech successfully

The R&D Investment grew 100 percent between 2006 and 2012 and the ratio of R&D investment to Gross Domestic Product (GDP) increased from 3.01% to 4.36% according to Institute for International Trade of Korea International Trade Association (KITA). Compare to this, Korea's ratio of R&D investment to GDP is world class over other developed countries. (Japan 3.30%, Germany 2.88%, USA 2.77%, France 2.24%)

KOREA LAB 2014 showing the technology of R&D in Korea was held on June 10(Tue.) to 13(Fri.) at KINTEX (Korea International Exhibition Center) in Korea. Major exhibitors include global measurement companies such as Agilent Technologies, Shimadzu Corporation, and the Horiba Group and other about 400 local and overseas businesses which produce research and lab equipment such as Young Lin Instrument, Scinco Co.,Ltd., Jeio Tech, Jisico, and Hanil Science Industrial.

The 2<sup>nd</sup> Korean Federation of Analytical Science & Technology Societies Joint Symposium of the Korea Society of Analytical Science (KOFAS) and the 52<sup>nd</sup> convention of the Korean Society of Analytical Sciences were held concurrently which brought thousands of scientists and officials at the analytical science and university to the KOREA LAB 2014. This symposium had speakers from Korea, US, Germany, Spain, China, and Japan-including Prof. Luis A. Colon (the University at Buffalo in the USA) with the topic, Chemical, Environmental, Pharmaceutical, Food & Agricultural, Electrochemical, Biochip and Biosensor, Forensic, Cellular, Biomaterial.

Also, other conferences & seminars (Policy Seminar, New Technology seminar and so on) were an overwhelming success as over 6 thousands scientists.

The largest laboratory & Analytical Equipment exhibition, KOREA LAB exhibition organized by Kyungyon Exhibition Corp. is the meeting place for the research and scientific communities in fields of Physico-Chemistry and Biotechnology in Korea showing the laboratory equipment for chemical-bio chemical-fine chemical- environmental industries, bio-food-pharmaceutical-cosmetic industries, and nanotechnology-new materials industries.

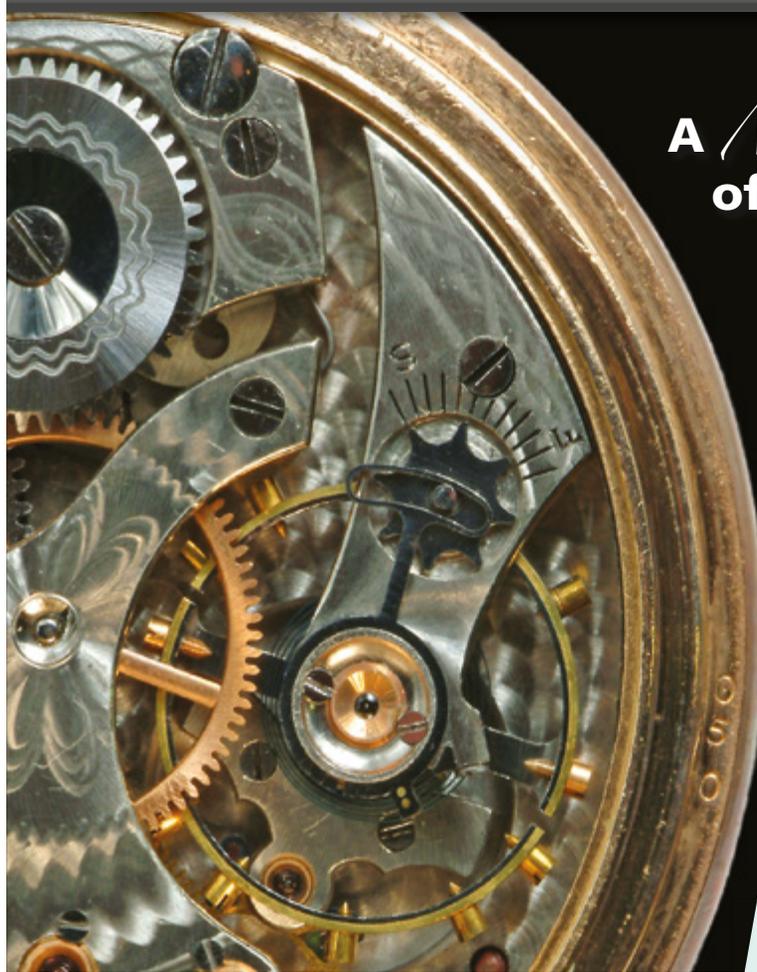
The 8<sup>th</sup> Korea Int'l Laboratory & Analytical Equipment exhibition (KOREA LAB

2015) will be held on April 21(Tue.) to 24(Fri.), 2015 in KINTEX 1.

**For further information,  
please contact Ms. Erica Lee  
hylee@kyungyon.co.kr**



SUPERIOR TEMPERATURE TECHNOLOGY FOR A BETTER LIFE



*A Masterpiece  
of Technology*

**TEST NOW!**  
The New Product Finder  
[www.julabo.de](http://www.julabo.de)

### Precision temperature control is our life's work

The precision, accuracy, and performance of JULABO temperature control solutions have made them fixtures in laboratories around the world. JULABO instruments cover every application from -95 °C to +400 °C in science, research, and industry.

**Julabo**  
THE TEMPERATURE CONTROL COMPANY



## Stirrer systems

### Single point and multipoint stirrer systems with a wear-free induction drive



SHP Steriltechnik AG presented its new magnetic stirrer LABOMAG at the analytica with great success. The product range includes magnetic stirrers with one to 14 stirring points. All stirrers are equipped with a powerful, wear-free induction drive that has no moving parts. Units with industrial and pharmaceutical industry standard housings are submersible up to 60°C.

The new single-point stirrers BE NINE – BE MINE also attracted plenty of attention. Designed for routine applications in microbiology laboratories,



their powerful induction drive, design, and LED illumination provide an impressive performance.

→ [www.shp-steriltechnik.de](http://www.shp-steriltechnik.de)



### Cryogenic grinding of lab samples

RETSCH's new CryoMill features an integrated cooling system which ensures continuous cooling of the grinding jar with liquid nitrogen. Thus the sample is embrittled and volatile components are preserved. LN2 is supplied through the Autofill System in the required amount so that the user never gets into direct contact with the liquid which makes operating the mill particularly safe.

The CryoMill achieves grind sizes down to 5 microns and can be equipped with grinding jars from 5 to 50 ml or up to 6 reaction vials of 2 ml in an adapter. A new feature is the possibility to store up to 9 SOPs. The mill can also be operated without cooling which makes it suitable for a vast range of applications.

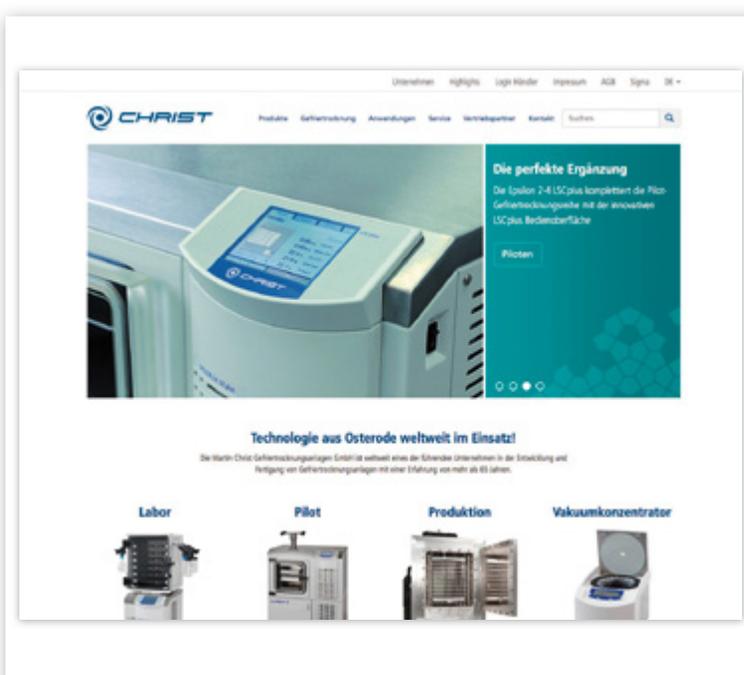
[www.retsch.com/cryomill](http://www.retsch.com/cryomill)



### Easy, fast and reliable – R-Biopharm RIDA®QUICK RQS lateral flow tests for mycotoxin quantification with RIDA®QUICK SCAN

R-Biopharm RIDA®QUICK lateral flow tests allow a quick, specific, semi-quantitative mycotoxin analysis without using a reader. The combination of R-Biopharm RIDA®QUICK RQS lateral flow tests with R-Biopharm RIDA®QUICK SCAN test strip reader provides fast and reliable quantification of test results. On this platform various quantifiable lateral flow rapid tests are available, validated for matrices like cereals, spices and nuts. Further applications are continuously developed. Within minutes samples can be analyzed with test strips and read out by RIDA®QUICK SCAN to check mycotoxin levels. The highly portable RIDA®QUICK SCAN can be connected to a PC or on demand, is available with barcode scanner and portable printer to allow a secure data documentation.

[www.r-biopharm.com](http://www.r-biopharm.com)



### Christ presents its new corporate design

First-class style for an international presence: Christ has completely revamped its brand design. The company is a leading global supplier of freeze-dryers. This premium quality is what makes the new brand design of Christ even more visible – from the website to the various brochures. Grand premiere: Christ presented the new design of the company for the first time at the Analytica in Munich. In doing so, the company is gearing up for the future. The new design reflects the reliability, targets, and quality of the company in a modern way to the outside. In addition, it underlines the connection between Christ and its sister company Sigma Laborzentrifugen GmbH. The new website will lead visitors to the website with the new design. The website welcomes visitors with an extensive, photo-filled slideshow with a news character and well-structured menu navigation. The responsive design enables the suitable display of the website on all mobile devices.

[www.martinchrist.de](http://www.martinchrist.de)

# products



## Optimized and extended!

For over 20 years Sarstedt has produced a wide range of high quality tissue/cell culture products, which are distributed worldwide. Sarstedt's vast experience and knowledge of customer requirements have resulted in optimisation and extension of the product range. The cell culture flasks, dishes, and plates have been optimized to enhance the usability and handling of the products. Three different colour coded growth surfaces, the extended plate range, and the labeling of all products with LOT number and expiry date are just some of the improvements made to ensure the outstanding quality of the new cell culture products. For more information, please visit

[www.sarstedt.com](http://www.sarstedt.com)



## Correlative Raman-SEM Microscope RISE

RISE Microscopy is a newly developed microscopy technique which combines confocal Raman Imaging and Scanning Electron (RISE) Microscopy. The RISE Microscope enables for the first time the acquisition of SEM and Raman images from the same sample area and the correlation of ultra-structural and chemical information with one microscope system. Both analytical methods are fully integrated into the RISE Microscope. Between the different measurements an extremely precise scan stage automatically transfers the sample inside the microscope's vacuum chamber and re-positions it. The integrated RISE software carries out the required parameter adjustments and instrument alignments. The acquired results can then be correlated and the Raman and SEM images overlaid.

[www.witec.de](http://www.witec.de)

## THE MAIN EVENT OF LABORATORY INDUSTRY



## VII International Forum «Complex Support of Laboratories»

October 14–16, 2014

KYIV EXPO PLAZA ufi Kyiv, Ukraine

### Supported by:

- Committees of the Verkhovna Rada of Ukraine
- Cabinet of Ministers of Ukraine
- Ministries and departments
- Professional associations and unions
- National Academy of Agrarian Sciences of Ukraine

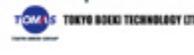
### Organizers:



### General partner:



### General sponsor:



### Partners:



320 exhibitors from 20 countries

600 new trademarks, worldwide brands

7 000 specialists

30 scientific-practical events

**LAB ComplEX** VII International Specialized Exhibition of Complex Support of Laboratories

**SPECIALIZED EXPOSITIONS**

- LAB ComplEX - Pharma
- LAB ComplEX - Industry
- LAB ComplEX - Apps
- LAB ComplEX - Science and Education
- LAB ComplEX - Hi-Tech NanoTech

### RELATED EVENTS

International Exhibition of Pharmaceutical Industry Technologies PHARM PROM  
[www.pharmcomplex.com](http://www.pharmcomplex.com)

International Specialized Exhibition CleanTechExpo «Clean rooms technologies»

- ◆ INTERNATIONAL PARTICIPATION AND VISITING
- ◆ FULL RANGE OF EQUIPMENT, LABORATORY FURNITURE, EXPANDABLE MATERIALS, COMPLEX AND INTEGRATED SOLUTIONS, SERVICES FOR LABORATORIES
- ◆ INNOVATIONS AND TECHNOLOGIES
- ◆ UKRAINIAN LABORATORY SCHOOL – MASTER-CLASSES ON OPERATING EQUIPMENT
- ◆ LABDEMO-TOURS – SPECIAL TECHNICAL EXCURSIONS
- ◆ BUSINESSPOINT PROGRAM, BUYER PROGRAM
- ◆ LABINNOVATION – ZONE OF OPEN PRESENTATIONS

International Specialized Partner: **labor&more**

General Information Partner: **ПРОИЗВОДСТВЕННАЯ ЛАБОРАТОРИЯ**

Official Information Partner:

General Internet-Partner: **LabComplex**

International Media Partners:



Media Partners:



To participate in the Forum:  
For participation in scientific-practical and business programs:

+380 (44) 526-90-25  
+380 (44) 526-92-89

expo@labcomplex.com  
marketing@labcomplex.com

[www.labcomplex.com](http://www.labcomplex.com)

## Economic Cooling

Compact recirculating coolers by JULABO

**The F series by JULABO offers space-saving and eco-friendly recirculating coolers for simple cooling applications from -10 °C to +40 °C.**

The F series of Compact-Recirculating coolers by JULABO are ideal for simple cooling tasks in laboratories and industry. The smallest recirculating cooler of this new family – the F250 – was technically up-graded to provide a wider temperature range from -10 °C to +40 °C. The new recirculating coolers F500 and F1000 feature even higher cooling capacities and stronger integrated pumps. The pump of the F500 delivers 24l/min at 0.5 bar, the stronger pump of the F1000 delivers 23l/min at 1.0 bar.

All units of the F series feature impressive product benefits. Set points are easily entered via a 3-key-control panel. Temperatures are easy to read from a distance on the large, bright LED display. The PID temperature control guarantees a temperature stability  $\pm 0.5$  °C. The filling port for the bath fluid is on the top and easily accessible. The integrated display shows the fluid level at a glance. The compact, space-saving design permits flexible positioning on or below laboratory tables benches. Like every JULABO instrument, the sides of recircu-

lating coolers have no venting slits and permit placement right next to each other or other laboratory units.

Thanks to their efficient, energy-saving operation, the compact recirculating coolers of the F series are ideal to replace cooling water. And the price is right making the purchase of a JULABO F series recirculating cooler a cost-efficient investment.

→ [www.julabo.de/en/products/recirculating-coolers](http://www.julabo.de/en/products/recirculating-coolers)



Cited in  
more than  
**20,000**  
publications

**35,000**  
clinical cell  
separations  
performed using  
our devices

Cited in more than  
**300**  
clinical  
publications

More than  
**7,000**  
products

More than  
**1,400**  
employees

More than  
**3,000**  
research tools

**200**  
GMP  
certificates

**1 FDA**  
approval

Offices in  
**25**  
countries

**10,000**  
patients  
treated using our  
CliniMACS®  
System

# 25

# YEARS

**A lot can happen in 25 years.** Technologies can transform. Diseases can be cured. A small cell separation startup can grow to become a global leader in cellular research and therapy, providing the products and solutions that help brilliant minds translate discoveries into therapies. We're honored to have supported your achievements over the past quarter century, and look forward to many more milestones to come. On our 25th anniversary, Miltenyi Biotec is excited to celebrate past and future innovation with you. Join the celebration at [www.miltenyibiotec.com/25](http://www.miltenyibiotec.com/25)



**Miltenyi Biotec**

# STICKY

# SITUATIONS



ONE TINY DROP OF ETHANOL  
SMEARS YOUR INK  
INTO OBLIVION.

DON'T GET STUCK.  
GET LEGIBLE LABELS  
THAT STICK!



You work too hard for your research to suddenly disappear. But when you use handwritten pen or a generic lab label to identify your work, you run the risk of having your ink dissolve, disappear or become illegible. With Brady Lab Labels, we've got you covered. Our labels are tested and re-tested in the harshest conditions to ensure your research lasts a lifetime - or at least until you need it.

REQUEST YOUR FREE WHITE  
PAPER ON 'SAMPLE CERTAINTY'



Go to: [www.bradyeurope.com/lab](http://www.bradyeurope.com/lab)  
or email: [emea\\_request@bradycorp.com](mailto:emea_request@bradycorp.com)

 **BRADY** 100