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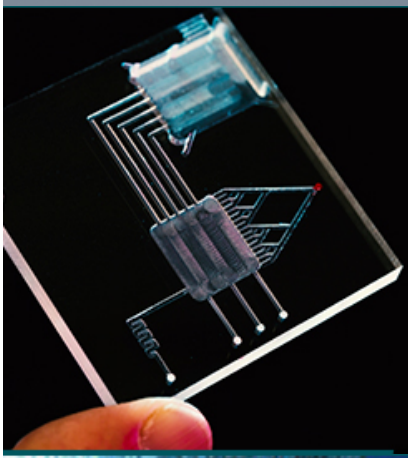


Lab-on-a-Chip & Microfluidics EUROPE 2019

18-19 June 2019 -- Rotterdam, The Netherlands

DE DOELEN

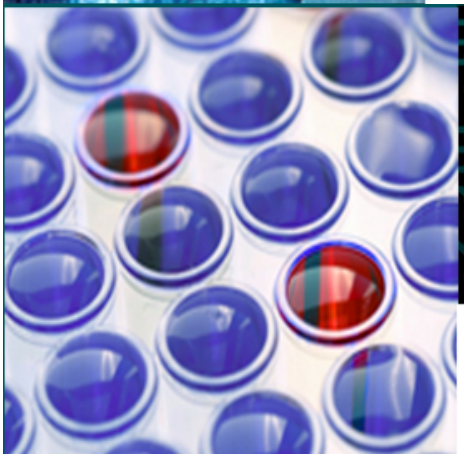
3 For 2 on All Delegate Passes

Organ-on-a-Chip & Tissue-on-a-Chip EUROPE 2019

18-19 June 2019 -- Rotterdam, The Netherlands

DE DOELEN

3 For 2 on All Delegate Passes



Point-of-Care, Biosensors & Mobile Diagnostics EUROPE 2019

18-19 June 2019 -- Rotterdam, The Netherlands

DE DOELEN

3 For 2 on All Delegate Passes

Conference Proceedings

Venue: de Doelen Conference Center – Rotterdam

The Netherlands

SELECTBIO

Dear Speakers, Delegates, Sponsors and Exhibitors,

Thank you for your participation at the **SelectBIO Lab-on-a-Chip & Microfluidics Europe 2019, Organ-on-a-Chip & Tissue-on-a-Chip Europe 2019 and Point-of-Care Diagnostics, Biosensors and Mobile Diagnostics Europe 2019 – 18-19 June 2019, Rotterdam, The Netherlands.** Here are logistics details to help you navigate the event.

All Conference Events Take Place at the de Doelen Jurriaanse Complex
Kruisplein 30 3012 CC Rotterdam, The Netherlands

- Exhibit Hall is the Jurriaanse Foyer
- Posters are Located in the Foyer of the Grote Zaal
- Plenary Session Takes Place in the Jurriaanse Zaal
- Lab-on-a-Chip Track Takes Place in the Jurriaanse Zaal
- Organ-on-a-Chip Track Takes Place in the Van Cappellen Zaal
- Point-of-Care Diagnostics Track Takes Place in the Leeuw/Keuris/Schat Room

Conference Overall Schedule

Day 1—Tuesday, 18 June 2019

- Conference Registration Starts at 07:45 with Coffee Served in the Exhibit Hall
- Conference Plenary Session Starts at 08:45 in the Jurriaanse Zaal
- Mid-Morning Coffee Break Takes Place at 10:30 in the Exhibit Hall
- Networking Lunch Takes Place at 13:15 in the Exhibit Hall – Meet Exhibitors in the Exhibit Hall and View Posters in the Foyer of the Grote Zaal
- Afternoon Session Starts at 14:15 with 3 Concurrent Tracks Running in Parallel:
    - **Lab-on-a-Chip Track Takes Place in the Jurriaanse Zaal**
    - **Organ-on-a-Chip Track Takes Place in the Van Cappellen Zaal**
    - **Point-of-Care Diagnostics Track Takes Place in the Leeuw/Keuris/Schat Room**
- Mid-Afternoon Coffee Break and Networking in the Exhibit Hall 15:45
- Networking Reception with Beer and Wine Takes Place in the Exhibit Hall from 18:15 to 19:15

Day 2—Wednesday, 19 June 2019

- Morning Coffee Served at 07:00 in the Exhibit Hall
- Conference Program Starts at 07:30
- 3 Concurrent Tracks Running in Parallel Throughout the Day
- Coffee and Tea Breaks and Lunch Offer Opportunity to Network with Exhibitors and View Posters
- Conference Closes at 18:30

We kindly request that you do not take pictures or videotape presentations as speakers will generally present unpublished data during the presentations—we greatly appreciate your cooperation in this matter. Even though we've taken all efforts to provide the most up-to-date conference agenda/program within these conference proceedings, please be advised that due to circumstances such as speaker last-minute changes/substitutions/cancellations, we may need to adjust the event program on-site. We greatly appreciate your understanding in this matter and will do everything possible to minimize alterations to the agenda/program

FREE WiFi is Available for All Conference Attendees
Username: SelectBIO – Password: Rotterdam

Thank you for your participation and we wish you an excellent SelectBIO conference experience.

Jeff Fan
Events Manager, SelectBIO
J.Fan@selectbio.com

SelectBIO Organ-on-a-Chip & Tissue-on-a-Chip Europe 2019 Satellite Meeting Sponsored by the ITN-MIMIC

Satellite Meeting Sponsored by the ITN-MIMIC

This Satellite Meeting is Sponsored by the ITN-MIMIC presents research efforts being performed in a University-Company Partnership focused on **Organ-on-a-Chip**.. MIMIC - "Mimicking organs-on-chips for high-throughput screening and basic research" - is an interdisciplinary European Industrial Doctorate at the interface of cell biology, engineering and drug development. ITN-MIMIC is a collaborative innovative research program created by the University of Sheffield (Sheffield, United Kingdom) in Collaboration with two industrial partners MIMETAS and Galapagos (Leiden, The Netherlands).

Satellite Meeting Date: Monday, 17 June 2019
Satellite Meeting Time: 15:30 to 18:40
Venue: Van Cappellen Zaal, de Doelen Conference Center, Rotterdam, The Netherlands.

This Satellite Meeting is Free and Open to all SelectBIO Conference Delegates, Speakers and Exhibitors and Offers an Excellent Opportunity for Scientific Exchange and Networking.

Satellite Meeting Schedule

15:30 Introduction to the Satellite Meeting. Dr Kai Erdmann, The University of Sheffield

15:40 Presentation by **Dr. Dorota Kurek, Senior Scientist, MIMETAS**, Entitled "*High-Throughput Human Organ-on-a-Chip System for Drug Discovery and Disease Modelling.*"

16:10 Presentation by **Dr. Kai Erdmann, The University of Sheffield**, Entitled "*In Vitro and In Vivo Model Systems to Investigate the Molecular Mechanisms of Lowe Syndrome.*"

16:40 Presentation by **Sindhu Naik, The University of Sheffield**, Entitled "*Establishment & Validation of In-Vitro Disease Model to Study Lowe Syndrome and Dent II Disease.*"

17:00 Coffee Break and Networking

17:30 Presentation by **Kinga Kosim, The University of Sheffield**, Entitled "*Establishment and Validation of an In Vitro Model for Crohn's Disease.*"

17:50 Presentation by **Claudia Beaurivage, Galapagos BV, University of Sheffield**, Entitled "*High-Throughput Microfluidic Gut-on-a-Chip Models for Drug Discovery and Target Validation in Inflammatory Bowel Disease.*"

18:10 Presentation by **Dr. Meike van der Zande, RIKILT – Wageningen University & Research (invited speaker)**, Entitled "*Human Gut-on-a-Chip as a Predictive Model for Compound Bioavailability and Toxicity.*"

18:40 Close of Meeting

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 674983.

SelectBIO EU Congress 2019
18-19 June 2019

Lab-on-a-Chip & Microfluidics Europe 2019
Organ-on-a-Chip & Tissue-on-a-Chip Europe 2019
Point-of-Care, Biosensors & Mobile Diagnostics Europe 2019

Exhibit Position	Company Name
1	Yole
2	PreSens GmbH
3	M24You GmbH
4	microfluidic ChipShop GmbH
5	BioDot, Ltd.
6	Plastic Design Corporation (PDC)
7	ELVEFLOW
8	Cellbox Solutions GmbH
9	Little Things Factory GmbH (LTF)
10	microdrop Technologies GmbH
11	Allevi
12	Kloé
13	Fluigent
14	CETONI GmbH
15	CELLINK
16	Emulseo
17	CytoSMART Technologies, B.V.
18	Enplas Europe Ltd.
19	Molecular Devices Corporation
20	IMT/Heidenhain GmbH
21	USHIO
22	STRATEC Consumables GmbH
23	Alveolix
24	miniFab
25	Micronit Microtechnologies B.V.
26	Redbud Labs
27	Tide Microfluidics B.V.
28	z-microsystems

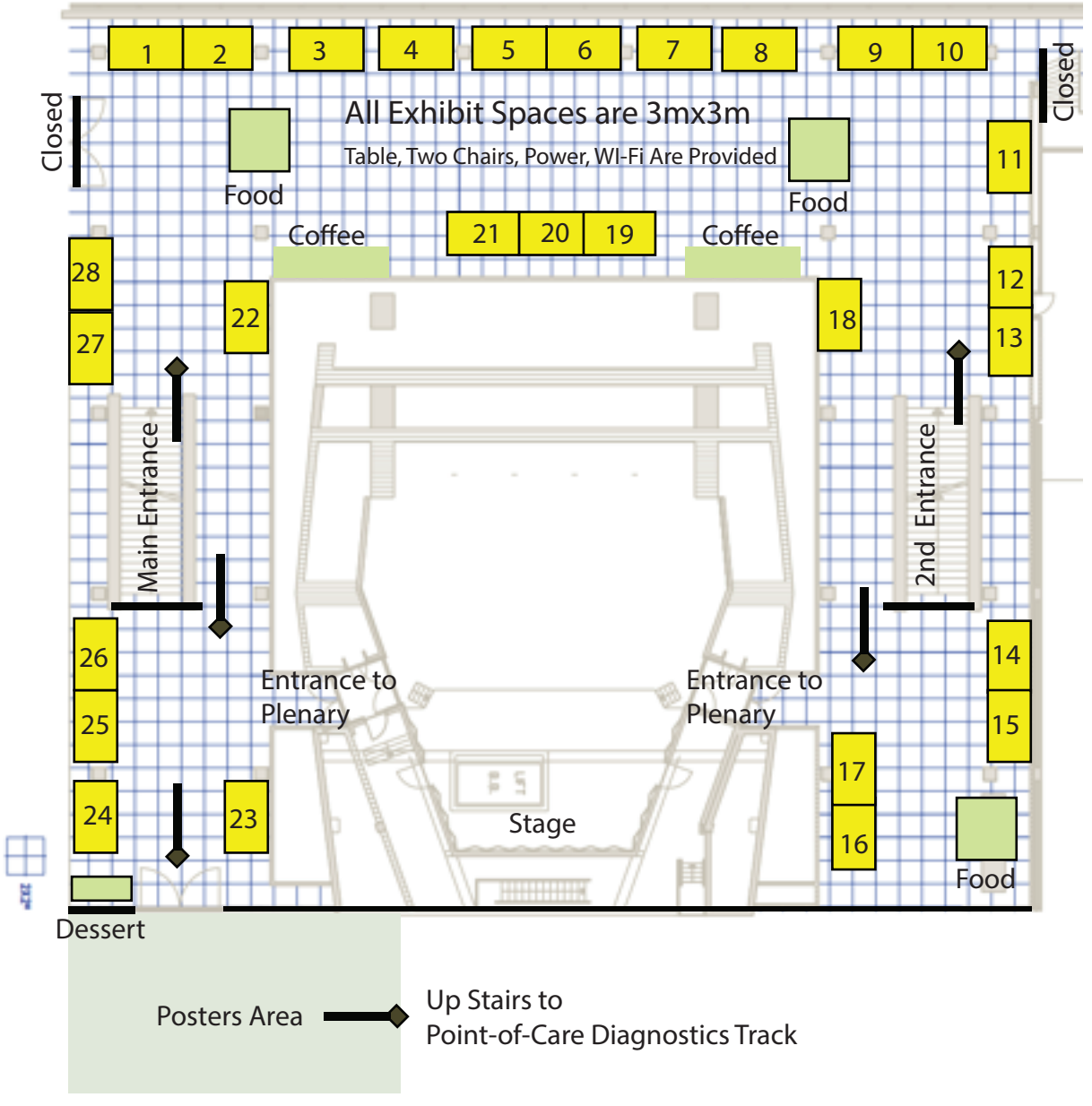


Exhibit Floorplan: Jurriaanse Foyer
de Doelen Conference Center -- Rotterdam, The Netherlands

Day 1 – 18 June 2019 Plenary Session Conference Agenda

07:45 Conference Registration, Materials Pick-Up, Morning Coffee and Tea in the Exhibit Hall

Session Title: Opening Plenary Session
Venue: Jurriaanse Zaal

08:45 **Chairperson's Welcome and Introduction to the Conference**
Nancy Allbritton, Kenan Professor of Chemistry and Biomedical Engineering and Chair of the Joint Department of Biomedical Engineering, University of North Carolina and North Carolina State University, United States of America

09:00 **Keynote Presentation**
Optofluidic Labs-on-Chip for Single Molecule Analysis
Holger Schmidt, Narinder Kapany Professor of Electrical Engineering, University of California-Santa Cruz, United States of America
Lab-on-chip devices have long held the promise of providing a convenient and rapid way to analyze small amounts of biological samples. However, when pushed to the ultimate limit of single molecule sensitivity, the detection mechanism is often based on off-chip elements. I will discuss a chip-scale platform that offers both integrated optical and electrical single molecule analysis. Optical integration is achieved by using liquid-core waveguides interfaced with traditional photonic elements to implement advanced functionalities. Examples include multiplex detection of single viruses, simultaneous detection of proteins and nucleic acid biomarkers, and front-to-back sample handling and single DNA detection on a single chip. Electrical single molecule analysis is achieved by integration of solid-state nanopores. Novel nanopore detection capabilities such as feedback-controlled delivery of single molecules to a fluidic channel are demonstrated. The combination of both optical and electrical detection modalities results in a novel, high throughput platform for single molecule analysis.

09:30 **Keynote Presentation**
Organs-on-Chips: Analytical Tools and Objects for Analysis
Elisabeth Verpoorte, Professor of Analytical Chemistry and Pharmaceutical Analysis, University of Groningen, The Netherlands
Organs-on-chips (OoC) can be viewed as biological processing units, meant to replicate on a smaller scale the cell architecture and functioning of the organs they represent. OoC may be used to probe and thus better understand the mechanisms by which organs function. Mostly, though, they will be used as in vitro processing tools, to yield insight as to the fate of compounds like drugs or foodstuffs in vivo. Either way, merging analytical detection technologies with microfluidics and cell culture is key to the development of these systems for advanced in vitro analysis. Several examples of analytical approaches for monitoring liver slice behavior stemming from our labs will be presented in this presentation.

10:00 **Keynote Presentation**
New Opportunities in Acoustofluidic Processing of Liquid Biopsies
Thomas Laurell, Professor, Department of Biomedical Engineering, Lund University, Sweden

10:30 Morning Coffee, Tea and Networking in the Exhibit Hall

11:15 **Keynote Presentation**

Nanosensor Chips for the Single-Molecule Sequencing of DNA and RNA

Steve Soper, Foundation Distinguished Professor, Director, Center of BioModular Multi-scale System for Precision Medicine, The University of Kansas, Adjunct Professor, Ulsan National Institute of Science & Technology, United States of America

We are generating a single-molecule DNA/RNA sequencing platform that can acquire sequencing information with high accuracy (>99%) at unprecedented throughputs (106 nt/s). The technology employs a fluidic chip populated with nanosensors that read the identity of individual mononucleotides from their characteristic flight-time through a 2-dimensional (2D) nanochannel (~50 nm in width and depth; >10 µm in length) and their current transient amplitudes. The nanosensors are fabricated in a thermoplastic via nanoimprint lithography (NIL). The mononucleotides are generated from an intact DNA fragment using a highly processive exonuclease, which is covalently anchored to a plastic support (500 nm in diameter) contained within a bioreactor that sequentially feeds mononucleotides into a 2D nanochannel. The identity of the mononucleotides is deduced from a molecular-dependent flight-time through the 2D nanochannel that is related to the electrophoretic mobility of that molecule. The flight time is read in a label-less fashion by measuring current transients (i.e., resistive pulse sensing) induced by a single mononucleotide when it travels through a constriction possessing molecular dimensions (<10 nm in diameter) and poised at the input/output ends of the flight tube. In this presentation, our efforts in building these nanosensors using NIL in thermoplastics will be discussed. We will also talk about the detection of single molecules using NIL-produced nanopores. Also, surface modifications of plastics for the immobilization of biologics, such as exonucleases, will be discussed and their enzymatic performance when surface immobilized. Finally, information on the manipulation of single DNA molecules using nanofluidic circuits that uses nano-scale features to shape electric fields will be presented.

11:45 **Keynote Presentation**

Intestine on a Chip for Basic Biology and Patient-Specific Medicine

Nancy Allbritton, Kenan Professor of Chemistry and Biomedical Engineering and Chair of the Joint Department of Biomedical Engineering, University of North Carolina and North Carolina State University, United States of America

The ability to monitor and control the environment at the cellular and tissue level is one of the most promising applications for microengineered systems. Advances over the past decade in our ability to isolate and culture stem cells when combined with microengineering make it possible to conceive of physiologically functional systems that reconstitute whole organ physiology. These "organ-on-a-chip" platforms enable the establishment of the tissue interfaces necessary for organ function while providing exquisite control of experimental variables and sharing the richness of the intact organism. My group is at the forefront of marrying these advances in stem-cell culture with microengineering to create in vitro tissue mimics with a focus on the intestine. We constructed in vitro epithelium for human and mouse, small and large intestine that bear a stunning physical resemblance to the in vivo intestinal epithelium epithelia displaying arrays of polarized crypts. Most importantly this system recapitulates much of the physiology of the native intestinal epithelium. The system is constructed by developing a self-renewing monolayer of primary cells which is then shaped using microfabrication techniques. The platform enables application of the diverse chemical gradients (growth factors, morphogens, bacterial metabolites, food substances, and gases) thought to exist along the crypt-villus axis. Application of gradients of microbiota-derived fermentation products across this tissue provided a direct demonstration that these products drive alterations in the size of the crypts' proliferative and differentiated compartments as predicted to occur in vivo. The system also enables co-culture of anaerobic intestinal bacteria above a physiologic mucus layer. Using this platform, small intestinal biopsies from humans can be used to populate the constructs with cells producing patient-specific tissues for personalized medicine.

12:15 *Keynote Presentation*

Emerging Technologies for Biohybrid Machines

Shoji Takeuchi, Professor, Center for International Research on Integrative Biomedical Systems (CIBiS), Institute of Industrial Science, The University of Tokyo, Japan

Engineers have created various kinds of machines such as smart phones, humanoid robots, self-driving cars, etc. However, there are still big hurdles to build a system that demonstrates attractive functions appearing in biological systems, such as single molecule recognition, highly efficient biomolecular production, biocompatibility and self-healing/self-reproducing ability etc… To achieve this function, we have studied biohybrid machines that harnesses the living system within artificial systems. In this symposium, I would like to talk about a couple of our recent results regarding biohybrid sensors and actuators.

12:45 **Keynote Presentation**

Towards Wearable Microfluidic Devices for Well-Being and Personalized Healthcare

Martyn Boutelle, Professor of Biomedical Sensors Engineering, Vice Chair Department of Bioengineering, Imperial College London, United Kingdom

Advances in microfluidic technologies, electronics and sensors, combined with the phenomenal growth in mobile computing power provided by current tablets and mobiles allow us to imaging finally taking the 'lab-on-a-chip' away from its laboratory full of control equipment. Through miniaturization and carefully engineered smart designs we can embed computer control and analytical best practice into portable even wearable devices that are able to compensate for shortcomings such as falling performance. These hybrid microfluidic systems appear to their target users as simple stable systems that tell them what they want to know. My group specializes in designing and building such microfluidic systems to meet the needs of acute critical care medicine. Key molecular markers are measured using both optical and electrochemical sensors and biosensors. We then work with clinical care teams to show proof of concept of the real-time continuous chemical information that microfluidic systems can produce. Our ultimate goal is that such systems can be used to monitor patients and guide therapy in a patient-specific, personalized way.

13:15 Networking Lunch in the Exhibit Hall and Poster Viewing in the Grote Zaal

Day 1 – 18 June 2019 – Afternoon Concurrent Tracks
Full Speaker Presentation Abstracts Online at selectbio.com Under the Respective Conference Website

Lab-on-a-Chip and Microfluidics Europe Track **Location: Jurriaanse Zaal**	**Organ-on-a-Chip & Tissue-on-a-Chip Europe Track** **Location: Van Cappellen Zaal**	**Point-of-Care Diagnostics, Biosensors & Mobile Diagnostics Track** **Location: Leeuw/Keuris/Schat Room**
Session Title: Lab-on-a-Chip and Microfluidics 2019, Emerging Themes	Session Title: Organs-on-Chips 2019, Emerging Themes	Session Title: Emerging Trends and Themes in Point-of-Care Diagnostics and Mobile Diagnostics
	14:00 *Lunch Time Presentation on Policy: Advancing Nonclinical Regulation, Policy, Science, Education and Training in the United States* **Kristie Sullivan, Vice President for Research Policy, Physicians Committee for Responsible Medicine, United States of America**	
14:15 **Keynote Presentation** *Janus Catalytic Micromotors: From Mobile Sensors on Lab-on-a-Chips to Mobile Reactors for Tailored Synthesis of Nanoparticles* **Alberto Escarpa, Full Professor of Analytical Chemistry, University of Alcalá, Spain**	14:15 **Keynote Presentation** *Human-on-a-Chip Systems for Use in Efficacy and Toxicological Investigations for Applications in Neurological Diseases* **James Hickman, Professor, Nanoscience Technology, Chemistry, Biomolecular Science and Electrical Engineering, University of Central Florida; Chief Scientist, Hesperos, United States of America**	14:15 *Commercialization of Microfluidic Devices for Point-of-Care Applications* **Vincent Linder, Founder and President, CDP BioMedical Consulting, Portugal**
14:45 **Keynote Presentation**	14:45	14:45

Microtubular Origami MEMS and NEMS **Oliver Schmidt, Professor & Director, Leibniz-Institut für Festkörper- und Werkstoffforschung, Germany**	*Three-Dimensional Blood Vessels-on-Chips: Perfusion With Blood and Integration Into Organs-on-Chips* **Andries D. van der Meer, Tenure Track Assistant Professor, Faculty of Science and Technology, University of Twente, The Netherlands**	*Bio-Inspired Laser-Induced Electrochemical Sensing Strategies: Antigen/Nanobody-based Magnetosensing* **Karolien De Wael, Professor, Antwerp University, Belgium**
15:15 *Luminescent Solar Concentrator Photomicroreactors* **Timothy Noël, Associate Professor, Eindhoven University of Technology, The Netherlands**	15:15 **Keynote Presentation** *Advanced Organ-on-a-Chip Systems: Integrated Microphysiological Platforms Recapitulating Complex Human Tissue* **Peter Loskill, Assistant Professor for Experimental Regenerative Medicine; Attract Group Leader Organ-on-a-Chip, Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, Eberhard Karls University Tübingen, Germany**	15:15 *Label-Free Biosensing With Impedimetric and Thermal Detection Methods* **Patrick Wagner, Professor, Soft-Matter Physics and Biophysics Section, Departement Natuurkunde en Sterrenkunde, Katholieke Universiteit Leuven, Belgium**
15:45 Afternoon Coffee and Tea Break and Networking in the Exhibit Hall		
16:15 *An Open Platform for Microfluidic Sample Prep* **Richard Spero, CEO, Redbud Labs, United States of America**	16:15 *Nanotechnology Enabling Advanced Organ-on-Chips* **Dries Braeken, R&D Manager, Life Science Technologies, IMEC, Belgium**	16:15 *Rapid Diagnosis of Breast Cancer: Innovative Approaches with a Focus on Low Resource Setting* **Jane Brock, Chief of Breast Pathology, Brigham and Women's Hospital, Harvard Medical School, United States of America**
16:45 *Scalable Wafer Level Production of Consumables for Life Science and*	16:45 *Microfabrication Technologies for Engineering a Joint-on-Chip*	16:45

Diagnostics Applications Made of Non-CMOS Compatible Materials on Glass. Challenges and Opportunities by Addressing Manufacturing and Standardization in a Foundry Concept **Alexios Tzannis, Business Development Manager Life Sciences, IMT Microtechnologies, Switzerland**	**Marcel Karperien, Professor, University of Twente, The Netherlands**	*Paper-based Analytical Devices for the Diagnosis and Monitoring of Infectious Diseases at the Point of Care* **Jean-Manuel Segura, Professor, University of Applied Sciences and Arts Western Switzerland Valais, Switzerland**
17:15 *All in One – Advanced Technologies for Complex Low Cost Microfluidic Devices in Glass, Silicon and Quartz* **Klaus Kadel, Business Development, Little Things Factory GmbH, Germany**	17:15 *Immunocompetent Gut-on-a-Chip as a Model of Tissue Inflammation* **Michael Bscheider, Group Leader, Roche Pharma Research and Early Development, Switzerland**	17:15 **Keynote Presentation** *Nanobiosensors for Diagnostics Applications* **Arben Merkoçi, ICREA Professor and Director of the Nanobioelectronics & Biosensors Group, Institut Català de Nanociencia i Nanotecnologia (ICN2), Barcelona Institute of Science and Technology (BIST), Spain**
17:45 **Keynote Presentation** *Free-Surface Microfluidics and SERS or High Performance Sample Capture and Analysis* **Carl Meinhart, Professor, University of California-Santa Barbara, United States of America**	17:45 *Functional Coupling of Human Pancreatic Islet Microtissues and Liver Spheroids in a Novel Micro-Physiological Multi-Organ System for Studies of Human Metabolic Diseases in Drug Discovery* **Carina Ämmälä, Team leader, Cardiovascular, Renal and Metabolism, AstraZeneca, Sweden**	17:45 *Low-Q-Whispering Gallery Modes-A New Platform For Label-Free Investigation of Surface Processes* **Lars Dähne, Founder & Managing Director, Surflay Nanotec GmbH, Germany**
18:15 Networking Reception with Beer and Wine in the Exhibit Hall -- Meet Colleagues and Network with Exhibitors		
19:15 Close of Day 1 of the Conference		

Day 2 – 19 June 2019 – Agenda for the Concurrent Tracks
Full Speaker Presentation Abstracts Online at selectbio.com Under the Respective Conference Website

Lab-on-a-Chip and Microfluidics Europe Track Location: Jurriaanse Zaal	Organ-on-a-Chip & Tissue-on-a-Chip Europe Track Location: Van Cappellen Zaal	Point-of-Care Diagnostics, Biosensors & Mobile Diagnostics Track Location: Leeuw/Keuris/Schat Room
07:00 Morning Coffee and Tea Plus Networking in the Exhibit Hall		
Session Title: Microfluidics Technologies and Applications	Session Title: Organ-on-a-Chip and Tissue-on-a-Chip: Technologies Meet Applications	Session Title: Technologies in Biosensors and Point-of-Care, Point-of-Need Diagnostics
07:30 *Photochemical Generation of Biofunctionalized Micro Sponges Via Two Phase Flow for Lab-on-a-Chip Applications* **Thomas Brandstetter, Group Leader, Freiburg University, Germany**	07:30 *A Microphysiolgical Model of Vasculature and MSC-derived Tissue Interaction* **Ian Whelan, Lead Author, Researcher, Trinity Biomedical Sciences Institute, Ireland**	07:30 *Monitoring and Diagnosis of Bacterial Infections, Using Micro and Nanotechnology* **Winnie Svendsen, Associate Professor, Technical University of Denmark**
	07:45 *Deep Organ: How Machine Learning Can Improve Organs on a Chip Experiments* **Davide Di Giuseppe, Researcher, University of Rome "Tor Vergata", Italy**	
08:00 *Microfluidic Assay for the Diagnosis of Sepsis from a Drop of Blood* **Daniel Irimia, Associate Professor, Surgery Department, MGH Harvard Medical School, United States of America**	08:00 *Bioengineered 3D Vascularized Glioblastoma Model* **Guohao Dai, Associate Professor, Department of Bioengineering, Northeastern University, United States of America**	08:00 *Planar Waveguide Biosensor Technology for Next Generation Point of Care Diagnostics* **Reuven Duer, Founder & CEO, Proactive Diagnostics, Inc., United States of America**
08:30	08:30 **Keynote Presentation**	08:30

Microfluidic Platforms with Bioinspired Functionalities: New Concepts for Future Devices **Dermot Diamond, Professor, National Centre for Sensor Research, Dublin City University, Ireland**	*"Cancer-on-a-Chip": Basic and Translational Studies in Cancer Biology* **Steven C. George, Professor and Chair, University of California, Davis, United States of America**	*Smart Thermometers: Screening for Biomarkers Using Molecularly Imprinted Polymers (MIPs) Combined with Thermal Detection* **Marloes Peeters, Lecturer, Manchester Metropolitan University, United Kingdom**
09:00 *Digital Microfluidics, Droplet Microfluidics, Centrifugal Microfluidics: Non-Contact Liquid Handling in the pL- and nL-Volume Range* **Eckhard Nordhoff, Chief Scientific Officer, M2-Automation, Germany**	09:00 *It's the Economy – Industrial Aspects of Organ-on-a-Chip Device Manufacturing* **Holger Becker, Chief Scientific Officer, Microfluidic ChipShop GmbH, Germany**	09:00 **Keynote Presentation** *Origami Paper Folding Enabling DNA Diagnostics in Under-served Rural Communities East Africa* **Jonathan Cooper, Wolfson Professor and University Vice Principal, Glasgow University, United Kingdom**
09:30 *FPC@DCU's Platform Strategy for Enabling Efficient Development of Robust and Manufacturable Lab-on-a-Chip Solutions for the Life Sciences* **Jens Ducree, Professor of Microsystems, Dublin City University, Ireland**	09:30 **Keynote Presentation** *Organ-on-a-Chip Technology as a Routine Tool in Drug Discovery and Development* **Paul Vulto, Managing Director, MIMETAS, The Netherlands**	09:30 **Keynote Presentation** *A Microfluidic Immunoassay Format for the Determination of Cardiac Troponin T at the Point-of-Care* **Eloisa Lopez-Calle, Head Assay Formats, Roche Diagnostics GmbH, Germany**
10:00 *Microfluidics for Biotech Applications: Overview of Technologies and Market Trends* **Sébastien Clerc, Technology & Market Analyst, Microfluidics & Medical Technologies, Yole Développement, France**	10:00 *Phenotypic Screening in 3D Culture Including ECM: Advantages and Challenges* **Nathalie Maubon, CEO/CSO, HCS Pharma, France** **Grégory Maubon, Digital Coordinator, HCS Pharma, France**	10:00 *Embracing Chaos – A Simplified Platform for Multiplexing Digital Assays in Polydisperse Droplets* **Samantha Byrnes, Research Scientist, Intellectual Ventures Laboratory, United States of America**
10:30 Morning Coffee and Tea Break and Networking in the Exhibit Hall		

11:00 *3D-Printed Microfluidics for Automation of Large-Library Molecular Selection Against Cancer Targets* **Noah Malmstadt, Professor, Mork Family Dept. of Chem. Eng. & Mat. Sci., University of Southern California, United States of America**	11:00 *Going 3D All the Way: 3D Microtissues in Modular Organ-on-a-Chip Solutions For Human-Centric Drug Discovery* **Jan Lichtenberg, CEO & Co-Founder, InSphero AG, Switzerland**	11:00 *Manufacturable Microfluidic Devices – Fine Tuning the Biochemistry and Fabrication* **Rosanne Guijt, Professor, Smart Sensing, Deakin University, Australia**
11:30 *High Resolution 3D Printing for Microfluidic and Organ-on-Chip Applications* **Aleksandr Ovsianikov, Associate Professor, Head of Research Group 3D Printing and Biofabrication, Technische Universität Wien (TU Wien), Austria**	11:30 **Keynote Presentation** *Human Vascular Microphysiological Systems to Model Genetic and Acquired Diseases* **George Truskey, R. Eugene and Susie E. Goodson Professor of Biomedical Engineering, Duke University, United States of America**	11:30 *Ultrafast and Sensitive qPCR-based Detection of Group B Streptococcus (GBS) in Patient Samples in a Matter of Minutes* **Maarten Fauvart, R&D Team Leader / Senior Scientist Life Science Technologies, IMEC, Belgium**
12:00 **Keynote Presentation** *Probing Proteins in Small Volumes* **Tuomas Knowles, Professor of Physical Chemistry and Biophysics, Department of Chemistry & Cavendish Laboratory, University of Cambridge, United Kingdom**	12:00 *A Breathing Human Lung-on-Chip for Drug Transport and Safety Studies* **Janick Stucki, CEO and Technical Director, AlveoliX AG, Switzerland**	12:00 *The Legal and Regulatory Landscape of Diagnostics Devices* **Erik Vollebregt, Partner, Axon Lawyers, The Netherlands**
12:30 *Come On Baby Light My Fire – Combining Photonics and Microfluidics* **Holger Becker, Chief Scientific Officer, Microfluidic ChipShop GmbH, Germany**	12:30 **Keynote Presentation** *Tomorrow Today: Organ-on-a-Chip Advances Towards Clinically Relevant Pharmaceutical and Medical in vitro Models* **Peter Ertl, Professor of Lab-on-a-Chip Systems, Vienna University of Technology, Austria**	12:30 *Revisiting the Point of Care – Changes to U.S. FDA Policies on CLIA Waivers and Opportunities in POCT* **James Boiani, Partner, Epstein Becker & Green, P.C., United States of America**

13:00 Networking Lunch in the Exhibit Hall and Poster Viewing		
	13:30 Luncheon Panel Discussion Moderated by Dr. Richard Spero, CEO, Redbud Labs Title: **"The Business of Microfluidics: Markets, Regulations, and Intellectual Property"** **Location: Van Cappellen Zaal** <u>Panelists</u>: Erik Vollebregt, Axon Lawyers, NL James Boiani, Epstein Becker & Green, US	13:30 *Luncheon Technology Spotlight Presentation: BioDot, Inc. Provides Non-contact, Low Volume Dispensing Solutions Valuable in the Biosensor Industry* **Chris Fronczek, Application Scientist, BIODOT, Inc., United States of America**
13:45 *Luncheon Technology Spotlight Presentation: Precise Contactless Spotting for Lab-on-Chip Applications* **Beate Poulson, Sales Manager, microdrop Technologies GmbH, Germany**		
14:00 **Keynote Presentation** *Optofluidic Imaging Flow Cytometry* **Andrew J. deMello, Professor of Biochemical Engineering & Institute Chair, ETH Zürich, Switzerland**	14:00 **Keynote Presentation** *Modeling the Embryonic Neural Tube in a Chip* **Thomas Laurell, Professor, Lund University, Sweden**	14:00 **Keynote Presentation** *Integrating Aptamer Technology with Paper-Based Point-of-Care Devices for Biomedical Monitoring* **John Brennan, Professor and Director, Biointerfaces Institute, McMaster University, Canada**

14:30 *Tunable Flow Confinements for Microscale Molecular Analysis on Tissues* **Govind Kaigala, Research Staff Member, IBM Research Laboratory-Zürich, Switzerland**	14:30 *Reverse Bioengineering for Precision Medicine* **Ken-ichiro Kamei, Associate Professor, Institute for Integrated Cell-Material Sciences (WPI-iCeMS), Kyoto University, Japan**	14:30 **Keynote Presentation** *Precise, Intelligent, Mobile and Secure POC Diagnostics: How Can Tech Help?* **Emmanuel Delamarche, Manager Precision Diagnostics, IBM Research - Zurich, Switzerland**
15:00 Afternoon Coffee and Tea Break and Networking in the Exhibit Hall		
15:30 Poster Awards	**15:30 Poster Awards**	**15:30 Poster Awards**
15:45 *High-Precision Overmolding as New Fully Automated, Integrated Method to Seal Microfluidic Devices for Demanding High-Volume Applications* **Andreas Schäfert, Director Business Development Medical Devices, Wilhelm Weber GmbH, Germany**	15:45 *THE LIVE CELL SHIPPER - A Portable CO_2 Incubator to Revolutionize Biopharmaceutical Supply Chain Programs* **Hans Nagels, COO and Managing Director, Cellbox Solutions GmbH, Germany**	15:45 *Novel Bioinstrumentation for Organ to Single Cell Imaging* **Barbara Smith, Assistant Professor, School of Biological and Health Systems Engineering, Arizona State University, United States of America**
16:15 *Development of Novel Single Cell Analysis Platforms to Dissect Cellular Heterogeneity* **Bart Westendorp, Assistant Professor, Faculty of Veterinary Medicine, Utrecht University, The Netherlands**	16:15 *Microvessel-on-a-Chip for Investigating Glioma-Vascular Interactions* **Yan Yan Shery Huang, University Lecturer in Bioengineering, University of Cambridge, United Kingdom**	16:15 *Enzymatic Biosensor to Support the Diagnosis of Adrenal Gland Tumors* **Michael Schöning, Professor and Director, Institute of Nano- and Biotechnologies, Aachen University of Applied Sciences, Germany**
16:45 *Single-Cell Dynamic Profiling of Cytokine Secreting Immune Cell* **Christophe Vedrine, Head of Biological Microsystems and Advanced Optics Engineering Unit, Bioaster, France**	16:45 *Towards Human on a Chip* **Danny van Noort, Associate Professor, Linköping University, Sweden**	16:45 *The SnapChip™ for a Precise Chip-to-Chip Transfer of Nanodroplets* **Sebastien Bergeron, Founder and CEO, Parallex BioAssays Inc., Canada**

17:15 *Image-based Measurement Systems and Image-Processing Tools for Micromixers and Droplet Microfluidics* **Gökhan Ergin, Product Manager, CTA & Microfluidics, Dantec Dynamics A/S, Denmark**	17:15 *Multiscale Computational Tools for Model-guided PK/PD Simulations on Human Body-on-Chips (HuBoC)* **Andrzej Przekwas, Chief Technology Officer, CFD Research Corp, United States of America**	17:15 *Translating Microfluidic Devices from the Academic Benchtop to the Point of Care via Extrusion-Based 3D Printing* **E. Brandon Strong, NSF Graduate Fellow, California Polytechnic State University, United States of America**
17:45 *Cancer Cell Spheroids as 3D Model for Drug Screening In Droplet-based Microfluidics* **Mario Saupe, Researcher, Institut für Bioprozess- und Analysenmesstechnik e.V. Heiligenstadt, Germany**	17:45 Close of Conference	17:45 Close of Conference
18:00 *Design of Deterministic Lateral Displacement Microfluidic Separators for Bioclinical Applications: Where Do We Stand?* **Stefano Cerbelli, Associate Professor, Dipartimento di Ingegneria Chimica, Sapienza Università di Roma, Italy**		
18:15 *Fabrication via DLP® Stereolithography and Characterization of Microfluidic Cartridges Suitable for Polymerase Chain Reaction (PCR)* **Charalampos Tzivelekis, Researcher, Newcastle University, United Kingdom**		
18:30 Close of Conference		

List of Posters and Associated Abstracts

Poster #	1
Poster Title:	Towards tailored formulation and real-time evaluation of drug nanocarriers performance using microfluidic technology
Poster Presenter Name:	Adrianna Glinkowska
Affiliation:	Eindhoven University of Technology

Abstract:

Drug nanocarriers have gained considerable attention in the development of treatment for various diseases and the field of theragnostics. The nanoscale size, in combination with capability of co-encapsulation of molecules, makes the nanoparticles promising candidates in drug delivery.

Microfluidic systems became a powerful tool in formulation of pharmaceutical products, thanks to their unique capacity to produce batches with desired particle features and high reproducibility. Those attributes play the key role in the drug delivery system performance, therefore it is important to control them.

We focus on microfluidic device-assisted nanoprecipitation to formulate 40 – 120 nm PLGA-PEG nanoparticles, in a stabilizers free process. Nanoparticles are suitable for parenteral route of administration and thanks to the color-coding, their effectiveness can be quickly assessed. We developed a 3D perfusable cancer-on-a-chip model recapitulating tumor microenvironment, suitable for evaluation of nanocarrier extravasation, stability and accumulation. The compatibility of the platform with microscopy techniques allows for real-time monitoring of the nanocarrier performance. Synergy of the combinatorial nanoprecipitation and biomimicking screening platform brings us one step closer to the doorstep of personalized nanomedicine.

Poster #	2
Poster Title:	Bio-electronic Cell Based Implant for Multiple Sclerosis Treatment
Poster Presenter Name:	Alejandra Benaissa
Affiliation:	EuroCat Barcelona

Abstract:

The implementation of electronic systems in the human body has led to numerous medical progresses. New emerging therapies invest in this area supporting advances and benefits stemming from genetics and cell-based therapy for addressing unmet needs for the caregivers and the patient.

The present device developed within the framework of Optogenerapy Project represents an innovative and effective therapeutic delivery with an impact on slowing the disease progression and increasing the Multiple Sclerosis patients' quality of life. This implant is based on wireless powered optogenetics technology which combines genetics and optics techniques to control and monitor activities of cells in a living tissue with light to directly and remotely control cells using Near Infrared Light (NIR) to produce themselves the necessary IFN-ß drug.

The cells are confined within a chamber sealed by a porous membrane for safe drug release, preventing immune rejection. Morover, replacing standard intravenous IFN-ß delivery by subcutaneous delivery prevents the side effects of current cellular therapies and efficiency-losses related to drug peaks and discontinuation, while saving non-adherence costs.

The technology developed in this work can be used as a multifunctional platform to revolutionize the therapeutic protein delivery in several clinical conditions focusing on the emerging field of theranostics.

Poster #	3
Poster Title:	Virtual prototyping and automated lab-on-chip and biosensor simulator for first step design
Poster Presenter Name:	Alexi Bonament
Affiliation:	PhD Student

Abstract:

Recently, lab-on-chips have become an important field of research at the interface between engineering science and biotechnologies. The lab-on-chip is composed of: biochemical reactions, a microfluidic system, biosensors and an electronic circuit for driving, processing and conditioning the signal. Their current technological limits for their industrial development are two types: 1) The absence of standard, reliable and repeatable manufacturing technologies. 2) The inherent complexity of their design, mixing different fields such as biology, microfluidics and electronics.

During the last 10 years, several investigations on the development of CAD tools dedicated to this technology have been reported in the literature have led. Literature work presented mainly revolves around the modelling and simulation of microfluidic circuits using Kirchhoff laws which can then be implemented on an electronic simulator. In lab-on-chip devices, the analysis area is a critical part. To handle this issue, we developed a simulator which takes the geometry of reaction into account. It combines compact models for microfluidics channels (using analogue equivalent circuits), resolution of Navier-Stockes equations at the steady states and a convection-diffusion model for chemical species solved with a finite difference approach. Simulations are performed with SPICE and Python interfaces are built in order to interface the different bricks of the software environment. Our simulator has been validated by comparison with COMSOL simulation results on several use cases.

Poster #	4
Poster Title:	Investigating the PK/PD/efficacy relationship of PI3K inhibitors in vitro, enabled by a microfluidic addition and removal device
Poster Presenter Name:	Alysha Bray
Affiliation:	CN-Bio innovations

Abstract:

Understanding pharmacokinetics (PK), pharmacodynamics (PD), and efficacy, is critical during the drug discovery process. The PK/PD/efficacy relationship for oncology medicines has historically been characterized in xenograft models. We explored an in vitro methodology, utilizing a microfluidic device, to study PK/PD/efficacy relationships. The device is capable of precision dosing and aspiration from standard culture well plates, to recapitulate PK-like profiles of compounds, or a combination of compounds, in vitro. BYL719 is a PI3K inhibitor which was tested on T47D (breast) and A549 (lung) oncology cell models. Using the device, we generated PK-like profiles for BYL719 (t1/2 6 hours), mimicking in vivo clearance profiles. Cellular p-AKT levels were initially reduced, in accordance with the PK-like profile, and recovered at 24 hours, replicating xenograft model data. PK-like dosing efficacy studies were performed for 3 consecutive days, mimicking daily dosing. As anticipated, cell growth inhibition was reduced but not as significantly as conditions with bolus drug addition at the Cmax concentration.

This study demonstrates how the device recapitulates PK-like profiles in vitro and allows for further exploration of the PK/PD/efficacy relationship. Availability of an in vitro method will enable these parameters to be interrogated earlier within the drug discovery process.

Poster #	5
Poster Title:	Lab on a Chip Approach to Develop Clot Imaging Based on Fibrin Targeting
Poster Presenter Name:	Andrea Viteckova Wunschova
Affiliation:	Veterinary Research Institute, Czech Republic

Abstract:

Thromboembolic diseases like myocardial infarction, ischemic stroke, pulmonary embolism and leg ischemia are leading causes of mortality and morbidity worldwide. Better imaging methods to reveal blood vessels occlusions and targeted thrombolysis could improve the patients' clinical outcome. In order to address such challenge fibrin a major component of blood clots was targeted.
A flow-through model of middle cerebral artery was fabricated out of silicone by means of 3D printed sacrificed element. The occlusion within the model was achieved with whole blood clot. Fibrin binding peptides were linked to liposomes carrying rhodamine. The fluorescence microscopy was used to evaluate the clot targeting. After that confocal microscopy was used to determine how deep the probe penetrated.

Data show the probe is able to bind to fibrin under flow condition and penetrate under clots surface layer. Taken together the fibrin targeting is a viable approach to detect vessel occlusions and to deliver thrombolytic agents.

Poster #	6
Poster Title:	Conceptual Design and Development of an Organ-on-Chip Research tool to Investigate the Initiation, Progression and Treatment of Bacterial Vaginosis
Poster Presenter Name:	Angel Naveenathayalan
Affiliation:	Brunel University

Abstract:

Bacterial Vaginosis (BV) is one of the most common vaginal disorders suffered by women, yet its aetiology is unknown. This condition desperately needs a new approach to developing effective treatment, as it is known to affect ~ 50% of the female population in the developing world and ~ 33% of women in the developed world. The disease is thought to be a result of ecosystem disruption with overgrowth of opportunistic pathogens rather than a single pathogen infection. Multi-species microbial biofilms and decrease in Lactobacillus crispatus are known to be the major aspects in BV; however, the initial process which causes this is unclear. Antibiotics or vaginal cream/gel are usually prescribed to treat the infection; however, reoccurrence is common. At present, there is no effective treatment for this condition. New studies are now focusing on the new paradigm Organ-on-Chip (OOC). This project involves creating a sophisticated 3D microfluidic tool the Vagina-on-a-Chip (VOC) which involves multidisciplinary research that will mimic the mechanical, biochemical and physical aspects of the vaginal tissue. The main aim of our work is to use the VOC platform to study the factors that cause disruption of the vaginal microbiome and the interaction between the vaginal epithelial cells and bacteria strains, to improve female healthcare.

Poster #	7
Poster Title:	Shape design dependent performance of DLD (deterministic lateral displacement) based particle separation systems - FEM modelling and validation
Poster Presenter Name:	Anita Bányai
Affiliation:	Hungarian Academic of Science Centre for Energy Research

Abstract:

Size dependent sorting of components is essential for effective sample preparation in Lab-on-a-Chip systems. Our goal is to achieve separation of bacteria from residues of urine having diverse sizes, shapes. Engineering of complex microfluidic systems generally relies on Computational Fluid Dynamics (CFD) simulations. However, particular size, shape, and friction effects need additional sophistication in the application of traditional particle tracing methods.

DLD microchannels were fabricated by soft lithography with six pillar cross-sections: circle, square and triangles with various orientation to test the separation efficiency depending on their shape and arrangement. A suspension of fluorescently labelled microbeads (with 16.5 and 20.4 µm diameters) and Human Serum Albumin (FITC-HSA) were focused between buffer fluids in the device. The separation efficiencies of the individual structures were quantified by the range of bead-deflection from the centred flow. Molecular diffusion was captured by recording the concentration of the diluted FITC-HSA along the channel.

Pillars' shape and configuration strongly influence not only the DLD effect, but the concentration profiles determined mainly by diffusion in laminar flow. Deflection of particles and spreading of focused sample stream were explained by FEM simulation considering the

pressure distribution and transversal flow generated by inhomogeneous hydrodynamic resistance due to asymmetries.

Poster #	8
Poster Title:	The Development of an OOC Automated Platform: Breast-on-a-Chip (BOC)
Poster Presenter Name:	Aya Aly
Affiliation:	Brunel University London

Abstract:

Breast cancer is the most common cancer in women in both the developed and less developed world. Due to its complex aetiology and pathophysiology, breast cancer requires substantial research to increase understanding of the risk factors associated with the disease and to develop novel therapies. As such, we require the development of a reliable experimental model, which recapitulates breast cancer in humans. Based on the increasing ethical and financial issues concerning animal testing and the fact that animals often lack the same physiology as humans, there is significant demands for the development of OOC technologies, which replicate the mammary gland and the process of carcinogenesis, allowing the robust study of the disease. This project aims to develop a BOC system and an automated integrated OOC platform for long-term monitoring of breast cell culture.

Poster #	9
Poster Title:	The stiffer the better? Understanding the influence of matrix stiffness on cartilage formation
Poster Presenter Name:	Barbara Bachmann
Affiliation:	Vienna University of Technology

Abstract:

Successful engineering of an articular cartilage-on-a-chip is vital to tackle degenerative diseases such as osteoarthritis. The lack of a functional in vitro system is, in part, due to a gap in the understanding of the mechanobiological aspects regulating formation and maintenance of articular cartilage. A crucial step towards bridging this gap can be attained by emulating the cellular microenvironment through precise tuning of the extracellular matrix stiffness. In this work, primary human chondrocytes were embedded in hydrogels with a defined stiffness. The hydrogels were tuned to achieve matrix stiffnesses of 1 kPa, 15 kPa and 30 kPa Young's Modulus using Rheology. Subsequently, the interplay of matrix stiffness and TGF-b3 on the chondrocyte viability, morphology, gene expression and extracellular matrix formation was determined. Upon embedding in fibrin hydrogel, all chondrogenic markers increased significantly, with the best results obtained in hydrogels of 30 kPa Young's Modulus. In contrast, dextran-based hydrogels displayed similar redifferentiation behavior despite a significant impairment in cellular viability. Successful modelling of articular cartilage in an organ-on-a-chip system requires a deeper understanding of the relationship between chondrocytes and their surrounding tissue, which can be achieved by characterization and optimization of the cellular in vitro environment.

Poster #	10
Poster Title:	Additive Manufacturing Processes for Printing Chip Systems with Embedded Pre-vascularized 3D Cell Cultures
Poster Presenter Name:	Bastian Böttcher
Affiliation:	Ernst-Abbe-University Jena

Abstract:

We present a manufacturing process of chip systems of perfusable bioreactors with embedded 3D cell cultures by using a bioprinting system with various tools. The bioreactor was fabricated by melting cyclo olefin copolymer (COC) granulate and print it on a COC slide using a piston-based extrusion system. The bioreactor consists of two pump-adaptors that are connected to an open chamber for the 3D-cell culture. Bioprinting was performed with a rheologically optimized hydrogel blend of alginate and gelatin that showed a very good printability with air pressures less than 100 kPa by using a 250 µm nozzle. At this pressure, the cell viability of HepG2 cells remained greater than 90%. Additional $CaCl_2$ as a fast crosslinker for alginate and transglutaminase for crosslinking gelatin will be used. Hollow channels for homogeneous nutrient distribution are printed simultaneously into the construct using a core/shell extruder. Gelatin solved in $CaCl_2$ was used as the core-material and the gelatin-alginate blend as shell-material which was crosslinked immediately during the printing process. Prior to transglutaminase-crosslinking, the construct is heated to 37°C to liquefy the gelatin which will be washed out afterwards. After the whole pre-vascularized 3D cell culture construct is printed and crosslinked, the bioreactor is sealed using a pressure sensitive foil. To enhance the information-value of such tests, endothelial cells can be seeded in the shell-material for printing simple blood vessels models.

Poster #	11
Poster Title:	Diagnostics for Traumatic Brain Injury: Raman Spectroscopy of the Retina and Optic Nerve
Poster Presenter Name:	Carl Banbury
Affiliation:	University of Birmingham

Abstract:

An unbiased quantitative, fast and accurate point-of-care method to diagnose TBI would fundamentally change current triaging and patient outcomes in scenarios such as sporting injuries, military, and roadside accidents.

Our focus is on using optical spectroscopy to measure subtle chemical changes to brain chemistry using the eye as an optical window to the brain. Sitting at the back of the eye, the optic nerve forms part of the central nervous system and is bathed in cerebrospinal fluid, which is in continuity with the rest of the brain.

For the first time, we show from a murine model that changes observed via Raman spectroscopy of the brain as a result of TBI, can also be detected distant from the injury site at the retina and optic nerve with a high degree of accuracy.

Poster #	12
Poster Title:	Compact plasmonic multichannel spectroscopic sensor platform
Poster Presenter Name:	Cédric Lenaerts
Affiliation:	Centre Spatial de Liège / Université de Liège

Abstract:

We present a hybrid plasmonic sensor architecture, as well as its first experimental proof-of-concept demonstrating its practical feasibility. The proposed approach supports two detection formats on the same lab-on-chip device: surface plasmon resonance (SPR) and localized surface plasmon resonance (LSPR) biosensing. The developed instrumental platform is dedicated to multichannel microfluidic biosensing and a specific microfabrication technique involving gold nanoparticles synthesis by pulsed laser writing was developed for the LSPR part. We experimentally demonstrate that the use of the total internal spectroscopic reflectometry can significantly enhance the LSPR sensor sensitivity to refractive index variations of the liquid sample.

Poster #	13
Poster Title:	INvitro DIagnostics for CAncer TEsting (INDICATE): Developing novel nanoparticle-based detection technology for POC liquid biopsy testing in cancer
Poster Presenter Name:	Charles Lawrie
Affiliation:	Biodonostia Research Institute

Abstract:

We are developing a novel system for the detection of clinically relevant single nucleotide mutations in the blood of cancer patients. We have focused our initial work on detection of a companion diagnostic biomarker for lung cancer, the L858R mutation of the EGFR gene. The technology is based upon the specific agglomeration of nanoparticles in the presence of DNA sequences containing single nucleotide mutations. The irradiation of these agglomerates results in localized temperature increases through plasmon resonance which is used to open thermo-responsive capsules containing high numbers of signal molecules. We are developing the technology to use this release of signal molecules as the input for a simple off-the-shelf LFA format without the need for optical or electronic based detection systems. In summary, our aim is to develop an easy-to-use, economic and truly portable POC diagnostic platform technology that can be readily exploited for use in many indications including (m)any cancer types, infectious diseases, veterinary use and anywhere else where infrastructure requirements are challenging.

Poster #	14
Poster Title:	Annealed Graphene Oxide Fluorescent Platform for Circulating Tumor DNA Detection
Poster Presenter Name:	Chong-You Chen
Affiliation:	Department of Electrical and Computer Engineering, College of Electrical and Computer Engineering, National Chiao Tung University

Abstract:

In recent years, circulating tumor DNA (ctDNA) has gradually highlighted its potential for detection and diagnosis. However, their low concentration has limited their clinical utility. Several studies had use fluorophore-labeled ssDNA probe adsorbed on graphene oxide (GO) as a well-established sensing platform for DNA detection. However, the efficiency fluorescence resonance energy transfer (FRET) and probe absorption ability of GO influence the sensing performance. To deal with the challenge, we developed a novel platform interfaced with annealed GO for attaching fluorescent DNA probe to specifically detect ctDNA for thyroid cancer with BRAF V600E mutation in a highly sensitive manner. The oxygen functional groups form clusters on annealed GO based on the mild thermal annealed procedure create more sp2 domain enhance DNA probe absorption and fluorescence quenching efficiency. Here, we compared the ctDNA detection sensitivity between GO and annealed GO based fluorophore-labeled DNA probe platform. We observed that sensor with annealed GO has higher signal-to-noise compare to GO. The nonspecific displacement by non-target ctDNA is slightly decreased due to the better DNA absorption ability of annealed GO. Overall, the result proved that annealed GO was a highly potential material in GO-based sensing platform for ctDNA detection.

Poster #	15
Poster Title:	SYSTEM ENGINEERING FOR MICROFLUIDIC APPLICATIONS
Poster Presenter Name:	Christian Freese
Affiliation:	Fraunhofer IMM

Abstract:

The microfluidic chip is usually at the heart of a microfluidic lab-on-a chip application. However, to really make use of such a microfluidic component in practical application a dedicated operating device design is required. For example, by combining a microfluidic chip design with adapted sample preparation and storage technologies, real-time data analysis as well as optimized macro fluid handling solutions, advanced functionality of the overall system can be gained. Here, we present a selection of microfluidic systems developed at Fraunhofer IMM, which highlight the interplay of microfluidic chip design and system engineering. All these systems realize a solution for a particular biomedical application reaching from CTC (circular tumor cell) isolation from whole blood, over PCR amplification for viral detection in nasal swab samples to the characterization of exosomes from patient plasma.

Poster #	16
Poster Title:	Functional and Mechanistic Neurotoxicity Profiling Using Human iPSC –Derived Neural Spheroid 3D Cultures
Poster Presenter Name:	Christian Holz
Affiliation:	Molecular Devices

Abstract:

Neurological disorders affect millions of people worldwide and appear to be on the rise with environmental factors being a suspected contributor. To address the urgent need for more complex, biologically relevant and predictive in-vitro assays, a human induced pluripotent stem cell (iPSC)-based 3D neural platform composed of mature cortical neurons and astrocytes was optimized for high throughput screening to assess neurotoxicity in larger compound sets. Multi-parametric analysis of spontaneous calcium oscillations exhibited by the neural spheroids included the oscillation rate, peak width, amplitude, and waveform irregularities. Cellular and mitochondrial toxicity were assessed by high-content imaging. For assay characterization, we used a set of neuromodulators with known mechanisms of action as well as set of selected known neurotoxic compounds. A screen of 87 pharmaceutical drugs, pesticides and flame retardants revealed that 57% of the compounds tested exhibited effects that were ranked according to their effective concentrations in-vitro. These result show that the iPSC-derived 3D neural spheroid assay platform is a promising biologically-relevant tool to assess the neurotoxic potential of drugs and environmental toxicants.

Poster #	17
Poster Title:	MultiSphere - A microfluidic multi-sized spheroid microarray for life science applications
Poster Presenter Name:	Christoph Eilenberger
Affiliation:	TU Wien

Abstract:

The enhanced predictive power of 3D multi-cellular spheroids in comparison to conventional monolayer cultures makes them a promising drug screening tool. However, clinical translation for pharmacology and toxicology is lagging its technological progression. To meet the growing need to improve the predictive power of toxicological, pharmaceutical and preclinical studies, the microfluidic multi-cellular spheroid array chip builds on the advancement of organ-on-a-chip technology that establishes, cultivates and supports a wide variety of multi-cellular spheroids. These aspects are particularly important because, in addition to the cell type, size is a critical parameter of any spheroid and organoid culture. Due the different sizes and geometries of the wells, different amounts of cells are captured within the cavities and thus, they aggregate to a 3D cell culture. It is well known that applied spheroid size and their size variation has a profound impact on the experimental outcome since spheroid size influences bioactivity, drug penetration barrier, expression profiles, signaling pathways and DNA repair mechanisms as well as cell cycle distribution. Applications of the chip are tailor - made toxicity-, differentiation- and cell staining protocols for specific cell lines of various types and origins.

Poster #	18
Poster Title:	High-Throughput Microfluidic Gut-on-a-Chip Models for Drug Discovery and Target Validation in Inflammatory Bowel Disease
Poster Presenter Name:	Claudia Beaurivage
Affiliation:	Galapagos BV, Leiden, The Netherlands Department of Biomedical Science, University of Sheffield, Sheffield, United Kingdom

Abstract:

Inflammatory bowel disease (IBD) is a group of chronic relapsing inflammatory diseases of the gastrointestinal tract. Patients suffering from IBD have presently limited options in terms of treatment due to the lack of physiologically-relevant models to study IBD. This study reports the development of two novel microfluidic gut-on-a-chip models that could lead to a better understanding of this complex pathology. The first model, simple and robust, is composed of the human cell line Caco-2 submitted to a pro-inflammatory trigger. Inflamed Caco-2 cells display loss of barrier function and increased cell activation; two important events of IBD pathology in patients. More importantly, we were able to prevent the establishment of inflammation by exposing the Caco-2 cells to known anti-inflammatory compounds as well as by decreasing the expression of inflammatory effectors by adenoviral knock-down. The second model, more complex and physiologically relevant, is a co-culture between human primary intestinal epithelial cells (IECs) and human primary macrophages, triggered by a mixture of cytokines and bacterial components. IECs and macrophages show increased cytokine production upon trigger, which could also be prevented by exposure to anti-inflammatory drugs used in IBD patients. Overall, we show two gut-on-a-chip that could be used to model IBD; a robust and simple one that could be used in high throughput screens

and a more complex and relevant one that could be used for refined purposed such as target validation or even personalized medicine. We hope that these models will lead to the discovery of novel drug targets to treat IBD patients more efficiently and accurately.

Poster #	19
Poster Title:	Array of roofed microwells suitable for the culture of light floating spheroids
Poster Presenter Name:	Daehan Kim
Affiliation:	Chung-Ang University

Abstract:

Microwell is used as a tool to generate spheroids for 3D cell culture. However, microwells have a problem that they cannot grow cells which have a lower density than culture media's density (ex. differentiated fat cells) because the upper surface of conventional microwell is open, which causes cell spheroids to float and disappear. So far, the popular way to grow floating cells is the hanging droplet method, however, it is labor-intensive and inappropriate for mass production. In this study, a roofed microwell (called 'Sigma-well') with the shape of Greek character, sigma (s), is fabricated by using the thermal expansion of the trapped air. When the air entrapped in the tilted PDMS substrate is heated, it expands and generates a spherical elliptical cavity inside the PDMS. Due to the presence of the roof, the floating cells can be cultured in the microwell without worries of escape. The production of Sigma-wells does not require conventional softlithography process which requires expensive equipment, and rather it can be produced through a cheap and simple process. The roofed Sigma-well system proposed in this study is expected to be used as a convenient tool for obesity-related research and other related cell biology studies in the future.

Poster #	20
Poster Title:	Microfluidic devices for cell culturing and electrochemical sensing of hydrogen peroxide and nitrite
Poster Presenter Name:	Daniel Rojas
Affiliation:	University of Teramo

Abstract:

Integration of electrochemical detection (ED) in cell culture is an advantageous strategy to detect the secretions from cultured cells. This is especially interesting for unstable species since they are not diluted prior to detection, so the minute quantities of species secreted be detected and quantified. Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) are a group of compounds of special interest because of their critical role in physiological processes like cellular signaling and immunological activity. However, an overproduction may cause the so-called oxidative stress (OS) which is able to cause damage to lipids, proteins or DNA. These alterations promote pathophysiological conditions such as diabetes, cancer, Alzheimer's and Parkinson's disease. To study this phenomenon, hydrogen peroxide (H_2O_2) and nitrite (NO_2^-) were selected as indicators of ROS and RNS respectively for their stability and for being the stable end-products for each group. In this work, the ED of these compounds has been studied employing different electrode materials like Pt, carbon black (CB) and Prussian Blue. The microfluidic system coupled with ED was further employed to culture different cell lines and to follow their response in terms of H_2O_2 and NO2- concentrations released after treatment with LPS and Zymosan A.

Poster #	21
Poster Title:	Printable cell culture platform
Poster Presenter Name:	Diosangeles Soto
Affiliation:	PhD Student

Abstract:

Traditional cell culture relies mostly on flat plastic surfaces, such as Petri dishes and multiwall plates. These commercial platforms are difficult to modify, which limits the range of customisation, functionalisation, and monitoring capabilities. The limitations restrict experimental design and expand the gap between in vitro and in vivo research. In contrast, cell behaviour research expands rapidly with the development of microfluidics and electrochemical detection methods. This study proposes a new approach for cell culture: a low-cost device based on stacks of a transparent flexible printable substrate and hydrophobic boundaries. The novelty is the introduction and stacking of layers for potential manipulation and access to the cells. Moreover, the use of a flexible printable film means that the device can be manufactured and modified using conventional coating, printing, and converting techniques. In this research, the concept is demonstrated using human dermal fibroblasts and integrating printed patterns or mineral coatings to influence cell fate. In summary, the device is easy and fast to manufacture, scalable, and can be potentially customised to influence, monitor, and assess cell behaviour. The end-use is not limited to cell culture but can be expanded to other areas, such as drug discovery, diagnostics, point-of-care, and environmental sensing.

Poster #	22
Poster Title:	Low-costs, real-time biosensor using loop mediated isothermal amplification (LAMP)
Poster Presenter Name:	Dogukan Kaygusuz
Affiliation:	Sabanci University

Abstract:

Since the beginning of genetically modified organism (GMO) usage, there has been on-going concern and debate about the commercialization of products derived from GMOs. There is an urgent need for developing highly efficient and easy to use methods to carry out rapid and high throughput screening of GMO components and to label GMO-derived foods appropriately. Herein, we present an alternative user-friendly GMO-diagnostic biosensor. Our proposed design is based on a simple gene recognition mechanism; the loop mediated isothermal amplification reaction (LAMP). The LAMP reaction requires 30 minutes under the physical conditions that our printed circuit board (PCB) is provided. The reaction occurs in the PDMS mini-wells and the case of the biosensor is fabricated using 3D printer based on Solid works design. The biosensor allows real-time monitoring of the LAMP reaction thanks to the colorimetric readout of the Hydroxy naphthol blue (HNB) reagent. HNB provides naked-eye visualization of each LAMP reaction under indoor light. Therefore, the GMO positive results are differentiated through a color change from violet to sky blue, while the negative results remain violet. Furthermore, our approach could certainly be modified for detection of other organisms. Last but not least, it is possible to be optimized for high-throughput for professional usage or kept simple for practical operations at home or fields.

Poster #	23
Poster Title:	A Tubular Organoid-Derived Gut-on-a-Chip Model by Preserving the Stem Cell Niche of Lgr5^{+} Intestinal Epithelia
Poster Presenter Name:	Dorota Kurek
Affiliation:	Mimetas BV, Leiden, The Netherlands

Abstract:

Microfluidic techniques are increasingly recognized as an important toolbox to add physiologically relevant cues to traditional cell culture. These cues include long term gradient stability and continuous perfusion. Microfluidic technology allows patterning of cell layers as stratified co-cultures that are devoid of artificial membranes, in order to capture complex tissue architectures found in vivo. Previously, we have introduced the OrganoPlate® platform for growing human intestinal gut tubules in a membrane-free manner. Although suitable for toxicity studies, this model uses human intestinal cell lines, such as adenocarcinoma line Caco-2, which has limited differentiation capabilities and harbors multiple gene mutations. In contrast, Lgr5^{+} intestinal organoids can develop crypt-villi morphology and form an epithelial barrier – features associated with gut epithelium. These organoids are usually grown as a polarized ball-like structures embedded in an ECM, with limited apical access. Here we show a human organoid gut-on-a-chip model which is composed of Lgr5^{+} gut epithelial cells grown inside of the microfluidic channels of the OrganoPlate®. We established a tubular shaped epithelial barrier model of the intestinal tract showing rapid cell polarization, tight junction formation and proper expression of intestinal markers. These gut tubules are suitable for high-throughput screening of compound effects through real time imaging of transport and barrier integrity. Moreover, the OrganoPlate® facilitates development of complex models of gut epithelial tubules co-cultured with endothelial vessels. These complex gut-on-a-chip models allow mimicking disease phenotypes

such as inflammatory bowel diseases (IBD) and support screening for potential drug targets. Protocols have been established that allow automated readout of the barrier integrity, followed by image analysis and quantification. The combination of $Lgr5^{+}$ gut organoids with the OrganoPlate® technology are a powerful combination to study physiology and disease mechanisms in patient specific gut models.

Poster #	24
Poster Title:	Modulating mechanical properties of the membrane for lung-on-chip devices
Poster Presenter Name:	Elvesys Microfluidics Innovation Center

Abstract:

The lung is the main organ of respiration whose function is to facilitate gas exchange across the alveolar-capillary (air-liquid) interface. Currently, essential contributions from mechanical stress to cell fate and tissue function are largely overlooked. Specifically, altered mechanical stiffness is a hallmark of many disease states, and is directly related to concomitant changes in the composition and/ or integrity of fibrous matrix protein networks.

Microfluidic organ-on-a-chip technology offers the ability to incorporate fine control of mechanical stress in organ-on-chip devices in the form of pressure. In this study membrane deformation was tracked at the micro scale in microfluidic devices, towards the design of lung-on-chip platforms with integrated mechanical profiles. Devices were used to measure the effect on membrane mechanical properties of blending native matrix proteins with PDMS. Force-extension data reveal strategies to tailor mechanical properties of membranes, as an additional parameter to applying mechanical stress. These studies have the potential to define lung-on-chip devices with both physiological and disease-matched mechanical profiles for drug testing.

Poster #	25
Poster Title:	Development of a novel assay for drugs of abuse based on Molecularly Imprinted Polymers as synthetic antibodies
Poster Presenter Name:	Fabiana Grillo
Affiliation:	University of Leicester

Abstract:
Over the last fifteen years the number of deaths from drug overdoses has increased significantly. According to the World Health Organisation (WHO), opioids were responsible for 160,000 of the 450,000 deaths from overdoses related to drug use in 2015. For this reason there is a rise in demand for a rapid, ease to use and relatively inexpensive method of detection for drugs of abuse. The research presented here is focused on the development of a working assay for drugs of abuse using molecularly imprinted polymers (MIPs) as synthetic antibodies, with particular focus on detection of fentanyl. Molecularly imprinted nanoparticle assay (MINA) was successfully developed to detect and quantify the concentration of fentanyl over the range 7.4-598.2 ng/mL, with a detection limit of 7.38 ng/mL. The novel assay uses the magnetic field generated by magnetic inserts on the bottom of a modified 96-microtiter plate. Displacement and competitive formats of MINA were developed, with competition achieved through use of iron oxide nanoparticles (IO-NPs) conjugated with fentanyl. This versatile assay has significant benefits compared to the currently employed immunoassays and is very easy and straightforward for the end user, due to the mix-and-read format which allows rapid throughput of analytical samples.

Poster #	26
Poster Title:	High-precision Syringe Pumps in Microfluidics and Lab-on-a-Chip Technology
Poster Presenter Name:	Franziska Dolke
Affiliation:	CETONI GmbH

Abstract:

For chip-based applications in particular, the precise and pulsation-free fluid delivery play a crucial role for success. The modular system design of CETONIs neMESYS high-precision syringe pumps meet these requirements. The perfection and practically unlimited usability of CETONIs fluidic system can be achieved through the use of the powerful laboratory automation platform QmixElements.
For instance, the neMESYS pump technology can be used to identify and sort bioparticles like blood cells using three-dimensional imaging flow cytometry. With the help of this method, a much more precise software-based identification of particles is possible. The interaction of high-precision syringe pumps for precise and pulsation-free fluid delivery with the optical measuring unit and computer-assisted reconstruction enable rapid identification of the biomolecules.
The high-precision of the neMESYS syringe pumps, combined with an elaborated setup, allowed the researchers to present flow cytometry with high accuracy and reproducibility.

Poster #	27
Poster Title:	Design Automation for Microfluidic Devices
Poster Presenter Name:	Gerold Fink
Affiliation:	Institute for Integrated Circuits / Johannes Kepler University Linz, Austria

Abstract:

The design and layout of microfluidic devices have become considerably complex tasks, because a huge number of physical parameters need to be considered, which all depend on and affect each other. Thus far, this complexity is frequently addressed by a "trial-and-error" scheme, i.e. by fabricating prototypes, observe their behavior, and refine the design until a working design is obtained -- a time-consuming and rather costly process. We present automatic software tools which aid designers in these tasks. Those methods include, e.g., an efficient simulator (relying on the 1D analysis model and utilizing analogies of microfluidic devices to electronic circuit) which allows to validate a design before the first prototype is fabricated. Case studies showed that this allows to reduce the design time from 30 days to a single day for certain practical relevant devices. Besides that, also software tools are presented that allow for an automatic generation of specifications (e.g., in terms of AutoCAD description) for frequently recurring components such as meanders (see http://iic.jku.at/eda/research/meander_designer/). By this, designers do not need to manually consider all needs, constraints, or fabrication settings anymore, but can determine the desired design in a push-button fashion.

Poster #	28
Poster Title:	Methodology for Visualization and Monitoring of Red Blood Cells Deformability: Computerized Cell Flow-Properties Analyzer (CFA)
Poster Presenter Name:	Gregory Barshtein
Affiliation:	The Faculty of Medicine, The Hebrew University of Jerusalem, Israel

Abstract:

Red blood cells (RBCs) have unique flow properties that play a crucial role in blood flow, specifically, their deformability. RBC deformability refers to the ability of the cells to adapt their shape to the dynamically changing flow conditions to minimize their resistance to flow. Some methods and instruments that have been proposed for characterization of RBCs deformability provide only average characteristics, but not give information regarding the distribution of this feature in a large population of RBCs. To meet these needs, we have designed and constructed a Computerized Cell Flow-Properties Analyzer (CFA) that enables the monitoring of blood cells directly visualized in a narrow-gap flow-chamber (200 nm), under controllable shear stress, resembling those in a small blood vessel. The image analysis of the cell shape provides the elongation ratio (ER) of individual cells, and their distribution in the RBCs population (6000 - 8000 cells). For all cells, we estimated the major (a) and minor (b) axes, and ER was calculated by the formula ER = a/b; ER =1 reflects round RBCs that were not deformed under applied shear. As, the portions of RBCs with a specific level of deformability (undeformable, low deformable, high deformable and et.c.) can be estimated.

Poster #	29
Poster Title:	Development of Microphysiological Systems for the Health Effects of Particulate Matter
Poster Presenter Name:	Guan-Yu Chen
Affiliation:	National Chiao Tung University

Abstract:

In recent years, our laboratory has developed technology to build lung-on-a-chip with the aim of creating alternatives for animal research and achieving more accurate and reliable preclinical experimental data. Our platform contains a continuously perfused cell-growth channel, which is designed to mimic the physiology at the tissue and organ levels and reproduce the cell structure, tissue interfaces, physicochemical microenvironment, and all actual conditions of the human blood/culture medium flow. This system possesses the advantages of in vitro analysis of the tissue function and the biochemical, genetic, hereditary, and metabolic activity of cells in the organ microenvironment. Currently, we use this system for a detailed health evaluation of fine aerosols and the development of a platform for a complete air-pollution health-evaluation model. Such systems will replace animal-based studies and provide a database of toxicological and exposure assessments and dose-response curves for corresponding pollutants, with a focus on lung health and risk assessment. This technology can even be used to construct lung chips reflecting different regions and ages, allowing the evaluation of subtle physiological differences and the promotion of regional policy implementations.

Poster #	30
Poster Title:	Understanding the role of macrophages in brain-tumor microenvironment using microfluidic, dynamic, cell-culture assays
Poster Presenter Name:	Hamza Yusuf Altun
Affiliation:	Sabanci University

Abstract:

Tumor microenvironment is a highly complex and dynamic structure consists of extracellular matrix, cancerous cells, healthy cells, immune system cells, blood cells, stem cells, epithelial cells and proteins secreted by these cells. In order to develop drugs and treatment methods that will be effective for the patients, a more detailed investigation of the tumor microenvironment is required. In the literature interaction of tumor cells and immune cells creates inflammation and this inflammation facilitates metastasis of cancer cells. Studies cannot fully explain what is the real interaction between those two types of cells because they cannot reveal properties of the tumor microenvironment. In order to develop efficient therapies, tumor microenvironment should be investigated under the detailed quantitative and systematic methods. Our study provides view of understanding tumor microenvironment at a single-cell level by creating dynamic culture conditions using microfluidic systems. In this study we co-cultured macrophages with glioblastoma in a microfluidic chip. By using this microfluidic device we obtained data about invasiveness of glioblastoma cells, how macrophages behave while interacting with tumor cells. Our study led us to understand tumor microenvironment dynamic structure and cells behavior at a single cell level.

Poster #	31
Poster Title:	Modeling Cardiac Ischemia with Human Induced Pluripotent Stem Cell-Derived Cardiomyocytes
Poster Presenter Name:	Henna Lappi
Affiliation:	Tampere University

Abstract:

Cardiovascular diseases are the leading cause of death worldwide, of which ischemic heart disease is the most common one. Ischemic heart disease causes damage and death of the cells in myocardium including cardiomyocytes (CMs) that are responsible of the contraction of heart. Pathophysiology of ischemic heart disease is still not fully understood, thus new models for ischemia are needed. Human induced pluripotent stem cells (hiPSCs) can be differentiated into CMs (hiPSC-CMs) providing a human model to study pathophysiology of cardiac diseases.

We have developed a cell culture platform that provides controlled environment for prolonged iPS-CM studies outside a traditional incubator. The platform enables precise control of the cell culture environment (e.g. temperature, oxygen level) and simultaneous imaging and functional assessment of the cells. In addition, pO2 can be measured continuously from the cell culture chamber with the fluorescence-based method. The mini-incubator has integrated technologies to control, as well as, adjust temperature and gas concentration.

We are modeling ischemia with hiPS-CMs cultured in the modular cell culture platform. The aim is to induce hypoxia to the hiPSC-CM culture and detect changes in the cell functionality, morphology, viability and protein as well as gene expression.

Poster #	32
Poster Title:	Development of a stationary liquid-phase lab-on-a-chip for recombinase polymerase amplification detection of Vibrio parahaemolyticus
Poster Presenter Name:	Hoseon Choi
Affiliation:	Gangneung-Wonju National University

Abstract:

Nucleic acid amplification tests (NAATs) are the most attractive approach to rapid pathogen detection, capable of finding few copies of a target nucleic acid with high sensitivity and specificity. In this study, we developed a stationary liquid-phase lab-on-a-chip (LOC) where the whole NAAT process including sample pretreatment, nucleic acid extraction, and amplification can be carried out. The LOC consisted of a sample chamber (SC), a lysis chamber (LC), an amplification chamber (AC) and connecting channels. A bacterial sample was mixed with antibody-functionalized magnetic particles (capture particles, CPs) and applied to the SC. By using a magnet, CP-bacteria complex was transported to the LC containing lysis buffer. Vibration was applied to the LOC, causing lysis of bacterial cells. Finally, the solution containing bacterial DNA was transferred to the AC containing a reaction mixture for recombinase polymerase amplification and amount of the amplified DNA was monitored by fluorescence measurement. Although structure of the LOC and the NAAT process were simple, the present method enabled detection of Vibrio parahaemolyticus with a low detection limit of 700 CFU within 50 min, proving its potential of being applied to point-of-care NAATs.

Poster #	33
Poster Title:	A microfluidic ex vivo intestinal-on-a-chip to study drug absorption
Poster Presenter Name:	Hossein Amirabadi
Affiliation:	TNO, The Netherlands

Abstract:

The majority of screening and predictive models do not reflect the physiology of the human intestinal tract since they show major limitations to include the processes that determine the oral bioavailability. This results in poor translation of drug candidates to clinical trials. Systems with ex vivo intestinal tissue can address these shortcomings, but they are often difficult to operate, limited in tissue viability maintenance and not suitable for small tissue samples. We have developed an organ-on-a-chip system that integrates small sizes of intestinal tissues, better suits higher throughput applications and shows low adsorption of conventional test drugs (<15%). Experiments with intestinal tissue in the chip showed proper barrier function with low leakage of FITC dextran (MW4000; <1%). Excreted lactate dehydrogenase (LDH) levels were below 1% of the initial LDH in the tissue after 4 hours and remained below 13% after 21 hours of placing the tissue in the chip. The ratio of the transcellular and paracellular absorption was in average 4.5 after 4 hours. These results showed that the intestine-on-a-chip model kept the tissue viable for at least 21 hrs. This platform will be used further to study drug absorption and host-microbe interactions on human intestinal tissue.

Poster #	34
Poster Title:	Usiigaci: Instance-aware single cell tracking in label-free phase contrast microscopy enabled by machine learning
Poster Presenter Name:	Hsieh-Fu Tsai
Affiliation:	Okinawa Institute of Science and Technology Graduate University

Abstract:

Single cell level segmentation and tracking is tantamount to the holy grail of microscopic cell migration analysis. Phase contrast microscopy images are particularly difficult to segment accurately to single cell level when cell density are high. We introduce Usiigaci, an open source all-in-one semi-automated pipeline to segment/track/analyze single cell migration. Using regional convolutional neural network, accurate single cell level segmentation is possible so as to provide quantitative information on single cell migration. Single cell tracking without staining or transgenic manipulation can be done to ensure minimalistic perturbation on cells. A Track-py based cell tracker with graphical user information enables users to validate cell tracking results to avoid erroneous results. The segmentation and tracking of Usiigaci is benchmarked and validated with the electrotaxis of NIH/3T3 fibroblasts in microfluidic chips. Quantitative single cell migration analysis provide accurate cell movement and morphological information for drug screening and in silico cell modeling.

Poster #	35
Poster Title:	Organic semiconductors based devices for heart on chip applications
Poster Presenter Name:	Jan Vitecek
Affiliation:	International Clinical Research Center, Czech Republic

Abstract:

Heart diseases are of serious socioeconomic impact. Current knowledge of their mechanisms is based on clinical data and animal models. Recently the option of in vitro studies of heart damage and regeneration based on cardiomyocytes and stem cells has been enabled. The connection of in vitro cell culture with sensors and actuators can provide a valuable tool for preclinical research. Since organic semiconductors have a potential to form an excellent interface for living cells we have focused on them for the heart on chip application.

First, approaches to improve the biocompatibility of selected organic semiconductors have been explored. Among other procedures, collagen IV coating was found to be the most efficient. Further, proof of concept experiments towards cardiomyocyte beating sensor based on PEDOT:PSS have been carried out. Currently we are working on improvement of signal to noise ratio. In parallel an actuator based on PEDOT:PSS to manipulate stem cell differentiation was developed. We have found that such device can enhance cardiomyogenesis. Moreover, a simple PEDOT:PSS electrode was found to be capable of pacing mature cardiomyocytes.

Poster #	36
Poster Title:	Events following nanoparticle exposure of the in vitro lung epithelium
Poster Presenter Name:	Janez Štrancar
Affiliation:	Researcher

Abstract:

One of the most important functionally of a tissue-on-a-chip should be its ability to resolve molecular events and predict upstream of events in the adverse outcome pathways. In case of nanomaterial exposure, many of the relevant events, most probably majority of the molecular initiating events are driven by physical interactions between the materials and supramolecular structures. We have recently published the work about lipid wrapping (Urbancic et al. Nano Letters 2018 18(8) 5294) that can drive the relocation of coagulation factors from epithelial membranes and potential interfere with coagulation cascade. We here further report preliminary data about the appearance of the complex structures where membranes and nanomaterials are involved at later time scales. Temporarily, it seems to serve as passivation of nanomaterial on epithelial cells. However, later time evolution and macrophages activity indicate substantial damage on the entire model, as revealed by time-lapse STED super resolution live microscopy.

Poster #	37
Poster Title:	Development of a tubing-based stationary liquid-phase immunoassay system for the point-of-care detection of bacteria
Poster Presenter Name:	Jaryong Koo
Affiliation:	Gangneung-Wonju National University

Abstract:

The stationary liquid-phase (SLP) immunoassay method, which are carried out by moving particles through different liquid phases, was proved to have a potential for rapid and sensitive detection of bacteria. In this study, we developed a tubing-based system for the visual SLP immunoassay which would be suitable for point-of-care testing. After a sample was mixed with antibody-functionalized magnetic nanoparticles (capture particles, CPs) and antibody/catalase-functionalized silica nanoparticles (labeling particles, LPs) in a syringe, the syringe was connected to tubing (T1) containing washing buffer. The mixture was injected into T1 and CP-bacteria-LP complex was moved from the sample mixture to the washing buffer with a magnet. By pressing the syringe, the washing buffer containing the complex was transported to a reaction tube which were connected to a substrate tube containing H_2O_2 solution through another tubing (T2). The H_2O_2 solution was transferred to the reaction tube by pulling the syringe, causing O_2 evolution by catalase activity associated with the CP-bacteria-LP complex. The bacterial number was determined by a distance that H_2O_2 solution moved in the T2. was measured by the movement of the. The assay system and procedure were very simple but enabled rapid and sensitive detection of bacteria.

Poster #	38
Poster Title:	Development of a micropipette-based volumetric method for the point-of-care testing of pathogenic bacteria
Poster Presenter Name:	Jeongmin Lee
Affiliation:	Gangneung-Wonju National University

Abstract:

Gas generation-based measurement is an attractive alternative approach for point-of-care testing because a gas volume change can be measured without instruments by visual distance readout. In this study, we developed a micropipette-based method for the point-of-care (POC) testing of Salmonella typhimurium. The method utilizes two types of particles: capture particles (CPs), which are magnetic nanoparticles functionalized with antibody; and labeling particles (LPs), which are silica nanoparticles functionalized with catalase and antibody. The assay kit was comprised of two tubes, a substrate tube containing H_2O_2 solution and a detection tub, which were connected by tubing. After a sample was mixed with CPs and LPs, CP-bacteria-LP complex was separated from free LPs by using a magnet and the complex was added to the detection tube. The H_2O_2 solution was transferred to the detection tube by applying a negative pressure to the detection tube with a micropipette which was adjusted to a volume slightly less than the volume of the H_2O_2 solution. The catalase activity associated with the complex was measured by the movement of the H_2O_2 solution remaining in the tubing. This method enabled sensitive detection of S. typhimurium down to 1000 CFU.

Poster #	39
Poster Title:	Magnetic-driven lung-on-a-chip: an easy-to-use toxicity assessment
Poster Presenter Name:	Jiawei Yang
Affiliation:	National Chiao Tung University/ Institute of Computer Engineering

Abstract:

Current research has enabled the use of organ-on-a-chip technology and creation of models for lung diseases. However, bottlenecks remain in terms of long-term regulation of cell cultures and their functions in microfluidics systems, as well as in the enhancement of in vitro representation of lung models and reference values of the data. In this study, a magnetically driven dynamic lung-on-a-chip system has been developed to use controlled magnetic force to drive a magnetic film on the chip, thereby directing the fluid within it to produce a circulating flow. The system has been confirmed to be conducive with regard to facilitating uniform attachment of human alveolar epithelial cells and long-term culture. Subsequently, reactions between silica nanoparticles and human alveolar epithelial cells have been used to validate the effects and advantages of the proposed dynamic chip-based system compared to a static environment. The innovative concept of the use of a magnetic drive has been successfully employed in this study to create a simple and controllable yet dynamic lung-on-a-chip culture system to realize its functions and advantages with regard to in vitro tissue construction.

Poster #	40
Poster Title:	Microwell geometrical effects on germline stem cell differentiation
Poster Presenter Name:	Junseon Park
Affiliation:	Chung-Ang University

Abstract:

Common ex vivo cell culture method is based on 2D culture with a benefit of simple experimental procedures, however, there are differences in comparison with in vivo microenvironments of cells. As an alternative approach, a cell spheroid culture method has been spotlighted since the 3D characteristics of spheroid culture is similar to that of in vivo cell environments.

In modern society, subfertility issues are worldwide and become one of serious social problems. Therefore, further intensive studies of germline stem cell are needed to provide solutions to solve this problem. Coculture of germline stem cells and its neighboring cell types in 3D culture platforms seem to be the first step for this type of research. In this study, we developed 4 different microwell array platforms having conventional (flat-bottomed), concave, networked, and omega geometries, to culture cell spheroids of germline stem cells and neighboring cells of mouse. Different microwell geometries are found to have a meaningful effect on the differentiation speed and quality of germline stem cells, in which diffusion of nutrient and signaling molecules between the cultured spheroids in microwells seem to have an important role. The results will be useful for human reproduction system studies and solving subfertility problems.

Poster #	41
Poster Title:	3D cell biosensor for cytotoxicity assays/3D cell structures for LoC chemosensitivity assays
Poster Presenter Name:	Karl-Heinz Feller
Affiliation:	Ernst-Abbe-University Jena

Abstract:

The poster will deal with a new method for the complex description of cellular effects to investigate the toxic potential of substances to different cell model lines and biopsies in a real time, sensitive and high throughput manner. In case of the cell lines the cells were transfected with a reporter/promoter plasmid construct as an early biomarker of stress induction (leading to GFP expression under stress). In this manner the measurements can be made under incubator-free conditions without any limitations. In 2D cell cultivation it was possible to show the cytotoxicity effect at various cell lines and in real time with plant extracts, chemicals as well as nanoparticles.

The development of 3D cell cultures with Matrigel scaffold and a hepatocyte cell line even more increases the relevance of the sensor towards the human skin or the behavior of the human organ. This is clearly shown in experiments comparing the toxic behavior of nanoparticles in 2D- and 3D- environment.

Poster #	42
Poster Title:	3D Printed Glass: Novel Microfluidic Device Fabrication Using Selective Laser-Induced Etching
Poster Presenter Name:	Kazumi Toda-Peters
Affiliation:	Okinawa Institute of Science and Technology Graduate University (OIST)

Abstract:

Polydimethylsiloxane (PDMS) based micro-devices fabricated by photolithographic techniques and micro-machined polymers (such as PMMA and COC) remain the standard in the field of microfluidics. Although these polymeric materials have numerous benefits such as the ability to rapidly prototype and a relatively low replication cost, they also have many drawbacks namely: PDMS's lack of rigidity, poor solvent resistance, high gas permeability, and 2D limited designs. To overcome these drawbacks, we utilize a cutting-edge microfabrication technique called selective laser-induced etching (SLE) to fabricate truly 3D monolithic structures within fused silica. SLE allows us to create transparent and chemically resistant microfluidic devices impossible with standard photolithographic or milling techniques. In this poster, we will present the techniques and technical challenges associated with SLE glass microfluidic device fabrication as well as results from recent experiments.

Poster #	43
Poster Title:	Establishment and Validation of an In Vitro Model for Crohn's Disease
Poster Presenter Name:	Kinga Kosim
Affiliation:	Department of Biomedical Science, University of Sheffield, Sheffield, United Kingdom

Abstract:

There is a great need for more reliable in vitro disease models for inflammatory bowel disease (Crohn's disease and ulcerative colitis) that are suitable for drug development. Having such models in place would greatly impact on drug development costs and increase safety of newly developed medicines. Here we present our research using the OrganoPlate® developed by MIMETAS to mimic Crohn's disease in vitro. The platform based on a microtiter plate harbors up to 96 chips and enables the culturing of perfused intestinal 3D tube-like structures in a membrane-free manner. In our model we are using both, gut epithelial cell lines as well as primary cells. We induce the inflammation state with MDP (muramyl dipeptide) that is a minimal bioactive peptidoglycan motif common to all bacteria. Proper epithelial cell polarization, formation of tight junctions and expression of intestinal markers have been confirmed in our model. Importantly, we are able to demonstrate and quantify the pro-inflammatory reaction of the epithelium in response to the inflammatory trigger. The diseased phenotype shows elevated levels of pro-inflammatory cytokines and disturbed barrier integrity as shown by TEER measurements. This physiologically relevant 3D model is suitable for high-throughput drug screening.

Poster #	44
Poster Title:	Microfluidic Chip to Separate Circulating Tumor Cells and Exosomes Respectively Toward Liquid Biopsy
Poster Presenter Name:	Ko-Chih Lin
Affiliation:	National Chiao Tung University

Abstract:

Liquid biopsy can be used in cancer diagnosis or individual immune status. It includes the isolation and detection of circulating tumor cells, circulating tumor microemboli, exosomes and circulating tumor DNA, as a source of proteomic and genomic information for cancer patients with real-time and non-invasive ways prior to treatment, during treatment, and during progression. Our team has developed a system for liquid biopsy with graphene oxide-based nano-biointerfaces and attempted to separate specific nanosized biomarkers such as circulating tumor cells, circulating tumor microemboli, and exosomes by microfluidic channels. The biggest advantage of this system is that we don't need other pretreatments or assistance forces to whole blood, as well as two-factor authentication. In addition, our system avoids damage to the exosomes because high speed centrifugation is not required during the separation process, thus allowing for higher purity and recovery than existing methods.

Poster #	45
Poster Title:	Vascularization of a Bone Marrow Model
Poster Presenter Name:	Kübrah Keskin
Affiliation:	TU-Berlin

Abstract:

The bone marrow is, as a harbour of the endosteal and perivascular niche of haematopoietic stem and progenitor cells (HSPCs), an important organ of the human body.

Sieber et al. mimicked the endosteal niche by developing a dynamic bone marrow model harbouring HSPCs in co-culture with Mesenchymal Stromal Cells (MSCs) for up to eight weeks in a hydroxyapatite coated zirconium oxide-based ceramic. The cultivation of the 3D construct is realized within the “Multi-organ-chip” (MOC) developed at our chair. The MOC is a microfluidic device consisting of a circular channel system which connects two wells to cultivate organoids.

To additionally mimic the perivascular niche, vascular structures must be added to the model. HUVECs, in co-culture with MSCs, elongate and form a primitive network. Since HSPCs must be cultivated in serum-free medium to prevent uncontrolled differentiation, tri-cultures were performed in which MSCs, HSPCs and HUVECs were cultivated in serum-free medium for 1 week. It could be shown that HUVECs survive in the serum-free medium and maintain primitive vascular structures. Further, it is planned to connect the vascularized model with the endothelialized channel system of the MOC, to set up a closed in vitro system of a vascularized Bone Marrow Model.

Poster #	46
Poster Title:	Real Time Continuous Monitoring of Microphysiological Systems Using Embedded Sensors
Poster Presenter Name:	KyungHwan Kim
Affiliation:	Jeju National University

Abstract:

With the advancement of microphysiological systems incorporating complex tissue-fluidic interactions, there is an increasing demand of integrating highly sophisticated parametric monitoring of the in-vitro environments to accurately mimic in-vivo physiology. In most of the recent researches multiple parameters are assessed including but not limited to the pH, CO_2, temperature, dissolved oxygen (DO), and lactate concentrations of the tissue culture media and visualization of tissue morphology during various stages of growth for different physiological and pathological studies. We have developed a microphysiological system on chip for continuous real time monitoring of the parameters like DO, lactate, and cellular impedance using embedded micro-sensors. Along-with off-chip real time monitoring of the pH using an optical pH sensor, temperature and CO_2 using an integrated controller, and tissue morphology using a custom-built microscope provide information the physical status of the system. All these sensors have been developed in-house along-with their respective custom-built instrumentation to meet the ever increasing needs of modern microphysiological systems for wide applications like drug toxicological assessments, environment stimulators, and personalized medicine.

Poster #	47
Poster Title:	FDM-3D printed electroosmotic pumps
Poster Presenter Name:	Liang Wu
Affiliation:	University of Wollongong

Abstract:

Microfluidic devices have already been employed the fields of cell biology and medical diagnostics by using inexpensive, customizable fluid-handling automation at the micrometer scale. Additive manufacture (3D printing) offers materials and possibilities that can contribute positively to current methods for microfluidics preparation3. The fused deposition modelling (FDM) method uses low cost thermoplastics such as polylactic acid (PLA) and thermoplastic polyurethane (TPU) to manufacture 3D structures with freeform features. These materials, and potentially nano-filled composites of them, provide the user with a relatively unexplored ability to create new microfluidic devices architectures which up until recently have been limited “classical” microfluidic approaches. Here we explore the FDM-3D printing technique to fabricate capillary (80-250µm in dimensions) structures based on face-centre cubic and body-centre cubic arrangements of layered TPU and PLA filaments. The resultant 3D printed capillary structures have been used in a simple electroosmotic pump configuration. A maximum flow rate for a single capillary EOPs was 1.0 µL/min at 1500V. In an extension to this work, graphene (EFG & LCGO) and thermally conducing boron nitride (BN) filled composite filaments (EFG/PLA, LCGO/PLA, EFG/LCGO/PLA, BN/PU) composites have been investigated and printed to form capillary structures and the impact upon the EOP function determined.

Poster #	48
Poster Title:	Fabrication and validation of a lung-on-a-chip system with tough adhesive hydrogel
Poster Presenter Name:	Linxiao Yang
Affiliation:	Hochschule Reutlingen

Abstract:

Although hydrogels are now widely spread due to their hydrophilicity, their tunable mechanical and chemical properties, and the prospect of simultaneously controlling biological responses, the low fracture toughness and fragility have limited their use in tissue engineering. However, hydrogel toughness and strong adhesion are desirable properties when considering applications such as microdevices of biomimetic systems. Here we apply a bioinspired tough adhesive hydrogel to create a lung-on-a-chip that mimics the mechanically active alveolar-capillary interface of the living human lung by using soft lithography. Human alveolar epithelial cells and microvascular endothelial cells are co-cultured in the microdevice with physiological flow. Since partitioning of molecules into chip device can significantly change solution concentrations and could potentially alter experimental outcomes, we also compare the absorption of small hydrophobic molecules with the chip device made out of polydimethylsiloxane (PDMS).

Poster #	49
Poster Title:	Droplet microfluidics for the analysis of protein-levels of cell lysates
Poster Presenter Name:	Lukas Metzler
Affiliation:	IMTEK - University of Freiburg

Abstract:

Droplet based microfluidics opens the door to analyze samples with high throughput and ultralow reagent consumption. Thousands of droplets can serve as individual nanoliter compartments for (bio)-chemical detection reactions. Furthermore, magnetic beads (MBs) offer an opportunity for heterogeneous immunoassays, providing a functional surface and enabling washing steps. Within this setup, the penetration of the water-oil-interface is circumvented by making use of the different wetting properties of hydrophilic and hydrophobic channels. This allows us to extract much smaller quantities of MB than usually reported. The automated capture and release of MBs in the µg/mL-range from nL-droplets enables both, highly sensitive static-measurements and kinetic measurements with a high time-resolution. The minimization of c(MB) made it possible to detect model targets down to the fmol/L range and proteins from cell lysates in the pmol/L-range by a sandwich immunoassay. Thereby, only 2 µL/sample and less than one hour for the sequential measurement of ten samples are required. Thanks to the low sample consumption, the high sensitivity and the high degree of automation, we envision an application for personalized medicine.

Poster #	50
Poster Title:	MICROFLUIDIC PLATFORM FOR THE PRODUCTION OF MONODISPERSE POLYME PARTICLES USING SOLVENT EVAPORATION
Poster Presenter Name:	M. de Vargas Serrano
Affiliation:	Tide Microfluidics B.V.

Abstract:

The MicroSphere Creator has shown excellent results in producing monodisperse particles, from a variety of polymers including PLGA, PCL or Polystyrene. Particles produced showed uniformity of production with coefficients of variation (CV) less than 0.2 for sizes ranges between 1.8µm and 30µm. This was over prolonged production periods between 2 to 20 hours. All these factors indicate that the Microfluidic technology of the MicroSphere Creator is capable of replacing standing batch processing techniques for the production of polymer particles.

Poster #	51
Poster Title:	The Body Cube – An Expandable Microphysiologic Device
Poster Presenter Name:	Mandy Esch
Affiliation:	NIST

Abstract:

We present a body cube that can be used to co-culture four human tissues in combination with each other with near-physiologic amounts of blood surrogate. We operated the device for 72 h with liver, GI tract, bone marrow, and kidney tissues, finding that cell viability is stable for 48 h and then decreases slightly at the 72 h timepoint. Similarly, both albumin and urea production by liver cells is stable for 48 h, and decreases at the 72 h. Currently microphysiologic devices like our body cube use up to 50 times as much blood surrogate than is physiologic. Our work shows that devices with physiologic amounts of liquid can be designed and operated, but that long-term operation will require more device optimization.

Poster #	52
Poster Title:	Cell Counting with Giant Magneto-Resistive Sensors
Poster Presenter Name:	Manon Giraud
Affiliation:	CEA France

Abstract:

The development of rapid, simple, cheap and specific early diagnostic tools, enabling the single-cell detection, is a real challenge in the medical field. The approach proposed in this work relies on a dynamic magnetic detection. Targeted cells are labeled with magnetic beads functionalized with cell-specific antibodies. Then, the immunocaptured cells are injected in a microfluidic channel located above highly sensitive giant magnetoresistance sensors (GMR) with a detectivity of about 100pT/sqrt(Hz) at 1kHz. A perpendicular homogeneous magnetic field polarizes the moving magnetic beads and field variations induced by the resulting stray dipolar field is detected. The first proof of specificity of such a test has been obtained in our lab with NS1 murine myeloma cells. The obtained sensitivity is equivalent to the one of an ELISA test realized on the same biological system. This device is still able to detect every single cell but presently, the sensitivity is limited by false positives created by magnetic particles aggregates flowing very near the sensors which give a signal comparable to cells flowing at larger distances.

Poster #	53
Poster Title:	3D printing for Environmental Applications
Poster Presenter Name:	Margaret McCaul
Affiliation:	Dublin City University

Abstract:

In recent years, advances in rapid prototyping related to 3D printing and fabrication technologies have dramatically improved the efficiency of producing in situ reagent-based analyzers for monitoring key environmental parameters, such as nutrients levels in natural waters. This improved prototyping efficiency is opening the way to more effective analytical platforms, combined with lower unit costs, higher frequency sampling, and longer service intervals for sensing platforms for analytical targets in natural waters. Here we describe the development of customized 3D microfluidic chips incorporating colorimetric detection for targeted analytes (PO_4^{3-}, NO_2^- and NO_3^-) in particular deployment scenarios; to include detector pathlength, LED-Photodetector choice and operational settings, fluidic mixing strategies, flow regimes.

Poster #	54
Poster Title:	Microfluidic chip as a tool for uniform generation of spheroids
Poster Presenter Name:	Mario Kandra
Affiliation:	The International Clinical Research Center of St. Anne's University Hospital Brno, Czech Republic

Abstract:

Organoids dramatically increased changed the field for creating models with 3D cellular organization allowing recapitulating biological properties of human tissues or organs. Weak methodological point is initial formation of cell spheroids which suffer from labor-intensive manipulation, continuity of medium exchange, as well as non-uniform size of spheroids and final divergence of organoids. Microfluidics is very promising platform to overcome these disadvantages. Due to automation, microfluidic systems are capable of continual medium flow in spatial and temporal domains, which allows to create better controlled microenvironments as well as apply lower amount of medium,
In this work, we present microfluidic chip for uniform formation of spheroids with low divergence of spheroid diameter. On the basis of a concave microwell-based PDMS multilayer chip, it enables a parallel perfusion culture of large amount of cell spheroids. Upon in silico simulations, we optimized chip designs and characterized several specific conditions in a microwells including sufficient nutrient exchange in all microwells. We characterized cell behavior of pluripotent stem cells such as proliferation rates, morphology of spheroids and differentiation during long-term cultivation in these microfluidic devices.

Poster #	55
Poster Title:	ADIPOSE STEM CELLS (ASCs) ISOLATION BY ON-CHIP PRE-TREATMENT OF BIOLOGICAL SAMPLES
Poster Presenter Name:	Marion Valette
Affiliation:	LAAS France

Abstract:

Adipose stem cells (ASCs) are of considerable interest for regenerative medicine or type II diabetes diagnosis. Migrating and circulating in lymph, their circulation in blood is not excluded. They are supposed to circulate in very small numbers and no method exists to isolate them from blood.

As ASCs do not present specific physical characteristic, we developed a two-step LOC enabling their isolation by combining size exclusion followed by immune-exclusion. This study presents the first step, based on hydrodynamic filtration, which aims at eliminating biological elements with a diameter below 10micrometers, corresponding to Red Blood Cells (RBCs), platelets and lymphocytes. LOC were manufactured using a performing and low cost microfabrication technique based on the lamination and lithography of photosensitive dry films. Tests were conducted on synthetic solutions of RBCs and ASCs mimicking natural samples. We demonstrated that 100percent of ASCs were recovered regardless of the ratio r=(concentration RBCs)/(concentration ASCs) but that the filtration yield of RBCs could vary from 45.3percent to 55.8percent for r ranging from 1.8e2 to 1.3e4. RBC filtration yield could be significantly improved by increasing the number of filtration channel for instance. Hydrodynamic separation efficiently pre-isolates adipose stem cells from complex samples without damaging cells.

Poster #	56
Poster Title:	Human Gut-on-a-Chip as a Predictive Model for Compound Bioavailability and Toxicity
Poster Presenter Name:	Meike van der Zande
Affiliation:	RIKILT-Wageningen Research, P.O. Box 230, 6700 AE, Wageningen, The Netherlands

Abstract:

Human intestinal barrier models grown in microfluidic devices have been proposed as improved in vitro models that better recapitulate the human intestinal functions. Microfluidic flow conditions allow for accurate control of the extracellular chemical concentration and physical microenvironment in which cells are grown. During this presentation, several types of gut-on-a-chip models, with increasing complexity in biology, will be discussed. First, the design and characterization of the models will be discussed, focusing on critical parameters that should be evaluated. Secondly, the models will be discussed in relation to their use and performance for bioavailability and toxicity studies, showing their potential for future application in the fields of pharmacology and toxicology.

Poster #	57
Poster Title:	All-in-water multiple emulsion
Poster Presenter Name:	Morteza Jeyhani
Affiliation:	Ryerson University

Abstract:

Unpublished.

Poster #	58
Poster Title:	Development of tumour-on-a-chip: Co-culturing 3D spheroids with 3D blood vessel mimics
Poster Presenter Name:	Noosheen Walji
Affiliation:	University of Toronto

Abstract:

Angiogenesis, or the development of new blood vessels, is an underlying mechanism enabling the growth of cancer tumors. There is interest in furthering our understanding of tumor vascularization to better understand cancer development and identify treatment targets. Tumor-vasculature platforms have been explored in literature, where microfluidic models have demonstrated high physiological relevance. The application of a microfluidic model to investigate tumor-vasculature interactions has not yet been studied extensively. In this work, a microfluidic tumor vascularization platform is developed for co-culture of 3D spheroids and 3D endothelial lumens, with an emphasis on high spatiotemporal control for improved physiological accuracy. The angiogenic potential of a spheroid is determined by areas of hypoxia, necrosis, and proliferation, as well as the production of key signaling molecules. The angiogenic response is measured in terms of endothelial migration distance as well as sprout quantity, location, and morphology. Preliminary results show spheroids of varying ages (time in monoculture prior to co-culture) demonstrate differences in angiogenic potential and subsequently induce distinctly different angiogenic responses. The observations made in this research will shed light on interactions between tumor growth and vasculature, enabling observations of the biological programming of tumor behavior at a cellular level that have been previously inaccessible.

Poster #	59
Poster Title:	Optimizing the ElectroHydroDynamic Lithography procedure towards an improved point of care platforms
Poster Presenter Name:	Paulo Gomes
Affiliation:	University of Birmingham

Abstract:

Understanding the Surface-Enhanced Raman Scattering (SERS) mechanism on ElectroHydroDynamic Lithography (EHD) pillars is critical for the improvement of these devices for biosensing applications. In this work, we compare different dimensions of EHD fabricated pillar to their adsorbed thiophenol SERS spectrum. The goal is to improve the EHD fabrication process by obtaining a relation between the pillar's surface topography to its surface enhancement, by finding and identifying enhancement hotspots and through coupling simulation data and experimental data into a feedback loop to the EHD design, thus fine-tuning the EHD surface to give the most enhancement. From combining the surface topography with the manipulation of hot spots together with simulations, we aim for an improved EHD design for future biosensing applications which will be a novelty for SERS technology for point of care platforms.

Poster #	60
Poster Title:	Effects of hydrodynamic parameters on droplet formation in two-phase microfluidic structures
Poster Presenter Name:	Petra Hermann
Affiliation:	Hungarian Academic of Science Centre for Energy Research

Abstract:

Cell-analytical, diagnostic procedures or chemical reactions can be precisely controlled and automatized by droplet fluidics on the microscale. In two-phase microfluidics two non-miscible liquids can form monodisperse droplets, defining individual containments or reaction chambers. An in-depth understanding of parameters of droplet generation process is essential for their reliable application.

This study analyses that process in junction type generators experimentally as well as in numerical simulations, considering hydrodynamic parameters (e.g. flow rates, viscosity, surface tension, etc.) to achieve stable and consistently controlled droplet-formation.

Sample microfluidic systems were fabricated by soft lithography. Experiments show that e.g. wetting behavior of aqueous phase on the structural material (PDMS) influence the frequency of the droplet formation while the oil phase flow rate or the capillary number directly the size of the droplets.

Key factors of the droplet formation have also been studied by finite element modelling (FEM) and simulations in 2D as well as 3D models, using standard methods of multiphase dynamics in Comsol Multiphysics. The influence of volume flow ratio, viscosity of the fluids, and interface tension were considered. Although the systems' behaviour could be described qualitatively by 2D models,

quantitative predictions and considerably more realistic analysis are expected from 3D simulations.

Poster #	61
Poster Title:	A Serological Point-of-Care Test for the Detection of IgG Antibodies against Ebola Virus
Poster Presenter Name:	Polina Brangel
Affiliation:	University College London

Abstract:

Ebola virus disease causes widespread and highly fatal epidemics in human populations. Today, there is still a great need for point-of-care tests for diagnosis, patient management and surveillance, both during and post outbreaks. We present a point-of-care test comprising an immunochromatographic strip and a smartphone reader, which detects and semi-quantifies Ebola-specific antibodies in human survivors. We developed a Sudan virus glycoprotein monoplex platform and validated it using sera from 90 human survivors and 31 local noninfected controls. The performance of the glycoprotein monoplex was 100% sensitivity and 98% specificity compared to standard whole antigen enzyme-linked immunosorbent assay (ELISA), and it was validated with freshly collected patient samples in Uganda. Moreover, we constructed a multiplex test for simultaneous detection of antibodies against three recombinant Sudan virus proteins. A pilot study comprising 15 survivors and 5 noninfected controls demonstrated sensitivity and specificity of 100% compared to standard ELISA. Finally, we developed a second multiplex subtype assay for the identification of exposure to three related EVD species: Sudan virus, Bundibugyo virus and Ebola virus (formerly Zaire) using recombinant viral glycoprotein. This multiplex test could distinguish between the host's immunity to specific viral species and identify cross-reactive immunity. These developed serological platforms consisted of capture ligands with high specificity and sensitivity, in-house developed strips and a compatible smartphone application. These platforms enabled rapid and portable testing, data storage and sharing as well as

geographical tagging of the tested individuals in Uganda. This platform holds great potential as a field tool for diagnosis, vaccine development, and therapeutic evaluation.

Poster #	62
Poster Title:	A microfluidic flow analyzer - portable, affordable lab-on-chip device for multiplex fluorescence detection
Poster Presenter Name:	Preksha Gupta
Affiliation:	Centre for Cellular and Molecular Platforms (CCAMP)

Abstract:

Flow cytometry is one of the most widely used technique in the field of biomedical research and diagnostics. The high-costs, bulkiness, complexity of use and requirement of trained personnel, limits their usage to few research labs and hospitals. We have developed a microfluidics based miniaturised flow analyser by integrating the concepts of microfluidics, optics and semiconductor electronics. The optics has been simplified by replacing high-speed cameras, microscopes, complex laser and open-space optic alignment systems with a novel optic fibre based detection system. MFA thus provides an easy to use, scalable, affordable lab-on-chip device for simultaneous high-throughput measurement of light scatter, absorbance and multiplexed fluorescence signals from single cells in low sample volumes with high sensitivity and specificity. This portable device is well adapted for use in diagnostics in low-resource settings.

Poster #	63
Poster Title:	Sensors for online monitoring of O_2, pH and CO_2 in microfluidics
Poster Presenter Name:	PreSens GmbH Team

Abstract:

No abstract available.

Poster #	64
Poster Title:	A polydopamine patterned perfluoropolymer-based substrate for protein microarray applications
Poster Presenter Name:	Qi Liu
Affiliation:	Chinese University of Hong Kong

Abstract:

In this work, we developed a new composite substrate for protein microarrays, which was based on a perfluorinated surface presenting the polydopamine (PDA) microspots array. Conventional protein microarray substrates often suffer from the high background noise and inconsistent signal quantification due to the nonspecific protein binding and non-uniform microspots morphology. The composite substrate in this work addressed these issues by taking advantages of the properties of the perfluorinated surface and PDA. The hydrophobic and oleophobic perfluorinated surface possessed good protein antifouling property with minimal nonspecific protein adsorption, while the PDA microspots provided the immobilization sites for the antibodies to anchor onto the surface to build the protein microarray. We fabricated the composite substrate by photolithography and optimized the protein microarray performance by tuning the surface roughness of the PDA microspots. To illustrate the applications of the composite substrate in protein microarray technology, we performed the immunoassay-based detection of cytokines.

Poster #	65
Poster Title:	Biomimetic action potential simulations with a microfluidic device
Poster Presenter Name:	Rauno Jõemaa
Affiliation:	Tallinn University of Technology (TalTech)

Abstract:

In the face of global medical costs for brain disorders, which by 2030 is estimated to reach USD 6 trillion while only USD 458 billion for the total costs of cancer, relevance of topics of this nature will keep increasing rapidly over the coming years, priorities are already changing. Alongwith stem cell, CRISPR and implantable electrode research, microfluidics shows potential for facilitating optimal conditions for controlled neurological research in medicine. This poster presents an early-stage biomimetic solution for an artificial neuron in microfluidics. The solution includes microscale channels, which are designed for 3D-print fabrication. The channels are covered with a thin layer of PDMS, which includes extruded planar check valves with embedded permanent micromagnets. A channel-wound electro-magnet enables scalable design for device actuation. By combining the cation selectivity of a Nafion membrane, the flexibility of PDMS and a novel electromagnetic-magnetic valve system in a micropump configuration, COMSOL proof-of-concept simulations have shown successful controlled action potentials using a mixture of biochemical ions K^+ (Potassium) and Cl^- (Chloride) at body temperatures.

Poster #	66
Poster Title:	Implementation of a thermodynamic framework for detection of low abundant mutations by hybridization on an impedimetric sensor
Poster Presenter Name:	Rebekka Van Hoof
Affiliation:	UHasselt/VITO

Abstract:

Numerous diseases, with cancer as the best-known example, are accompanied by the occurrence of specific point mutations in the genome. The identification of these mutations is of great clinical value at time of diagnosis and for monitoring of disease progression. Recently, a thermodynamic framework for sequence-based hybridization of DNA has been developed at VITO. This concept uses the theory of DNA hybridization combined with information from custom-designed microarrays, to design oligonucleotide-modified surfaces capable to detect a single-point mutation with very high selectivity and sensitivity, down to 1% single-point mutations in a background of wild-type sequences. However, the microarray technique suffers from long reaction times, requires fluorescent labelling and needs expensive equipment for the optical read-out.

In this project we will develop an easy-to-use impedimetric sensor platform capable of detecting low-abundant mutations with the capability for multiplexed measurements. We believe this is possible by implementing an adapted version of the thermodynamic framework mentioned above to create a sequence-specific recognition layer on the sensor surface. The obtained impedimetric biosensor will provide an elegant alternative to the current techniques for mutation detection in clinical samples as it is aimed to be fast, user-friendly, cost-effective, sensitive and label-free, and thus suitable for point-of-care applications.

Poster #	67
Poster Title:	Micropillar-assisted electric field enhancement for high-efficiency inactivation of bacteria
Poster Presenter Name:	Sanam Pudasaini
Affiliation:	Nanyang Technological University Singapore

Abstract:

Development of high-efficiency and environment friendly bacterial inactivation methods is of great importance for preventing waterborne diseases which are one of the leading causes of death in the world. Traditional bacterial inactivation techniques have several limitations such as longer treatment time, use of harmful chemicals, formation of toxic byproducts, bacterial regrowth etc. Here, an electroporation-based continuous flow insulator-based AC dielectrophoresis device (iDEP) is developed and that the device achieved high bacterial inactivation performance (>99.9%) within a short exposure time (<1 s). Inactivation performance was evaluated for Escherichia coli and Enterococcus faecalis under various electric field conditions. More than 4 log removal of bacteria was obtained with an applied voltage of 300 V for the flowrate of 1 mL/hr. Images from scanning electron microscope confirmed the formation of electroporation-induced nanopore within the cell membrane. The reported method of inactivation does not involve any chemicals and the formation of harmful by-products is also minimized.

Poster #	68
Poster Title:	Fluid resistance optimized microfluidic shear device for mechanotransduction studies
Poster Presenter Name:	Sanat Dash
Affiliation:	Researcher

Abstract:

A logarithmic microfluidic shear device was designed and fabricated for cellular mechanotransduction studies. The device contains four cell culture chambers in which flow was modulated to achieve a logarithmic increment. Resistance values were optimized to make the device compact. The network of resistances was developed according to a unique combination of series and parallel resistances as found via optimization. Simulation results done in Ansys 16.1 matched the analytical calculations and showed the shear stress distribution at different inlet flow rates. Fabrication of the device was carried out using conventional photolithography and PDMS soft lithography. Flow profile was validated taking DI water as working fluid and measuring the volume collected at all four outlets. Volumes collected at the outlets were in accordance with the simulation results at inlet flow rates ranging from 1 ml/min to 0.1 ml/min. The device can exert fluid shear stresses ranging four orders of magnitude on the culture chamber walls which will cover shear stress values from interstitial flow to blood flow. This will allow studying cell behavior in the long physiological range of shear stress in a single run reducing number of experiments.

Poster #	69
Poster Title:	Gut-On-Chip Peristalsis: How To Fix Your Gut
Poster Presenter Name:	Sara Sibilio
Affiliation:	IIT Italy

Abstract:

Numerous contractile activities occur in the bowel wall both in the circular and longitudinal muscle layer. During normal gut function, the intestinal mucosal layer is subjected to numerous forces, is well know that the mucosal cells are submitted to shear and pressure stress with endoluminal chyme, and further repetitive deformation engendered by peristaltic muscular contraction. Luminal contents are generally minimally compressible so contraction of the muscular layers results in mucosal compression between the contracting musculature and the non-compressible chyme, at the same time the peristaltic contractility of the intestinal tract induces deformation and pressure on the intestinal mucosa. This mechanical forces are less known as shear stress and Hoop (cylindrical) stress. After the realization of intestinal peristalsis on chip, we want to test either the interstitial pressure due to the shear stress from endoluminal chyme and intraabdominal pressure due to Hoop stress as we known peristalsis stimulus, and reproduce simultaneously both mechanical stress in order to evaluate the different effect on intestinal epithelial damage and repair.

Poster #	70
Poster Title:	Unravelling the Complexity of Parkinson Disease one Neurotransmitter at a Time
Poster Presenter Name:	Sarah Spitz
Affiliation:	TU Wien

Abstract:

With yet unknown aetiology, Parkinson's disease constitutes the second most common neurodegenerative disorder worldwide. Characterized by a loss in dopaminergic neurons within the substantia nigra of the midbrain, it results in a variety of symptoms such as termors, akinesia and rigidity severely impairing the quality of everyday life. Due to the emergence of IPSC technology it is now possible to recapitulate highly complex structures in vitro, including structures of the midbrain relevant for PD research. However, engineering and monitoring such midbrain organoids (MOs) under a biomimetic environment favorable of brain development still remains challenging. Here we present a new strategy for the cultivation and monitoring of human derived midbrain organoids employing an organ-on-a-chip platform with an electrochemical dopamine detector. This platform allows for the physiologic cultivation of midbrain organoids within a hydrogel chamber, under dynamic flow conditions while monitoring the electroactive neurotransmitter dopamine in situ.

By employing electrochemical analysis, it was possible to detect a significant difference between healthy and diseased human MOs, as well as distinct differences across individual cell lines derived from different patients. Furthermore, electrochemical analysis was validated by HPLC – MS/MS, demonstrating that electrochemical analysis might be a powerful tool for monitoring neurotransmitter release of human MOs.

Poster #	71
Poster Title:	Human pluripotent stem cell derived liver organoids
Poster Presenter Name:	Sean Harrison
Affiliation:	University of Oslo

Abstract:

Human pluripotent stem cell (hPSC) derived hepatocytes have potential to revolutionise the field of hepatotoxicity and represent a paradigm shift for the treatment of liver disease and regenerative medicine. Unfortunately, current hPSC derived hepatocytes do not fully recapitulate the full cellular and metabolic repertoire of a healthy adult liver. Current liver organoid models generally provide the opportunity to study one or two cell types of the liver and can be used to interrogate drug metabolism and liver tissue regeneration but lack functional and cellular equivalency when compared to the liver sinusoid. To address these shortcomings we have developed a small molecule based 3D liver organoid model system from hPSCs, that mimics liver development to generate many of the cell types of the liver (hepatocytes, cholangiocytes, stellate, LSECs, endothelial cells). These organoids demonstrate features of primary liver including the production of serum proteins and coagulation factors at almost physiological levels, along with enhanced drug metabolism activity and inducibility that is maintained long-term. This simple and robust method of generating large numbers of liver organoids is of interest to the field for hepatotoxicity and disease modelling, providing a cost effective and scalable source of liver tissue that can facilitate Liver-on-Chip research.

Poster #	72
Poster Title:	Rapid prototyping, manufacturing and application of microfludic devices
Poster Presenter Name:	Sebastian Rudi Adam Kratz
Affiliation:	TU Wien

Abstract:

In the advent of affordable photo- and soft-lithography using PDMS, low cost multi-step microfabrication methods have become available to a broad scientific community today. Although these methods are frequently applied for microfluidic prototype production in academic and industrial settings, fast design iterations and rapid prototyping within a few minutes with a high degree of flexibility are nearly impossible. To reduce microfluidic concept- to-chip time and costs, pressure sensitive adhesives promises high design flexibility, rapid fabrication and simple biochip assembly, most adhesives are toxic for living biological systems. Since an appropriate biointerface and proper biology-material interaction is key for any cell chip and organ-on-a-chip system, only a limited number of medical-grade materials are available for microfluidic prototyping. Our results show that (a) both simple and complex microdevices can be designed, fabricated and tested in less than 1 hour, (b) these microdevices are stable for weeks even under physiological shear force conditions and (c) can be used to maintain cell monolayers as well as 3D cell culture systems.

Poster #	73
Poster Title:	Mimicking the oviduct mechanical stimulation microenvironment to enhance the efficiency of embryos culture
Poster Presenter Name:	Seungjin Lee
Affiliation:	PhD Student

Abstract:

In vitro fertilization (IVF) is one of the important technologies to overcome the infertility problems of human. However, the low quality of embryos cultured through IVF compared to embryos produced in vivo is still a task to be solved. In spite of various biochemical trials, it shows limitations in increasing the efficiency, and the technology of mimicking the in vivo mechanical stimulation microenvironments is considered as a solution. We focused on the cilia of the oviduct and hypothesized that the development of the embryos is affected by the inevitable contact with the cilia on the oviduct tissue. Various micropatterns were formed on the bottom of the microwell using a CNC machine to recreate oviduct-like structure. Two types of micropatterns were tested, and case studies were performed with different pattern geometries. The results of this study will demonstrate the need for engineered micropatterns and provide useful information on optimized micropatterns for advanced in vitro embryos culture systems.

Poster #	74
Poster Title:	UV-light and heat induced fabrication of polymer-modified paper by CH-insertion reaction of functional polymers for potential application in microfluidic paper-based analytical devices
Poster Presenter Name:	Simon Schölch
Affiliation:	University of Freiburg

Abstract:

Polymer-modification of cellulosic material plays a key role in the fabrication of microfluidic paper-based analytical devices (µPADs). Modification via CH-insertion reaction through photo- or thermo-reactive functional groups tackles various fields. By using a photomask, structuring of paper is possible which allows the fabrication of channels inside the substrate and better protein-repellency can be gained by attachment of suitable copolymers. For the preparation of a detection area, bioactive- or capture molecules must be attached to the cellulose fiber network. In most cases, the molecules are simply physically adsorbed on the cellulose which often is fast and easy but has the disadvantages of low reproducibility caused by possible gradual loss and low density of adsorbed molecules. A linkage by strong and thermally stable covalent bonds between detection molecules and cellulose fibers often provides robust sensors with reproducible results. However, most techniques usually rely on the OH groups of cellulose fibers and require modification of substrate and/or detection molecule what make it complex and expensive. In our approach, we attach a functional polymer and detection molecule to the cellulose via a simple yet efficient UV-induced CH-insertion reaction. No prior modification of the cellulose substrate is needed in this process.

Poster #	75
Poster Title:	Establishment & Validation of In-Vitro Disease Model to Study Lowe Syndrome and Dent II Disease
Poster Presenter Name:	Sindhu Naik
Affiliation:	Department of Biomedical Science, University of Sheffield, United Kingdom

Abstract:

Lowe syndrome and Dent II disease are two rare X-linked recessive genetic disorders affecting eye, kidney and brain. The Inositol polyphosphate 5-phosphatase OCRL-1, encoded by the OCRL gene, dephosphorylates (PI(4,5)P2 & PI(4,5)P3 present on cell membranes and other vesicles into PI4P. Mutations in OCRL lead to the accumulation of PI(4,5)P2 and PI(4,5)P3 causing cataracts, mental disabilities, and kidney dysfunction in Lowe syndrome patients. Dent II disease displays mild phenotypes of kidney dysfunction, also due to mutations in OCRL gene. Research has shown that OCRL is involved in multiple cellular processes such as clathrin mediated endocytosis, membrane trafficking and actin skeleton dynamics. The underlying molecular mechanisms of the disease is still largely unknown, due to absence of physiologically relevant models. We have established a unique in-vitro model to study disease phenotypes of kidney, by generating OCRL-knock-out proximal tubule cell line, utilizing CRISPR-Cas9 gene editing technology. Our model, combined with MIMETAS OrganoPlate® technology, enables culturing of 3D proximal tubules with shear stress, mimicking the in-vivo environment. We have successfully characterized our disease model to show phenotypes recorded in literature such as defects in primary cilium maintenance, transport, actin cytoskeleton abnormalities, and megalin mediated endocytosis defect. The OrganoPlate® 3D diseased kidney model offers a novel way of studying Lowe syndrome and its underlying disease mechanisms and a unique opportunity to screen for drugs in a high throughput manner, which could ameliorate the disease

condition. Furthermore, the functional characterizations might give us an insight into yet unknown disease mechanism.

Poster #	76
Poster Title:	Antibody-modified methylene blue/graphene oxide composites for label-free electrochemical biosensing
Poster Presenter Name:	Steffen Kurzhals
Affiliation:	AIT Austrian Institute of Technology GmbH

Abstract:

There is an ever-growing demand for small, low-cost, fast, and quantitative point-of-care testing devices. The aim of the H2020-project Greensense is to develop a paper-based electrochemical biosensor for drug-of-abuse detection matching these requirements. For fast and quantitative measurements, label-free electrochemical assays combining capture molecules with a redox-active layer-system are a promising approach. In such assays, specific binding events at the capture molecules cause a reduction in electron transport through the layer system to the electrode.
We aim for the development of inkjet-printable graphene oxide (GO) / methylene blue-labelled antibody (MB-AB) composites. For the formulation of stable redox-active inks with maximal loading of methylene blue, the effects of MB-concentration, pH, and ionic strength were investigated. After successful ink-formulation, the printing performance using a Dimatix DMP-2831 inkjet-printer and the electrochemical behavior of a screen-printed three electrode system (graphite working electrode) modified with these inks were evaluated. Concerning the printing performance, a moderate coffee staining effect and a 35 % enlarged printed area compared to the 1 mm2 nominal area were observed. Differential pulse voltammetry measurements on modified sensors showed peak currents of ~2.5-3.5 microampere/mm2. Future studies will focus on the effect of different MB-AB/GO ratios in the composites on the assay.

Poster #	77
Poster Title:	A fast and simple contact printing approach to generate 2D Protein Nanopatterns
Poster Presenter Name:	STRATEC Consumables GmbH

Abstract:

Protein micropatterning has become an important tool for many biomedical applications as well as in academic research. Current techniques that allow to reduce the Feature size of patterns below 1µm are, however, often costly and require sophisticated equipment. We present here a straightforward and convenient method to generate highly-condensed nanopatterns of proteins without the need for clean room facilities or expensive equipment. Our approach is based on nanocontact printing and allows to fabricate protein patterns with feature sizes of 80 nm and periodicities down to 140 nm. This was made possible by the use of the material X-poly(dimethylsiloxane) (X-PDMS) in a two-layer stamp layout for protein printing. In a proof of principle, different Proteins at various scales were printed and the pattern quality was evaluated by atomic force microscopy (AFM) and super-resolution fluorescence microscopy.

Poster #	78
Poster Title:	Human iPS Cell-derived Liver-on-a-Chip for Virus Infection
Poster Presenter Name:	Taiki Satoh
Affiliation:	Tokyo Institute of Technology

Abstract:

Hepatocyte has three cellular polarities in liver tissue; basal, apical and lateral. They are important for transportation and metabolization of molecules such as drugs and for exportation of their metabolites. It is difficult to construct the cellular polarities in culture system. There are reports that succeeded in the construction of apical polarity in culture. Few reports mentioned construction of basal polarity in culture. In this research, a hepatic tissue culture model consisting of human iPS-cell derived hepatic lineage cells, hepatic stellate cells and endothelial cell networks on EHS gel was established. This model was cultured on a dual flow fluidic device system which can switch between circulating and one-way flow for virus infection and proliferation, respectively. Also this device has upper filter on the culture chamber to avoid the line from the clogging with died cells after receiving virus-induced damage. Culturing on fluidic device made liver specific functions increased; urea synthesis and metabolism enzymes. In addition, this model enabled to improve the gene expression of basal membrane transporters such as NTCP and OATP, indicating the construction of cellular polarities. It suggests that this system would be useful for the screening of anti-virus drug.

Poster #	79
Poster Title:	“Invasive aspergillosis on-a-chip” – a novel disease model to study Aspergillus fumigatus infection in the human lung
Poster Presenter Name:	Thi Ngoc Mai Hoang
Affiliation:	Hans Knöll Institute

Abstract:

Fungal infections in immunocompromised patients have been seen at increasing rates during the last few decades. Despite new methods and established pathological mechanisms, a human cell-based model to investigate invasive aspergillosis is still lacking. Here, we established an “invasive aspergillosis on a chip” model to study A. fumigatus infection by conidia. The microfluidic “lung-on-a-chip” included human lung epithelial cells at an air-liquid-interface, as well as human endothelial cells to study the growth and the invasive behavior of A. fumigatus hyphae. Based on this novel disease model, the advanced automated image analysis of 3-dimensional confocal microscopy data allowed us to quantify numerous parameters of hyphal growth, including length, volume, and branching levels. The addition of macrophages to the model partially inhibited the growth of the fungus (as indicated by reduced hyphal length, volume, and branching) and facilitated the production of proinflammatory cytokine and chemokine (IL-6, IL-8, and MCP-1) compared to the model without macrophages. The additional perfusion of isolated healthy human leukocytes eliminated the hyphal growth. The development of this “invasive aspergillosis on a chip” system is very promising due to its potential contribution to the understanding of fungal pathogenicity in invasive aspergillosis.

Poster #	80
Poster Title:	Innovative technique to reconstruct thick tissue with embedded microvascular network on chip
Poster Presenter Name:	Thibault Krammer
Affiliation:	CEA France

Abstract:

Tissue engineering aims at developing in vitro functional tissues or organs in order to provide test platforms or transplants. However, most tissues are perfused by blood capillaries networks providing nutrients and oxygen to cells. Because of the oxygen diffusion limit inside tissues, cells are at most 200 micrometers away from a capillary. Therefore, difficulties to build a vascularized network perfusing tissues limit the development of thick matured tissues. Microfluidic devices are increasingly used to build vascular systems and control the microenvironment. Techniques to build in vitro 3D microvasculature essentially lies on the patterning of hollow channels covered with endothelial cells, or on the self-assembly of endothelial cells into capillaries by applying specific cues. Despite their advantages, some limitations remain and prevent the development of thick vascularized tissues.

An innovative technique to develop a microvascular network inside a thick tissue construct will be presented. This device presents three main advantages. First, capillaries are grown inside a biocompatible material while supplying the cells embedded in the tissue. Second, different types of cells can be cultured depending on the tissue wanted. Third, the system is versatile, the finale architecture of the tissue can be easily adapted by modifying the microfluidic chip.

Poster #	81
Poster Title:	Development of a particle-based method for rapid and sensitive detection of DNA without enzymatic amplification
Poster Presenter Name:	Wonho Seo
Affiliation:	Gangneung-Wonju National University

Abstract:

Current molecular diagnostic methods are based on enzymatic amplifications such as polymerase chain reaction or isothermal amplifications which are susceptible to contaminants or environmental factors. In this study, we developed a simple, ultrasensitive method to detect DNA without enzymatic amplifications, by using two kinds of particles, capture particles (CPs) and labeling particles (LPs), each prepared by immobilizing capture probes and labeling probes on magnetic nanoparticles and europium-chelate nanoparticles respectively. Binding of CPs and LPs to target DNA was mediated by capture-mediating oligonucleotides (CMOs) and label-mediating oligonucleotides (LMOs), each capable of binding to target DNA and corresponding probe. The mediating oligonucleotides were designed to have a hairpin consisting of probe-binding sequence and a part of target-binding sequence and a single-stranded toehold containing another part of target-binding sequence. Therefore, the probe-binding sequence was accessible only after the mediating oligonucleotides bound to target DNA, obviating the need to remove free mediating oligonucleotides. The detection process involved reaction of target DNA with particles and mediating oligonucleotides, removal of unbound materials by magnetic separation, and fluorescence measurement. The method was proved to have a potential to be applied to point-of-care molecular diagnostics by enabling detection of DNA with a zeptomole-sensitivity within 30 min.

Poster #	82
Poster Title:	Microencapsulation of phase change material via microfluidics
Poster Presenter Name:	Xing Han
Affiliation:	Hong Kong University

Abstract:

Microencapsulation of PCMs can prevent the leakage of PCM during usage. Here, we fabricate Microencapsuled PCMs (MEPCMs) from double emulsion templates via microfluidics. The dimension of the core and shell structure of the microcapsules can be precisely controlled using microfluidics. The microfluidics-fabricated microcapsules are very uniform compared with those from other emulsification processes. The droplet generation process and destabilization process are carefully studied for the well-controlled production of MEPCMs. The chemical composition, thermal properties and thermal stability of microcapsules are investigated. The microcapsules show promising potential in energy storage. Moreover, microcapsules can be used as security code with infrared thermal imager under room temperature after cooling.

Poster #	83
Poster Title:	A proof-of-concept study: Measuring the variation in cytoplasmic ion content of doxorubicin-treated CCRF-CEM cells via modified ion-release based impedance spectroscopy
Poster Presenter Name:	Yagmur Demircan Yalcin
Affiliation:	Mikro Biyosistemler Electronic Inc.

Abstract:

This study presents the variation in cytoplasmic ion content of doxorubicin-treated CCRC-CEM cells (CCRF-CEM/doxRT), explored via modified ion-release based impedance spectroscopy (IRbIS). Average total ion concentration per cell was calculated by measuring variations in solution conductance after lysis of a population with a known cell count.
Chemotherapeutics induce apoptosis in cancer cells. During apoptosis, cells influx/efflux ions. If net effect of ion exchanges on cytoplasmic ion concentration is differentiable, apoptosis can be detected via electrical techniques for drug effect analysis. Therefore, net effect of induced apoptosis by doxorubicin in the cytoplasmic ion concentration of CCRF-CEM cells was explored by IRbIS.
CCRF-CEM cells were seeded into T75 flasks, incubated for 24h, and exposed to doxorubicin (500nM in phosphate buffer saline (PBS)) for 14h. Control group was subjected to the same volume of PBS. Next, cells were lysed by following the method. Total cell number was adjusted as 6x105 cells in 8mL DI water. Two experiments were carried out with triplicate measurements. Results indicate that cytoplasmic ion concentration of CCRF-CEM/doxRT cells (394mM±17mM) was 10% less than that of nontreated ones (440mM±12mM) although viability of them (98%±1%, Trypan blue viability assay) was the same with the nontreated ones.

Poster #	84
Poster Title:	Integration and automation of 3D flow-focusing microfluidic system for single particle sorting
Poster Presenter Name:	Yingkai Lyu
Affiliation	PhD Student

Abstract:

The separation and sorting of particles (cells, beads, and droplets) are critical in a variety of biomedical applications including early disease diagnostics, therapeutics, cell tracking, and clinical research etc. The current standard methods are using 2D microfluidic chips fabricated by PDMS. However, it's substantially limited to adjust the flow flexibly as the researchers intend to conduct multi-functional assays in a single experiment. Furthermore, the signals detected in the microscale channels tend to be easily deteriorated by the PDMS as well as the substrate materials. This work aimed to develop a 3D integrated and automated microfluidic system with the flexibility and stability for multi-functional assays of different particles. A sorting accuracy higher than 95% was experimentally achieved and reasonably high purity of 85.2% was eventually realized with the initial ratio of the targeted fluorescent beads standing at approximate 17%. The novelty towards this study lies in the 3D flow-focusing function in the detection area, effectively demonstrating the flexibility and stability of the system. Therefore, this method would be promising to apply in a variety of single particle analysis within a highly compatible microfluidic chip.

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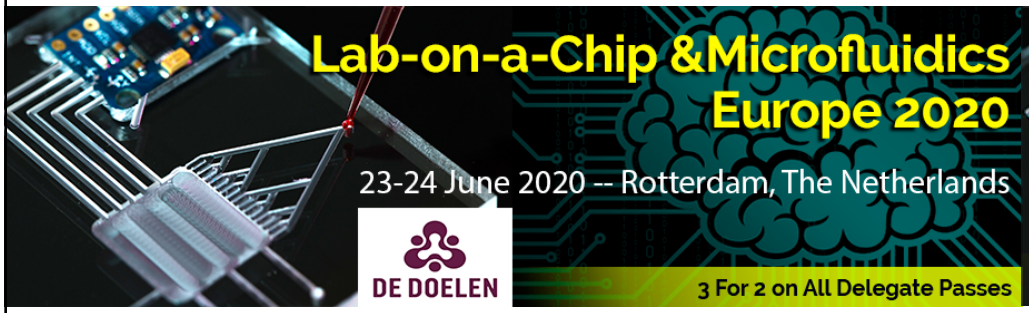

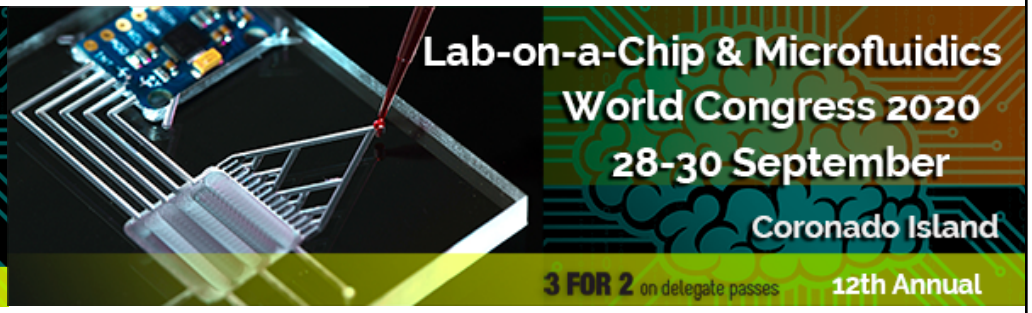

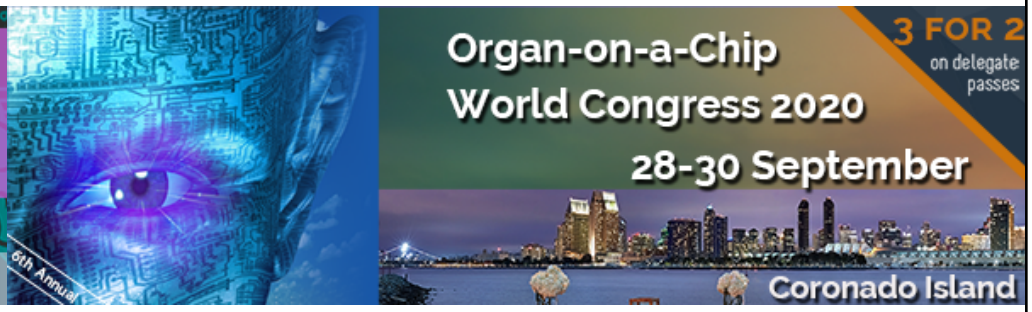

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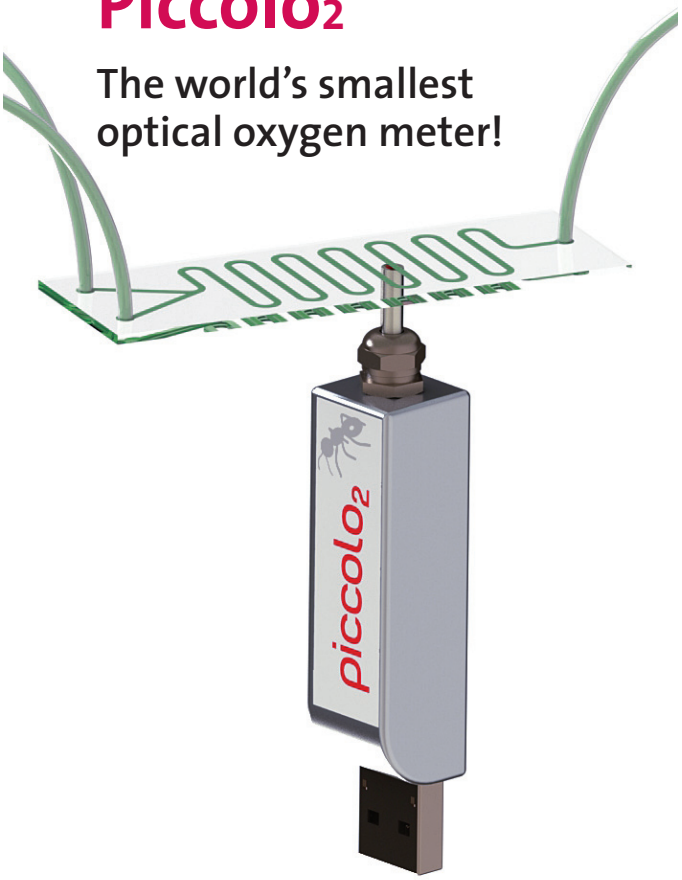

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