OSCAR | UNIVERSITY OF OXFORD

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OSCAR'S DIGITAL HEALTH LAB develops method for classifying organ failure patients using electronic health records

OSCAR SCIENTIST to participate in social service program to mentor students pursuing overseas studies

Front cover image: optical pumping organic laser captured in OSCAR's Optoelectronic Technology Laboratory (OeTL)
Photo credit: Dr. Chenbo Wang & OeTL

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OSCAR's Digital Health Laboratory develops method for classifying organ failure patients using electronic health records

Organ failure is one of the most life-threatening events in Intensive Care Units (ICU).

Heart failure (HF), respiratory failure (RF), and kidney failure (KF) have high mortalities and prevalence in the ICU, with HF being the most common hospital admission diagnosis of patients that had unplanned transfers to ICU (12%). The most common diagnosis of unplanned ICU transfers is RF (27%). A population-based cohort study shows that KF has the highest one-year mortality rate (18.2%) among all organ failures that were investigated.

Gaining a better understanding of organ failure patients offers the potential to help with predicting organ failure and therefore the treatment of patients. This has prompted researchers in OSCAR's Digital Health Laboratory to develop a clinical-decision-support system for identifying HF, RF, and KF patients using electronic health records.

The system relies on learning informative patient representations from patients' diagnostic histories, using deep neural networks. Researchers utilized a public ICU dataset to verify the models and performed two tasks: patient clustering and classification.

▲ *Fig Visualisations for the patient clusters. The support system discovered two distinct clusters from the electronic health record data.*

The support system identified two stable distinct clusters (see below figure) among patients with the three organ failures, demonstrating application in clinics as a severity identification tool and for flagging complications that may come with organ failure. The system achieved an accuracy of 99.28% in distinguishing between patients suffering from the three types of organ failure.
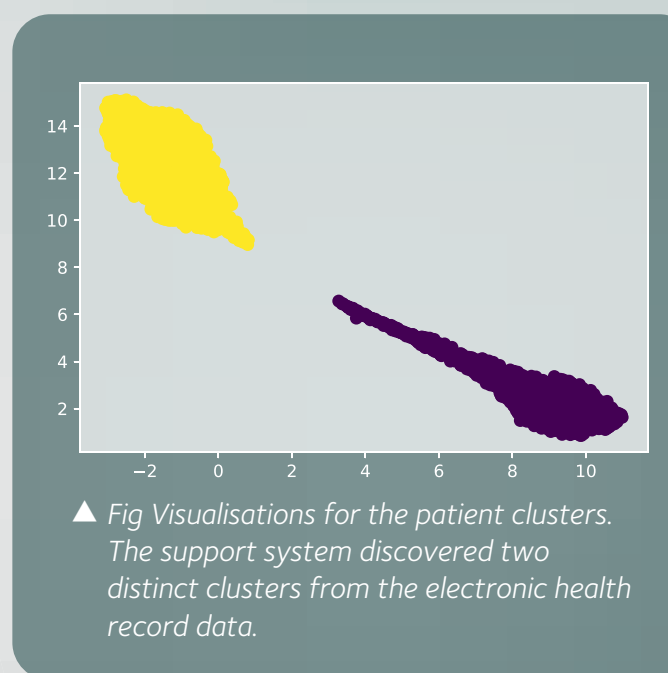
This research is led by Prof. David Clifton. A patent application derived from this research has been filed.

OSCAR Academic Seminar Series

On Friday 8th July, OSCAR PIs and researchers met online and in person for OSCAR's second Academic Seminar session this year, and the 12th in total.

The two guest speakers invited to present their research work were Dr. Haiyun Pei, Co-PI for the Regenerative Medical Engineering group at OSCAR, and Prof. Ian Thompson, Professor of Engineering Science, University of Oxford.

The OSCAR Deputy Director Prof. Mark Moloney chaired the meeting.

Talk 1 – "A novel strategy for cancer treatment " by Dr. Haiyun Pei

The first talk, delivered by Dr. Haiyun Pei, outlined a novel strategy for cancer treatment.

Adoptive cell immunotherapy for the treatment of malignancies has greatly advanced in the last decades. Immune cell-based therapies have become a promising approach to better treat and potentially cure malignancies that are refractory to other modalities, such as chemotherapy, radiation therapy, or surgery.

Although T cells engineered to express chimeric antigen receptors (CARs) have demonstrated potency against CD19-expressing tumours in several trials, the efficacy of CAR-T cells against solid tumours has been more limited. In addition, CAR-T cells can induce substantial toxic effects, and the manufacture of the cells is complex.

In her talk, Dr. Pei discussed an emerging cancer treatment therapy that has the potential to overcome these limitations.

Talk 2 – "Sustainable treatment of wastes" by Prof. Ian Thompson

Prof. Ian Thompson highlighted his ongoing research on the biological treatment of waste metal working fluids, which is representative of industrial wastewater that is difficult to be disposed of sustainably. For non-biodegradable chemical components, the employment of electron beams and nanomaterials was also discussed. The research aimed to convert the organic carbon components in the waste liquid into valuable products such as biogas and bioplastics while achieving in-situ regeneration of water resources.

Prof. Thompson further demonstrated a second research project planned for OSCAR, the development of a highly efficient anaerobic digestion reactor. He described how there have been few improvements in conventional reactor designs over the past 100 years.

Conventional anaerobic digestion reactors are estimated to be 30-times less efficient than cattle stomachs at converting biomass into valuable products. Using a bio-mimetic approach, Prof. Thompson and his team have developed a bioreactor with significantly higher conversion efficiency than existing commercial products. The research is still in its early stages.

About the speakers

Dr. Haiyun Pei is the Co-PI of the Regenerative Medical Engineering group, led by Prof. Zhanfeng Cui. She is the Topic Editor of *Cells, Epigenomes, Genes, IJMS, IJTM*. She was a post-doctoral associate in the Stem Cell Institute and in the Department of Chemical Engineering and Materials Science at the University of Minnesota.

Ian Thompson is a Professor of Engineering Science, Fellow of St Edmund Hall College and Honorary Professor at the Institute of Urban Environment, CAS.

Prof. Thompson focuses on the development of sustainable systems for the treatment of industrial effluents, water recycling on site and conversion of organic waste to bioenergy or other high-value products. The emphasis is on exploiting microbial biodegradation potential for environmental bioremediation and end-of-pipe pollution prevention.
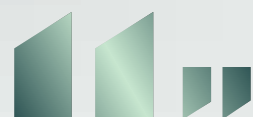
Meet OSCAR's New Researchers

Haiyan Song joined OSCAR on July 4th, 2022, as a Research Technician in Prof. Ian Thompson's group. In 2022, she graduated from the University of Science and Technology Beijing with a master's degree in Environmental Engineering. During her master's degree, she focused on the preparation of microbial, molecular biological and biocatalysts for catalysis and regeneration. She explored different catalyst regeneration strategies to achieve industrial biocatalyst regeneration, the reuse of catalysts, and reduced costs of industrial production.

"I'm honoured to be a part of OSCAR, which has a nice and active research atmosphere." Haiyan says, "OSCAR provides a very good platform for scientific research. Currently, the treatment and disposal of waste metalworking fluids (MWFs) in metalworking processes is challenging due to their high pollutant load (chemical oxygen demand) and toxicity. Disposal of this waste through a biological route is an increasingly attractive option since it is effective with relatively low energy demands. In OSCAR, I will focus on the microbial treatment of MWFs under the guidance of Prof. Thompson. With the necessary knowledge and skills, I'm prepared to face any challenges in my work and do my best to contribute to our team at OSCAR."

Haiyan Song
Research Technician
in Prof. Ian Thompson's group

Yixuan Guo joined OSCAR in July 2022 as a Research Assistant in Prof. Mauro Pasta's group, shortly after he graduated from Fudan University with a master's degree in polymer chemistry and physics. During his postgraduate period, he focused on the research of electrode materials for zinc-ion batteries, which sparked his interest in electrochemistry and the development of next-generation clean energy technologies.

"Before my graduation, when I was planning my future career, there was a dilemma for me whether to work in an industrial corporate or a research institute. However, after a short and pleasant tour in OSCAR and a rewarding interview with Prof. Mauro, I immediately set my mind on joining OSCAR." Yixuan says. "My first week in OSCAR has been great. And I find myself quickly adapted to my post here, thanks to the pleasant working environment, which I believe conduces to all the productive work here done by OSCAR members."

In OSCAR, Yixuan's research focus will be on electrochemical energy storage and conversion. "Research on clean energy has become an urgent need and I am glad that I can be a part of it. We are currently investigating single-atom electrocatalysis and its application in proton exchange membrane water splitting, which shows great promise for future green hydrogen production. I hope that I can make a difference by devoting my best effort to my tasks in OSCAR."

Yixuan Guo
Research Assistant
in Prof. Mauro Pasta's group

Dewan Wang joined OSCAR on July 4th, 2022, as a Research Technician in Prof. Paul Stavrinou's group. He obtained his bachelor's degree in Electrical Automation from the Southeast University Chengxian College In 2013, and his master's from Jilin University in 2020.

Dewan has 9 years of industry experience in the field of thin-film coating technology and coating equipment. Previously a coating process engineer, he was exposed to materials of various applications, including solid-state batteries, perovskite solar cells, diaphragm, window membrane, water-based environmental protection tape, graphite heat conduction, automobile baffle, liquid crystal display, photoresist and hydrogen fuel proton membrane. He has accumulated a wealth of knowledge and skills in coating defects identification, problem-solving, material utilization, yield improvement and operation process standardization. He was also responsible for the implementation and instruction of customized design, installation, commissioning and upgrade for pilot and industrial production lines for the specific requirements of different industries.

"I am very proud and excited to join OSCAR as a member of the Optoelectronics Technology Laboratory," says Dewan. "On this first-class platform, I will devote my knowledge and skills to the development of applied technologies, and work together with the team to promote the pilot-scale evaluation of innovative technologies, explore their commercialization values, and speed up their commercialisation process."

Dewan Wang
Research Technician
in Prof. Paul Stavrinou's group

OSCAR scientist to participate in social service programme to mentor students pursuing overseas studies

OSCAR Co-PI Dr. Yun Wang was recently appointed as an external mentor for a local social service programme aimed at preparing local university students for overseas studies and their return to Suzhou to start a career.

Under the programme, Dr. Wang will offer guidance to students on making study and career plans and improving professional skills. The appointment will allow Dr. Wang to do her part to nurture young talent while also participating in SIP's efforts to develop a sound talent ecosystem.

▲ *Dr. Yun Wang (L7) is among more than a dozen business executives and scientists in biomedical, nanotech and AI sectors who were conferred the mentorship*

The programme, named "Homing", has been initiated by the SIP Federation of Overseas Chinese (SIPFOC). By providing pro bono mentoring and networking for university students' receiving education in China and abroad, through to employment matters and the start-up of business ventures in Suzhou Industrial Park, "Homing" is expected to bolster Suzhou's profile as the "city of choice" for talented people returning to China after completing their education abroad. "
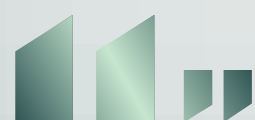
OSCAR Outreach and Collaboration

OSCAR Research Scientist Dr Khan was invited to speak at the 2022 International Conference on Green Packaging Material and Technology, held on 14th July.

Dr Khan is one of the researchers behind a novel antimicrobial surface coating technology developed in OSCAR's functional materials laboratory. At the conference, he presented the prospects of this leading technology being applied in foodstuff packaging.

Fungal growth is one of the main contributors to food spoilage. Commercial antiviral technologies rely mostly on silver or copper nanoparticles which do not apply to food packing products. OSCAR's antimicrobial coating kills viruses, bacteria, and fungi, and it applies to a variety of packaging materials, including polypropylene, polyethene and cellulose. The coating not only helps reduce the risk of contamination but also allows a longer shelf life for foodstuff. Dr. Khan believes that the packaging industry can benefit from his technology.

OSCAR Senior Manager Steven Chen and Media & Comms Supervisor Yanting Li met with members of the Universities of Oxford & Cambridge Alumni Network Jiangsu-Zhangjiang. The alumni organisation's visit may open up opportunities for co-hosting events expected to bolster OSCAR's public engagement and impact.

Mr. Jinbo Xin (R3), board chair of Jinzhenyuan Electronic Technology, visited OSCAR's Optoelectronic Technology Lab on 20th July. The visit saw the two sides exchange ideas on prospective research collaboration.

Did you know this about SIP?

In the south of SIP lies the Suzhou Dushu Lake Science&Education Innovation District (SEID), the talent reservoir and innovation engine for SIP.

■ 200 universities and colleges within 2 hours' drive from each other.

■ 1.4 million graduates in Jiangsu Province every year, 44% with science and engineering majors.
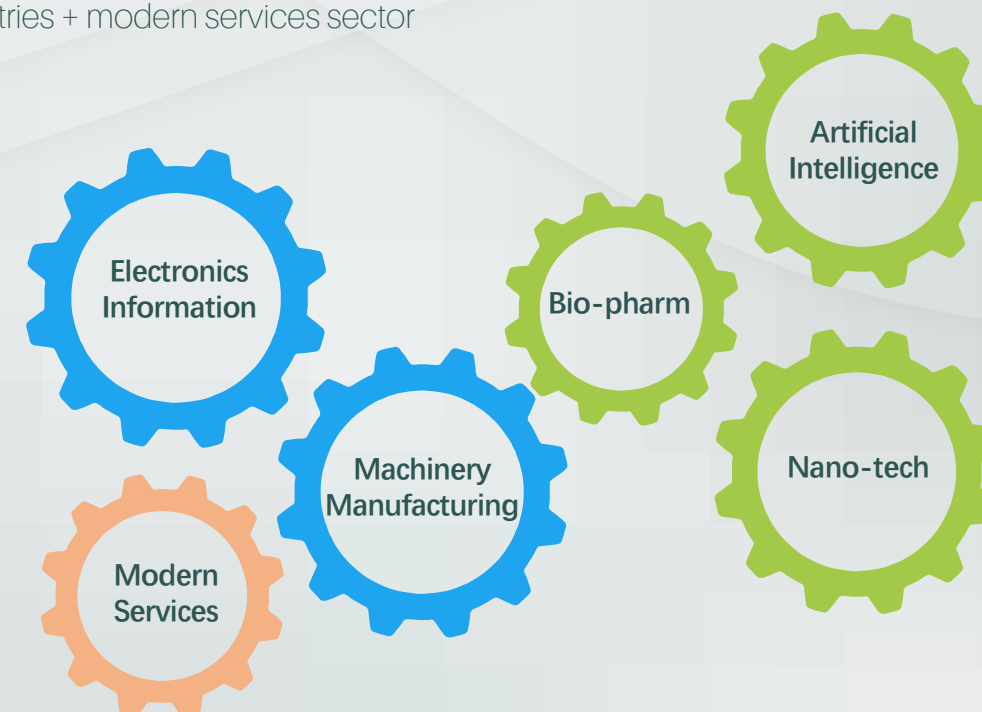
SEID is the only International Higher Education Demonstration Zone of China

■ 46 technical institutes, 15 affiliated with the Chinese Academy of Sciences

■ 33 famous universities from worldwide set up campuses here

■ More than 85,000 students on campus and over 5000 educators

■ 11 Sino-foreign cooperative education projects

The industrial mix of SIP:

2 leading industries + 3 emerging industries + modern services sector

- Electronics Information
- Machinery Manufacturing
- Modern Services
- Bio-pharm
- Artificial Intelligence
- Nano-tech

Leading industries

-precision engineering companies in SIP

■ CNC Machine Tool
■ Motor, Engine
■ Electrical Machinery
■ Compressor
■ Low-Voltage Electric
■ Molding, Casting, Stamping
■ Specialized Equipment

Leading industries

-intelligent manufacturing solution providers in SIP

Well-known intelligent manufacturing system integration solution supplier

EMERSON **Honeywell** **SIEMENS** **BOSCH** **Schneider Electric**

- ■ **BOSCH:** Vehicle electronics
- ■ **NAXTEER:** Electric steering system
- ■ **HARMAN:** Automotive entertainment system
- ■ **GF:** Chassis aluminum parts
- ■ **Vmware:** Electric car battery pack
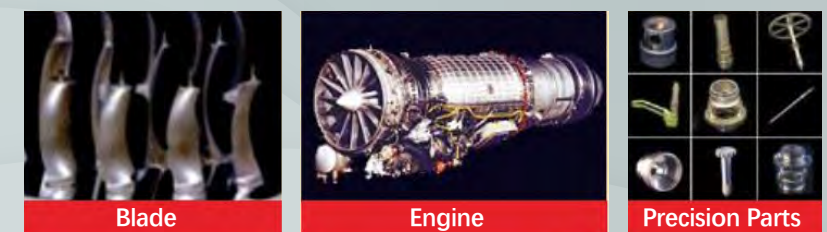- ■ **KINGLONG:** Commercial vehicle
- ■ **UMICORE:** Three-way catalyst

Leading industries

-automobile manufacturing in SIP

Engine system

Braking system

Power system

Steering system

Auxiliary system

金龙客车 KING LONG 中国客车专家   **BOSCH**   **nexteer** AUTOMOTIVE

· A P T I V ·

GM   **DELPHI**

ZF   **+GF+**   **=TE** connectivity

HITACHI Inspire the Next 日立 未来先驱   **SEW EURODRIVE**

mtu   **MAGNA**   NITTA   **Gates**

SATURN Electronics & Engineering, Inc.   **œrlikon**   **TRICO**

HYDRO   **KROMBERG & SCHUBERT**   **Haldex**

NORD   **umicore**   **montaplast**

Leading industries

-aviation parts manufacturers in SIP

| Casing Cover | Casing | Shield Ring | Engine Shell |

Aviation Parts

GE   **SAFRAN** AEROSPACE · DEFENCE · SECURITY   **ROLLS ROYCE**

Honeywell   **thyssenkrupp**   **PRIMUS** INTERNATIONAL

ARCONIC   **SAM**   **PERMASWAGE**

| Blade | Engine | Precision Parts |

Source: Suzhou Industrial Park Convergence Media Centre