Japan-UK Joint Workshop

on Life Science and Biomedical Engineering

3rd December 2015

Embassy of Japan in the UK

Programme

Opening remarks

14:15 – Mr Hiroshi Matsuura, Minister, Embassy of Japan in the UK
Mr John McKinley, CEO, Precision Medicine Catapult

Session 1 Efforts towards innovation from clusters in Japan and the UK

14:30 – 14:45 Ms Sarah Haywood, Chief Operating Officer of MedCity
14:45 – 15:00 Mr Kentaro Yamaguchi, Bureau for promoting "Healthcare New Frontier", Kanagawa prefectural government, Japan

Session 2 Latest trends and future of biomedical sensing and imaging in Japan and the UK

15:00 – 15:15 Prof. Quentin Pankhurst, University College London
"Biomedical Applications of Magnetic Nanoparticles'"
15:15 – 15:30 Prof. Tony Cass, Imperial College London
"Engineering Nucleic Acid Aptamers for Healthcare Applications"
15:30 – 15:45 Prof. Eiry Kobatake, Tokyo Institute of Technology
"Design of DNA-Protein Hybrid Molecules for Biosensing"

15:45 – 16:00 **Coffee break**

16:00 – 16:15 Dr. Adrien Desjardins, University College London
"Optical ultrasound and photoacoustic imaging for guiding minimally invasive procedures"
16:15 – 16:30 Prof. Sergei G. Kazarian , Imperial College London
"Spectroscopic imaging for biomedical research"
16:30 – 16:45 Prof. Natsue Yoshimura, Tokyo Institute of Technology
"The possibility of electroencephalography signals towards non-invasive brain-machine interfaces"

Session 3 Industrial Collaboration between Japan and the UK

16:45 – 17:00 Dr. Tommy Duncan, Touchlight Genetics Ltd.
17:00 – 17:15 Mr Anil Vaidya, Life-science Specialist, JETRO
17:15 – 17:30 Mr Matthew Lovatt and Mr Hiroshi Sheraton, Baker & Mckenzie

Q&A / Discussion

17:30 – 17:55 Promoting innovation in Japan and the UK, and future investment

Closing Remarks

17:55 – 18:00 Professor Susumu Kajiwara, Tokyo Institute of Technology

18:00 - **Networking Reception**

Mr John A. McKinley LLB, Solicitor
CEO, Precision Medicine Catapult

Biography

John McKinley has been CEO of the Precision Medicine Catapult since May 2015, joining from Enigma Diagnostics where he was Chairman and CEO. A qualified solicitor, he has over 25 years of experience in the healthcare diagnostics and environmental industries, building global public and private companies as CEO, Director and Chairman. Having worked across the EMEA, China, USA and Asia-Pacific, John has extensive deal-making and licensing expertise, and over his career has raised over £100m from a range of sources.

At Enigma Diagnostics, a public-private partnership with the Ministry of Defence, John led the company through development of its flagship in-vitro diagnostic instrument, culminating in European CE mark approval in 2014. During this time he was negotiated substantial investment from China, as well as a commercial partnership and a ground-breaking collaboration with the Chinese Center for Disease Control and Prevention. He also secured a range of industrial, funding and R&D partnerships including with GlaxoSmithKline, Thermo Fisher and global manufacturers and suppliers.

Earlier roles were at Celsis International plc, where he was a Board Director, Legal Director and Company Secretary, and at Australian gene silencing company Benitec. As Chairman and CEO, he led the company through its listing on the Australian Stock Exchange.

John's Chairman and NED positions have been at healthcare and environmental diagnostic companies Smart Holograms, Alaska Food Diagnostics and Acolyte Biomedica. In addition, from 2013 – 2014, he was a member of the UK Government Steering Group for the Technology Strategy Board's Innovation Platform for the Detection & Identification of Infectious Agents.

Ms Sarah Haywood
Chief Operating Officer
MedCity

Biography

Sarah Haywood became Chief Operating Officer of MedCity in October 2014, after fulfilling the role in an acting capacity since MedCity's launch in April 2014.

Sarah is a graduate of the NHS Management Training Scheme in Wales and started her career in the NHS, working in a number of NHS Trusts, including Great Ormond Street NHS Foundation Trust, before joining Novartis Pharmaceuticals Research as the Head of Operations for a neuroscience drug discovery unit, located on the UCL campus.

From there, Sarah joined the civil service and undertook a number of roles as a member of the Senior Civil Service, including leading the DTI (now BIS) Bioscience Unit before it became part of the Office for Life Sciences. Her last role in BIS was leading the design and legislation for the extension of the right to request flexible working and the shared parental leave system. In January 2014 she joined London & Partners where she worked with Dr Eliot Forster to establish MedCity.

Sarah has a degree in Biology from the University of Oxford, a post graduate diploma in management and an MA in human resources management; she is a chartered fellow of the Chartered Management Institute.

Mr Kentaro Yamaguchi
Deputy Director General,
Healthcare New Frontier Promotion Bureau,
Kanagawa Prefectural Government, Japan

Biography

April 1983: Enter Kanagawa Prefectural Government, Japan
(Experienced, City Planning, Industry Promotion, Environment Policy,
Kanagawa office in Los Angeles, US, etc)

Healthcare New Frontier –Launching Kanagawa Model into the world

Japan is facing the era of the unprecedented super-aged society. Kanagawa is one of the most rapidly aging prefectures in Japan. Other developed countries are also moving toward the super-aged society.

Our wisdom is tried how to overcome this drastic change.

To cope with this issue, We must innovate our healthcare system. Kanagawa, as the front runner, is now promoting "Healthcare New Frontier" policy, which will be the model for the rest of the world.

"Healthcare New Frontier" is a bundle of healthcare and industrial/regional policies. Its key concept is "Curing ME-BYO," the scope of which is something broader than that of "disease prevention" in the western medicine context. Combining this concept with the utilization of the most-advanced medical treatments/information technologies, we aim to achieve innovations in technology, business and social system, and eventually extend to healthy longevity of the citizens and to create new markets and industries at the same time.

Regenerative Medicine and Cell Therapy is a highly promising area in pursuing to develop cutting-edge medical care. It can provide not only complete cures for the ills but also global market expansion in the future. We are promoting scientific and technological developments as well as practical realization and industrialization of Regenerative Medicine and Cell Therapy, for accelerating such innovation toward the brighter future.

Professor Quentin Pankhurst
Director, Healthcare Biomagnetics Laboratory
University College London

Biography

Quentin Pankhurst is an academic innovator in the medical technology sector. In 2007 he founded Endomagnetics Ltd. to commercialise the SentiMag®, an intra-operative device for sentinel node detection in breast cancer surgery, and its associated tracer, Sienna+®. The company has successfully guided both products through CE marking as Class IIa devices; has treated more than 8,500 patients in 20 countries; and is currently undertaking a pivotal trial in the US under an IDE licence.

Quentin is also a Professor of Physics and Director of the Healthcare Biomagnetics Laboratory at University College London, where he runs programmes in bio- and nanomagnetism aimed at making practical advances in the use of magnetic nanoparticles in healthcare.

Biomedical Applications of Magnetic Nanoparticles

'Healthcare Biomagnetics' – the sensing, moving and heating of magnetic nanoparticles *in vitro* or in the human body – is a rapidly changing field that is attracting much interest worldwide. It offers the potential to develop safe and convenient alternatives for a diverse range of therapeutic and diagnostic healthcare applications, using injectable materials of proven safety and reliability.

Healthcare Biomagnetics makes use of the three fundamental 'action-at-a-distance' properties of magnetic materials – their ability to act as remote sensors, as mechanical actuators, and as sources of heat for both hyperthermia and thermoablation.

In this presentation the speaker will focus on one of these modalities, and will describe current and on-going work in the field.

Professor Tony Cass
Imperial College London

Biography

Tony is Professor of Chemical Biology in the Department of Chemistry and the Institute of Biomedical Engineering at Imperial College London. He graduated with degrees in Chemistry from the Universities of York and Oxford.

His research is focused on using analytical science to solve problems in animal and human health especially through creating devices that perform the analysis at point of decision in the belief that providing measurement data rapidly can allow remedial action to be taken much more effectively. To deliver on this idea requires collaboration with engineers, clinicians and environmental and animal scientists. Currently his work is funded by several different agencies and includes projects on improved diabetes management, early detection of bile salts in maternal blood for management of cholestasis of pregnancy, penside avian influenza diagnostics, and well-side determination of arsenic(III) in drinking water. To realise these devices his research uses a combination of biomolecular engineering of proteins and nucleic acids, low cost production of electrochemical sensors and performance enhancement through the use of nanomaterials. Translation of university research to meet societal and commercial needs is a key aspect of his work and several years ago he and Professor Gabriel Aeppli (UCL and ETH) founded BioNano Consulting to further these aims.

In this talk Tony will illustrate the versatility of small single stranded nucleic acid molecules known as aptamers in both diagnostic and therapeutic applications. The chemical versatility, robustness and low cost of these molecules are well suited to diverse tasks in biomedicine.

Professor Eiry Kobatake

Department of Environmental Chemistry and Engineering,
Interdisciplinary Graduate School of Science and Engineering,
Tokyo Institute of Technology

Biography

Academic Career

1984.03: BE in Polymer Chemistry, Kyoto University

1986.03: ME in Polymer Chemistry, Kyoto University

1990.03: DE in Chemical Engineering, Tokyo Institute of Technology

Work Experience

1986.04-1987.03: Mitsubishi Chemical Co.

1990.04-1994.09: Assistant Professor, Tokyo Institute of Technology

1994.10-1997.05: Lecturer, Tokyo Institute of Technology

1997.06-2013.03: Associate Professor, Tokyo Institute of Technology

2013.04-: Professor, Tokyo Institute of Technology

Research Interests

+ Molecular Design of Super Bio-functional Proteins
+ Regulation of Cellular Functions with Engineered Proteins
+ Tissue Engineering by Controlling Cellular Information Networks
+ Construction of Biosensing Systems

Design of DNA-Protein Hybrid Molecules for Biosensing

Recently, DNA-protein hybrid molecules have been used as versatile tools for a variety of applications in biotechnology and materials science. In particular, the utility of DNA-protein hybrid has emerged in biosensing systems to quantify target molecules. Despite the potential applicability of DNA-protein hybrid molecules, synthetic methods remain challenging. Chemical synthesis of DNA-protein hybrid has been successful over the past years, although the incorporation of DNA into larger proteins is still poorly developed. Furthermore, these methods require extensive purification of the hybrid to remove excessive protein and DNA after each coupling step. To overcome these problems, we developed a novel method for site-selective conjugation of a recombinant protein with single-stranded DNA. To make such DNA-protein hybrid molecules, we paid attention to Gene A* of coliphage φX174. Gene A* protein can cleave the specific sequence of DNA, and a phosphate bond is formed between the cleavage site of DNA and the tyrosine residue of the Gene A*. Therefore, one can imagine Gene A* could be used to construct a DNA-protein hybrid site-specifically, and covalently.

By using this strategy with Gene A*, DNA-antibody-binding protein hybrid was constructed for the application to a sensitive immunoassay. Here, DNA was used as a signal molecule for the detection. Immuno-rolling circle amplification (IRCA) was performed with the hybrid, and interferon-γ could be detected with high sensitivity.

Dr. Adrien Desjardins
Senior Lecturer
University College London

Biography

Adrien Desjardins received his BSc in Physics and Mathematics from the University of British Columbia, and his PhD from Harvard University and the Massachusetts Institute of Technology in Biophysics, Medical Physics, and Biomedical Engineering. As part of his PhD, he performed an internship at Terumo Medical Corporation in Hadano, Japan, to develop a new Optical Coherence Tomography system for intravascular imaging. After obtaining his PhD, he joined Philips Research as a Project Leader, where he led the development of a novel interventional medical device with integrated sensors and initiated first-in-human studies. In 2011, he accepted a position as Lecturer at the University College London. Currently, as a Senior Lecturer, he leads the Interventional Devices Group, with a focus on developing new imaging modalities and medical device tracking technologies to guide minimally invasive clinical procedures.

Optical ultrasound and photoacoustic imaging for guiding minimally invasive procedures

Recent advances in optical sensing techniques have the potential to transform medical devices and minimally invasive procedures. Traditionally, many medical devices such as needles and catheters have been passive conduits for accessing tissue targets. There is currently significant interest in integrating sensors that provide real-time information about the micro-structure and molecular composition of biological tissue. These new active medical devices can also interact with external image modalities such as ultrasound to identify their locations within patients. I will present recent advances in real-time all-optical ultrasound imaging in which transmission and reception is performed with telecommunication-grade optical fibres, interventional photoacoustic imaging, and ultrasonic medical device tracking.

Professor Sergei G. Kazarian
Professor of Physical Chemistry
Imperial College London

Biography

Sergei G. Kazarian is Professor of Physical Chemistry at the Department of Chemical Engineering of Imperial College London. Professor Kazarian is a Fellow of the Royal Society of Chemistry and a Fellow of Society for Applied Spectroscopy. He joined Imperial College London in 1998 and was promoted to Professor in 2006. He is an Associate Editor of *Applied Spectroscopy* and an editorial Board member of *Vibrational Spectroscopy*. Most of his recent research is focused on FTIR spectroscopic imaging and its applications for characterisation of polymeric, pharmaceutical, forensic and biomedical systems. His research also encompasses confocal Raman microscopy and tip-enhanced Raman scattering for materials characterisation. He has published over 200 articles in leading scientific journals. He presented his research at the Royal Society's 350th Anniversary Summer Science Exhibition in 2010 and he was awarded the RSC Sir George Stokes Award for his research with ATR-FTIR spectroscopic imaging in 2015.

Spectroscopic imaging for biomedical research

FTIR spectroscopic imaging has emerged as a powerful tool for characterisation of polymeric, pharmaceutical and biomedical systems. This talk will outline the research we are developing in this area (www.imperial.ac.uk/vsci) with focus on FTIR spectroscopic imaging in both ATR (Attenuated Total Reflection) and transmission modes. Chemical visualisation with enhanced spatial resolution in micro ATR imaging mode broadens the range of biomedical samples (cross-sections of blood vessels or hair, surface of skin, single cells, etc.) amenable to study with FTIR imaging, which were previously ruled out by the inadequate spatial resolution. Macro ATR-FTIR imaging provides many opportunities for studying dynamic biochemical systems. Emerging biomedical applications of these methods will also be discussed.

Professor Natsue Yoshimura
Associate Professor
Precision and Intelligence Laboratory
Tokyo Institute of Technology

Biography

Natsue Yoshimura received her B. S. from Tokyo University of Science in 1994. After working for industrial firms about 9 years, she returned to academic field to receive her M.S. in Medical Science from Tokyo Medical and Dental University in 2006 and Ph.D. in Engineering from The University of Electro-Communications in 2009. She joined Tokyo Institute of Technology in 2009 as a post-doc researcher. In 2010, she became an assistant professor and has been an associate professor since April 2015. Her major research interests are revealing neural signaling in the brain during motor, language, and emotional activities using non-invasive techniques such as electroencephalography and functional magnetic resonance imaging.

The possibility of electroencephalography signals towards non-invasive brain-machine interfaces

Brain-machine/computer interfaces (BMI/BCI) have drawn attentions from the medical, engineering, and entertainment fields as interfaces for the next generation because they provide means to control robots and computers without using users hands. In the medical field, micro-array electrodes have been implanted in the brain of extremity-disabled patients to control an arm robot. This evidence suggested the potential of practical use of BMI/BCI. To expand the application of BMI/BCI to wide variety of people, non-invasive techniques without medical surgery are necessary. However, since non-invasive brain activity recording techniques have much lower spatial resolution compared to invasive techniques, it is widely considered to be difficult for non-invasive techniques to decode detailed information at the same level as invasive techniques. The presentation will introduce a solution to overcome low spatial resolution of Electroencephalography (EEG) signals in conjunction with another non-invasive technique, functional magnetic resonance imaging (fMRI), which has relatively higher spatial resolution.

Dr. Tommy Duncan

Group Business Development Officer

Touchlight Genetics Ltd.

Biography

Dr. Duncan holds the position of Group Business Development Officer at Touchlight Genetics, a biotechnology company with a DNA synthesis platform focused on the development of novel biological therapeutics. Prior to joining Touchlight, Dr. Duncan spent four years at L.E.K. Consulting, a leading commercial strategy consultant to the Life Sciences industry, where he led a broad range of commercial strategy, due diligence and product strategy projects for Life Sciences Investors and biopharmaceutical clients. Dr. Duncan holds a D.Phil in cell and molecular biology from the University of Oxford, UK.

Touchlight Genetics: Enzymatic amplification of DNA

Demand for DNA is growing rapidly, driven by the proliferation of advanced targeted therapeutics such as cell and gene therapy, in addition to growing industrial applications including metabolic engineering and biomaterials. Today's method of amplifying DNA constructs relies on the expensive and inefficient process of bacterial fermentation – a process that is insufficient to meet growing DNA demand.

Touchlight Genetics has developed an entirely enzymatic process of DNA synthesis that is fast, efficient and has a yield that can easily meet growing demand for DNA. Furthermore, our dbDNA™ expression cassettes eliminate the need for bacterial sequences and antibiotic resistance genes in the production of biological therapies.

Our dbDNA™ also has many important unique properties (encoding of multiple expression cassettes, large or "difficult" genes, among others) that have enabled us to explore in-house programmes to develop differentiated, next generation therapeutics, in addition to industrial applications of DNA.

Mr Anil Vaidya
Life Science Specialist, Investment Team
Japan External Trade Organisation (JETRO)

Biography

Anil Vaidya is a life science (biopharma) and healthcare consultant supporting private and public organisations understand commercial market entry opportunities in the UK, the Far East and Asian life science sectors. Anil currently supports JETRO London as their Japanese life science specialist.

Anil is also the founder of Scanurse, a medical app venture developing a machine vision diagnostic platform for the consumer market that can diagnose a variety ofmedical conditions. Until recently Scanurse was a hardware venture and finalist in the Qualcomm Tricoder X Prize Competition.

Anil has worked in the USA, Japan, India and the UK. He is a chartered engineer (C.Eng) with a Masters degree in Biomedical Engineering (MSc) from the USA and an undergraduate degree in Instrumentation and Control Engineering (B.Eng (Hons)) and an Executive MBA from the UK.

Mr Matthew Lovatt

Associate, Corporate Tax at Baker & McKenzie, London

Biography

Matthew received both his LL.B. in Law and his LL.M. in International Economic Law from the University of Warwick, in 2006 and 2007 respectively.

He joined the London office of Baker & McKenzie in 2011 after working in an in-house legal role with a large finance focus.

Matthew is a member of the Corporate Tax subgroup of Baker & McKenzie's tax practice. His practice focuses on the tax structuring of corporate reorganisations and investments, particularly in regulated industries, and upon the UK tax aspects of intellectual property development and exploitation. Many of Matthew's clients are located in the APAC region.

Matthew spent significant time working with the firm's tax group in Amsterdam in 2013 and he will shortly commence a secondment to Baker & McKenzie's office in Singapore. Matthew has been learning to speak Japanese for a number of years and he is currently able to speak the language at an intermediate level.

Phone: +44 (0) 207 919 1345

Mobile: +44 (0) 7920 494 794

Email: matthew.lovatt@bakermckenzie.com

Industrial collaboration between Japan and the UK

The UK government has been working toward ensuring that the UK has the most competitive corporate tax system in the G20. The presentation will also briefly consider key aspects of the UK tax system that are likely to be of interest to entities developing intellectual property in the UK and Japanese investors in such activities.

Mr Hiroshi Sheraton
Partner
Baker & McKenzie, London

Biography

Hiroshi leads the Pharmaceuticals & Healthcare group in Baker & McKenzie's London office. This group is made up of practitioners from across a wide range of practice groups who specialise in advising clients within the industry.

Hiroshi's practice covers all aspects of intellectual property law with a particular emphasis on litigation, licensing and collaboration agreements in the life sciences sector.

Much of his work is cross-border in nature. He has expertise in advising on pharmaceutical regulatory issues where they interact with traditional IP rights such as matters concerning Supplementary Protection Certificates, data exclusivity and clinical trials as well as in a licensing context.

Hiroshi graduated from St John's College, Cambridge with a degree in Natural Sciences (Biochemistry & Molecular Biology) and started his working life as a medicinal chemist in the pharmaceutical industry.

Presentation

Cross border collaboration, particularly in the bioscience and healthcare fields, can highlight cultural and legal differences relating to the generation, ownership and exploitation of valuable intellectual property rights, and the need to adopt new working practices to ensure success and to avoid disputes. The presentation will outline some key areas on which to focus.

Professor Susumu Kajiwara
Vice Dean and Professor, Ph. D.
Graduate School of Bioscience and Biotechnology
Tokyo Institute of Technology

Biography

Educational qualifications:

Dr Sci in Life Sciences, Tokyo Institute of Technology, Yokohama, Japan (1993)
M Sci in Life Science, Tokyo Institute of Technology, Yokohama, Japan (1990)
B Eng in Chemical Engineering, Tokyo Institute of Technology, Tokyo, Japan (1988)

Professional experience:

2015-present:Director, Organization for Life Design and Engineering, Tokyo Institute of Technology, Tokyo Japan
2013-present:Senator, Japanese Biochemical Society, Japan
2012-present: Advisor to the President, Tokyo Institute of Technology, Tokyo, Japan
2012-present: Professor, Core Division of Advanced Research, Graduate School of Bioscience and Biotechnology, Tokyo Institute of Technology, Yokohama, Japan
2006 - 2007: Visiting research fellow, University of Otago, Dunedin, New Zealand
2002 - 2005:Deputy Director, Council for Science and Technology Policy (CSTP), Cabinet Office, Japan government
1998 - 2012:Associate Professor, Department of Life Science, Graduate School of Bioscience and Biotechnology, Tokyo Institute of Technology, Yokohama, Japan
1995 - 1998:Assistant Professor, Department of Chemical Engineering, Graduate School of Science and Technology, Tokyo Institute of Technology, Tokyo, Japan
1993 - 1995:Researcher, Central Laboratories for Key Technology, Kirin Brewery Co., Ltd., Yokohama, Japan