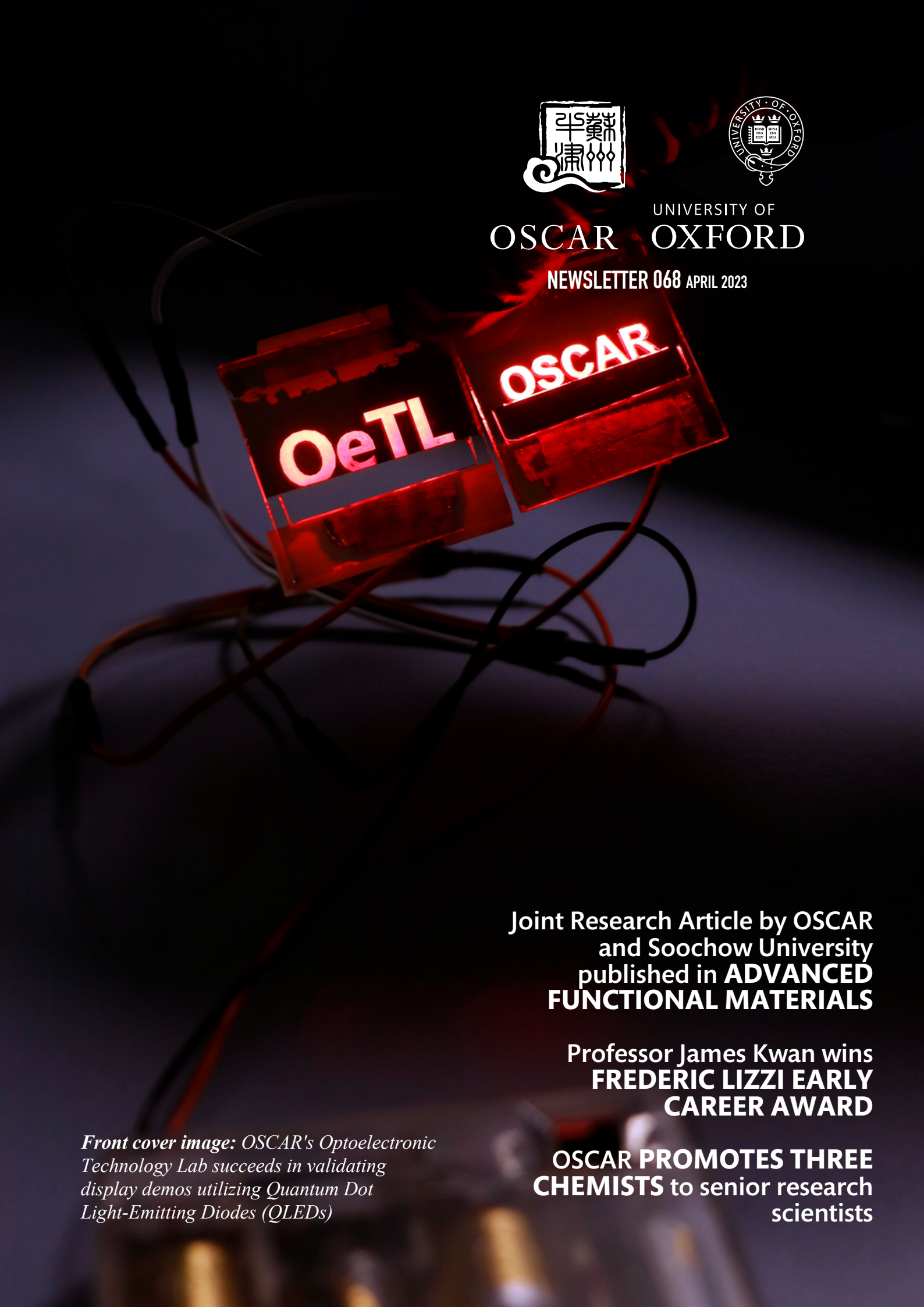




UNIVERSITY OF  
**OSCAR OXFORD**

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Joint Research Article by OSCAR  
and Soochow University  
published in **ADVANCED  
FUNCTIONAL MATERIALS**

Professor James Kwan wins  
**FREDERIC LIZZI EARLY  
CAREER AWARD**

**OSCAR PROMOTES THREE  
CHEMISTS** to senior research  
scientists

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## Joint Research Article by OSCAR and Soochow University published in Advanced Functional Materials

OSCAR's Optoelectronic Technology Laboratory (OeTL) and researchers from Soochow University recently reported a surface defect suppression approach that achieved a high colour purity of the light-emitting diode (LED) of free-standing single-crystal perovskite film. This collaborative work was published online in *Advanced Functional Materials* in April.

Metal halide perovskites have proved to be promising candidates for LEDs. High colour purity is one of the important features of metal halide perovskite light-emitting diodes (PeLEDs), as well as high photoluminescence quantum yield, wide tuneable bandgap, and high carrier mobility. The property of high colour purity can fully satisfy the required colour gamut (Rec.2020) for more vivid and ultra-high-definition displays.

Due to a low defect concentration, single-crystal perovskite tends to show higher colour purity as a light emitter. However, surface defects nullify the intrinsic superiority of the bulk single-crystal properties. Therefore single-crystal perovskite-based LEDs have failed to show high colour purity advantage up until now.

Surface passivation is the most effective way to suppress the surface defects of perovskite films for PeLEDs. For example, surface passivation defects of perovskite with methylamine bromide (MABr) can drastically reduce the full width at half maximum (FWHM) to below 20 nm. Similarly, passivation of 2D perovskite with the P=O moiety can also produce similar effects.

Surface defect suppression for single-crystal perovskite is a feasible way to improve the colour purity of electroluminescence (EL) in single-crystal perovskite-based LED devices. However, the surface state of single-crystal films is very different from those of polycrystalline films, which makes existing passivation methods unsuitable for single-crystal optoelectronic devices. Therefore, it is necessary to explore an effective way to suppress surface defects of single-crystal perovskite films.



In this work, a free-standing  $\text{CsPbBr}_3$  single-crystal film was fully wrapped by polymethyl methacrylate (PMMA). It was observed that the ultra-thin PMMA layer acting as a passivation layer significantly improved carrier lifetime and suppressed surface defects. It is noteworthy that the passivated free-standing single-crystal perovskite films were feasible for building up a vertical LED device structure, avoiding the edge glowing and short-circuiting of LED devices. As a result, the single-crystal perovskite device achieved a high colour purity (FWHM = 15.8 nm) and a large luminescent area ( $>2 \text{ mm}^2$ ). This work demonstrated the highest colour purity in the field of halide perovskite in green colour and provides a new route for free-standing single-crystal films for vertical device structure.

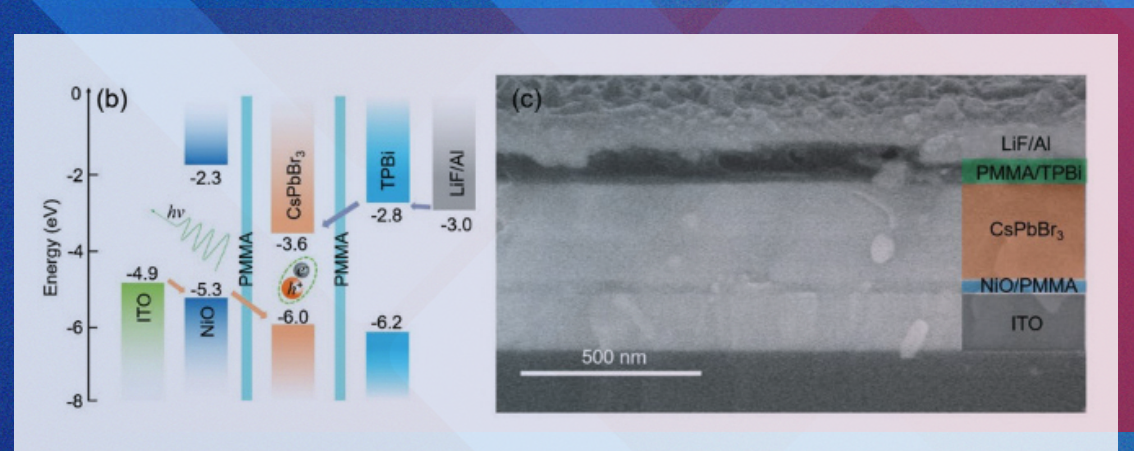


Figure Energy level diagram and SEM cross-sectional image of the as-fabricated LED device structure.

Dr. Jingsong Huang, Co-PI of OeTL and Head of OSCAR-Hongda ITC for Perovskite Technology, and Professor Guifu Zou from College of Energy, Jiansheng Jie from Institute of Functional Nano & Soft Materials, Soochow University, are the corresponding authors of the research paper. Dr. Lutao Li, a visiting PhD student from Soochow University, is the first author. Dr. Yun Hu, Research Scientist in OeTL also contributed to this work as the co-first author.

The full article is available online: Li, L., Hu, Y., Chen, Y., Wang, C., Zhao, G., Du, X., Wang, C., Xiao, L., Lu, Z., Wang, J., Wang, D., Jie, J., Huang, J., Zou, G., Surface Defect Suppression for High Color Purity Light-Emitting Diode of Free-Standing Single-Crystal Perovskite Film. Adv. Funct. Mater. 2023, 2301205. <https://doi.org/10.1002/adfm.202301205>



## Professor James Kwan wins Frederic Lizzi Early Career Award

OSCAR's Principal Investigator Professor James Kwan has received the Frederic Lizzi Early Career Award.



James Kwan (second from right) with his award. Photo copyright G. Perret.

Awarded by the International Society for Therapeutic Ultrasound, the Frederic Lizzi Early Career Award was established in 2008 in honour of Frederic L. Lizzi, a pioneer in advanced diagnostic and therapeutic applications of ultrasound, to recognise early career achievements in the field of therapeutic ultrasound.

Professor James Kwan is a Principal Investigator at the Department's Physical Acoustics Laboratory (PacLab) and at the Oxford Suzhou Centre for Advanced Research (OSCAR). His research interests include the application of mechanical, thermal, and chemical effects of ultrasound and cavitation to address challenges in personal and environmental health.

He leads the Kwan Research Group, whose research areas include sonochemistry — the use of ultrasound and cavitation to promote chemical reactions or facilitate nanoparticle formation; designing and developing novel ultrasound devices and cavitation nuclei to enhance the treatment of diseases such as cancer and peripheral artery disease; and using ultrasound to mechanically disrupt biofilms, which make many medical and environmental infections difficult to treat, and to enhance the transport of antibiotics.

Sourced from <https://eng.ox.ac.uk/news/lizzi-award-for-professor-james-kwan/>





# OSCAR promotes three chemists to senior research scientists

OSCAR has promoted Drs. Dandan Wang, Yang Cao and Ziyue Xiong to Senior Research Scientist roles in recognition of their exceptional research and contribution to the work in OSCAR. The three new Senior Research Scientists are from the chemistry research group led by Professors Mark Moloney, Luet Wong, and Jeremy Robertson.



In February 2019, **Dr. Dandan Wang** joined OSCAR as research scientist in Prof. Mark Moloney's research group. She focuses on the surface modification of materials using carbenes to introduce a variety of properties onto a diversity of materials. Her research aims at the development of polymerization of biscarbene systems, and the introduction of thermal responsive, wetting, adhesion or biocidal behaviours to polymer and protein surfaces.

**Dr. Yang Cao** started working closely with the OSCAR team from 2017 to establish the chemistry research laboratories. His research focuses on engineering cytochrome P450 enzymes to oxidise organic molecules at specific positions. This research is aimed at the synthesis of natural products, intermediates, drug fragments and their derivatives via biotransformation, and to develop sustainable and environmentally friendly production processes.



**Dr. Ziyue Xiong** joined Prof. Jeremy Robertson's group at OSCAR as a research scientist in January 2020. Her work at OSCAR focusses on the use of C-H hydroxylating enzymes in a variety of synthetic chemistry applications, especially the total synthesis of natural products. Her research interests include enzymatic organic synthesis, natural product synthesis, and organic electrochemistry.

The chemistry group's research interests span three areas: surface science and application, biocatalysis, organic synthesis and drug R&D.



Professors Mark Moloney, Jeremy Robertson and Luet Wong applaud the newly appointed and express their delight in continuing to involve them in the future development of OSCAR.



**Professor Mark Moloney** says: "Dandan was among the very first research scientists appointed at OSCAR, and has been responsible for the establishment of the laboratories, commissioning and running of instrumentation, and the commencement of our research programme. To do this, she has been involved in many different aspects of OSCAR life, and has shown patience and determination to make our work a success. Her promotion to Senior Research Scientist recognises her key contributions over the last 5 years, and I am delighted to be able to continue working with her as we move to the next phase of OSCAR's development."



**Professor Jeremy Robertson** says: "In the early days of planning OSCAR's infrastructure and research, we aimed to appoint Research Scientists who were more than just experts in their field; they also had to be open-minded, ambitious, entrepreneurial, and aligned with the principles of collaborative translational science upon which OSCAR was founded. We have been very fortunate in engaging Yang, Dandan, and Ziyue who embody these qualities and who have done so much collectively to establish and build the Chemistry operation at OSCAR; their ongoing efforts are producing exciting research results and driving the vibrant atmosphere on the 8th floor. I'm delighted with their appointment as Senior Research Scientists and look forward to working with them more closely now that travelling to OSCAR is once again straightforward."



**Professor Luet Wong** says: "Yang was pivotal in the design, layout and equipment procurement of the chemistry and microbiology research laboratories at OSCAR. The process started while Yang was at Oxford where he worked remotely with the OSCAR teams and liaised with instrument suppliers. Yang was one of the first research scientists appointed at OSCAR; he was involved in the installation, commissioning, and training of other group members on the use of new instruments. Yang has brought his expertise in chemistry, biology and engineering to our chemoenzymatic synthesis program at OSCAR to great effect. The chemistry teams are a tightly knit group that will continue to produce exciting results across surface science, synthesis to biotechnology. I am delighted with the appointment of Dandan, Yang and Ziyue to Senior Research Scientist positions and look forward to working with them to take basic research to applications and commercial processes."





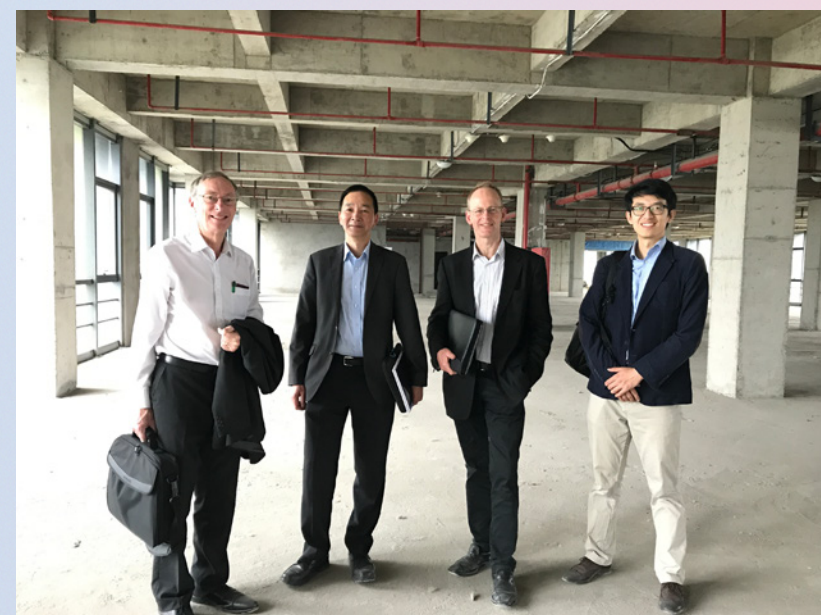
As they take a step forward in careers, Dandan, Yang and Ziyue were asked to look back on their academic journey with OSCAR, and to consider their ambitions for the future.

### Reflecting on the founding days

Dandan and Yang were the “first comers” in the group. They were deeply involved in the fit-out of the chemistry lab, which is modelled on practices adopted by the chemistry labs at Oxford University.

Yang went back to China from Oxford in May 2018 with Mark, Luet and Jeremy and took part in the screening and tendering briefing of the experimental instrument models and suppliers selected for the analytical centre. “We run a lot of the instruments every day, but it’s quite a scientific and technical issue when it comes to selecting the right models and meeting the required conditions for placement and function. Throughout I gained more understanding of the subject of instrument analysis.” says Yang.

Dandan still vividly remembers the day when Prof. Moloney showed her the general floor plan of the chemistry group in OSCAR. “It was incredible to see how close we were to having a fully equipped lab with NMR, GC, HPLC, and other essential tools for characterizing chemical compounds. I was captivated by the idea and eager to witness the transformation of the space into a functional laboratory. With only one other member, Yang in the group and three supervisors, we embarked on a journey that involved purchasing necessary equipment, overseeing installations, and constructing pipes and fume hoods, among other tasks. It took us approximately six months to complete the setup of the lab.”



### The chemists are “one”

Ziyue came on board in January 2020. Prior to joining OSCAR, Ziyue felt apprehensive about the work environment and how she would get along with colleagues. Nevertheless, upon joining the team, her concerns quickly dissipated. “The team comprises responsible PIs who offer excellent scientific guidance and support.” She says, “My colleagues are kind, enthusiastic and easy to get along with, creating a pleasant working atmosphere. The office and laboratory spaces are well-maintained, clean, and bright, adding to the overall positive work environment.”



“Members of the three chemistry sub-groups interact daily.” Yang adds, “We are seated very close to each other in the office and the laboratory is a shared chemical research centre. We are each other’s go-to person for questions. All we need is a call before we start bouncing ideas.”

These exchanges are crucial for research work and have the potential to foster future collaborations among these chemists.

Ziyue says, “Our group (led by Jeremy) has formed a successful partnership with Luet’s group, combining biosynthesis with traditional organic synthesis. Through this partnership, we have complemented each other’s strengths and weaknesses. Biocatalysts can help us reach points that traditional chemicals cannot, and our expertise can help better apply those biocatalysts in chemistry.” The article published in *Nature Synthesis* last year is the result of this cooperation.



## Delivering impactful scientific research

Despite the disruption of Covid-19, the chemistry group has grown from just two researchers in 2018 to nine members now, producing outputs ranging from impactful articles and patents to pipeline projects close to commercial adoption. The group has also been active in pursuing grants and talent programmes and has been successful in obtaining prestigious designations such as the 'Suzhou Foreign Expert Workstation', 'Innovation and Entrepreneurial Doctor', and the 'National High-Level Foreign Expert Program'.



"After Covid broke out, for a long time, I faced a situation where I had to shoulder all the tasks of scientific research, daily management, and external communication. The pressure was indeed great, but it was also very rewarding. I came out of this time a better professional," says Yang, "I'm happy that we're leaving the shadows of Covid-19 behind. Our progress is accelerating and there has been a flow of outputs in the past year. We have completed our first patent application and the second is being drafted."

Mark's team has initiated discussions with the industry to explore potential applications of their techniques. The ultimate goal is to establish a spin-out company that will facilitate the transformation of academic achievements into tangible contributions to the industry.

According to Ziyue, they have a patent application in progress and three manuscripts underway.

## Thriving professionally with OSCAR

Ziyue chose to stay at OSCAR because the research work here is focused on improving the application of science in real-life scenarios, which perfectly aligns with her own research goals. "While exploring uncharted knowledge and pushing the boundaries of science is cool, I believe that being able to convert research findings into practical solutions that enhance people's lives carries greater significance." Ziyue says.

Dandan thinks that OSCAR stands as a remarkable platform for talent development. "One notable advantage of OSCAR is its incorporation of different disciplines on each floor, facilitating interdisciplinary collaboration, which is crucial for addressing complex global research problems. OSCAR promotes researcher outreach and encourages active engagement beyond the confines of the laboratory. This emphasis on seeking external knowledge contributes to the cultivation of well-rounded researchers with a holistic understanding of their area of expertise."

Yang shares his ambitions to contribute to the development of related industries in Suzhou and even in China in the coming five years. "Suzhou Industrial Park and OSCAR have provided us with valuable and strong incubation support. Next, we will focus on introducing new resources, expanding the team, and starting commercial operations."





# OSCAR Academic Seminar series

On Monday 10 April, OSCAR held its 3<sup>rd</sup> Academic Seminar of the year. The symposium was the 17<sup>th</sup> intercontinental video conference to date, with participants from the UK and China in attendance. The two nominated guest speakers, invited to showcase their expertise and academic achievements were: (i) Professor Luet Wong, OSCAR PI in Inorganic Chemistry, Jennifer C. Green Fellow in Inorganic Chemistry, St Hugh's College, University of Oxford; and (ii) Professor David Clifton, OSCAR PI in Engineering Science, Royal Academy of Engineering Chair of Clinical Machine Learning, Fellow of the Alan Turing Institute, Professor of Clinical Machine Learning, & OCC Fellow in AI & Machine Learning at Reuben College, University of Oxford. OSCAR Director Academician Professor Zhanfeng Cui chaired the session.

## Talk 1 – “Fine chemicals and pharmaceuticals from synthetic biology”.

Natural products have been used as fragrances, and medicines for centuries. Historically, most consumer products and medicines are derived from plants. Professor Luet Wong revealed that the advent of synthetic organic chemistry has led to explosive growth in consumer products,



complementing and often replacing natural products. He went on to describe most active ingredients in consumer products are chemically synthesized, while small-molecule drugs are increasingly assembled from molecular fragments. However, there is a growing awareness of the environmental costs of the products we use and the exploration of sustainable biotechnological production processes with mild reaction conditions and few operating steps.

In the lecture, Professor Luet Wong introduced the main research direction of his group, which is the selective C-H bond oxidation catalysed by the evolved cytochrome P450 enzyme. This research can not only play an important role in the sustainable synthesis of existing products, but also in the discovery of new compounds with altered and stronger biological activity. Professor Wong also discussed the design of enzymes and the application of evolutionary enzymes in chemoenzymatic, and total biosynthesis.

## Talk 2 – “What can AI do for OSCAR?”

Professor David Clifton's talk revealed how conventional modelling has changed over the past few years, and the way machine learning has changed dramatically, from a single model for a single dataset, single task, to a multi-tasking, multi-data source, providing many opportunities for interdisciplinary research in OSCAR.



In the lecture, Professor Clifton used the research of OSCAR and the University of Oxford as an example to explain how contemporary machine learning can use historical data to quickly respond to new infectious diseases such as COVID-19. He also gave an overview of the development status and application scenarios of contemporary machine learning in the fields of medicine, biochemistry and life sciences. These developments provide unprecedented opportunities for new cooperation between OSCAR's research groups and with partners across China.



# OSCAR Outreach and Collaboration



OSCAR welcomed dozens of alumni from Oxford and Cambridge Universities on 8 April as they showed up for a 'Dual Carbon Goals and ESG Development Forum'.

Co-hosted with the Oxford & Cambridge Alumni Network Jiangsu-Zhejiang, the Forum featured a keynote speech by OSCAR's Research Scientist Dr. Chenbo Wang, and two plenary sessions by alumni with deep involvement in the technology development and investment strategies surrounding carbon peaking, carbon neutrality and ESG.



*Dr. Chenbo Wang works in OSCAR's Energy Storage and Conversion Laboratory. His speech offered the audience observations of the application and technological development of hydrogen energy in China, and the challenges facing the adoption of hydrogen energy. He also shared insights into the PEM electrolytic cell industry.*



*Panellists discuss investment strategies to serve the dual carbon goals*



*Panellists discuss state-of-the-art technologies that help reduce carbon emissions and their IP arrangements*

# Meet OSCAR's New Research Scientist



**Dr. Jiaqi Kuang**

**Research Scientist in Professor Zhongmin Qian's Group**

Dr. Jiaqi Kuang joined OSCAR in April 2023 as a Research Scientist in Prof. Zhongmin Qian's group. She achieved her PhD degree in 2022 at the University of Liverpool. Her research during her doctoral study was focused on the role of information disclosure in Fintech, and the application of natural language processing (sentiment analysis) in the field. The main research direction of her master's studies was the industry lead-lag effect in the stock market.

Jiaqi says "OSCAR is not only a well-known academic institution but also a warm and enthusiastic family. It is my pleasure to join Prof. Zhongmin Qian's group as he has in-depth research in mathematical models and deep learning."

Jiaqi's previous research mostly focused on the application of NLP (Nature Language Processing) and sentiment analysis in the financial market and Fintech. In the future, she also hopes to communicate more mathematical theoretical models with group members to expand the field of application.

At OSCAR, Jiaqi will further study the application of deep learning using new models and algorithm mining priori factors and continue research on big data and financial data security.





# OSCAR receives first granted patent

The Digital Health Lab's patent for a clinical computer-aided diagnosis system was granted in April, becoming the first granted patent secured by OSCAR. The application was processed through a fast-track pre-examination route which enabled patent granting within as little as 8 months.

The patented technology is a clinical-decision-support system for identifying heart failure, respiratory failure, and kidney failure patients using electronic health records.

According to OSCAR's IP manager, Yechen Gui, OSCAR declared a total of 18 technical claims in the application, of which 16 were supported. "In terms of independent claims, we obtained a greater legal protection surrounding our core technology. Other possible alternatives to the technology were also accepted and granted so as to better defend against any competitors' imitation and get-around designs."



# SIP News in April

## *SIP Ranked First in Suzhou's 2022 Comprehensive Evaluation*

Suzhou Industrial Park (SIP) was announced as one of five first-place winners in the 2022 comprehensive evaluation of the development of Suzhou's county-level cities and districts, marking the fifth consecutive year of SIP's achievement.

Last year, SIP's GDP reached RMB 351.561 billion, representing a 2.3% increase year-on-year. The total output value of industrial enterprises above designated size reached RMB 685.02 billion, while the total imports and exports reached RMB 715.13 billion. SIP's actual use of foreign investment amounted to US\$2.089 billion.



SIP's innovation in various industries, such as integrated circuit, biomedicine, and modern services, continued to grow in 2022, demonstrating advancements in both technology and operation modes. Multiple innovation platforms, including research institutes and labs, were established, with the total R&D expenditure accounting for 5.01% of the GDP.

Furthermore, SIP also demonstrated high performance in international cooperation, urban management and renewal, administrative staff training, and other areas.

SIP's consistent achievement in the comprehensive evaluation highlights its strength in high-quality development and its contribution to the overall development of Suzhou.

Sourced from <http://www.sipac.gov.cn>