MEDIA RELEASE
FOR IMMEDIATE RELEASE

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SINGAPORE RESEARCHERS DEVELOP WORLD’S FIRST HIGH-
THROUGHPUT IMAGING PLATFORM FOR PREDICTING KIDNEY TOXICITY

Automated cellular imaging platform efficiently and accurately predicts toxicity of chemical compounds paving the way toward safer products

Singapore — Researchers at A*STAR’s Bioinformatics Institute (BII) and the Institute of Bioengineering and Nanotechnology (IBN) have developed a highly efficient and accurate cellular imaging platform for predicting the toxicity of compounds to the kidney. The approach, which combines cell culture, imaging and computational methods, could prove invaluable to companies from the food, nutrition, cosmetics, consumer care, chemical and pharmaceutical industries by enabling them to predict the safety of their products while in development.

Chemical compounds, which may originate from medicine, food or even the environment, could injure the kidney and impair its function of eliminating waste from the body. About 20% of hospital or community acquired cases of acute kidney injury can be attributed to nephrotoxic drugs. Currently there is no accurate method for screening large numbers of potentially nephrotoxic compounds with diverse chemical structures.

Existing approaches for predicting the toxicity of chemical compounds include animal testing, which involves high costs and long turnaround times that result in low throughput, making it unsuitable for screening the ever-increasing numbers of potentially nephrotoxic compounds used in products. On top of the ethical issues involved, animal testing may also result in poor prediction of human toxicity due to inter-species differences. Other methods of nephrotoxicity
screening are also slow, laborious and costly, or may require prior knowledge of the compounds’ chemical structures or mechanisms.

Over the past three years, researchers from IBN and BII have worked together to develop cell-based screening methods to address this highly critical need, particularly as animal testing bans for cosmetics have been implemented in the EU, Norway, India and Israel, with many more countries expected to follow suit. The A*STAR researchers were able to develop the first and only cell-based renal screening platforms that can predict nephrotoxicity with high accuracy\(^1\). Improving on this, the researchers have now developed an imaging-based method that can be used to test much larger numbers of compounds.

Dr Lit-Hsin Loo, Principal Investigator from BII who co-authored the study, said “By automatically analysing more than 25,000 microscopy images of cells treated with different compounds, we were able to identify phenotypic signatures of kidney cells that can be used to predict the \textit{in vivo} toxicity of compounds with diverse structures and mechanisms, with a validated accuracy of 80 – 90%.”

In this study, more than 2 million individual cells were screened for their reactions to over 40 different chemical compounds, including industrial chemicals, antibiotics, antivirals, chemotherapy drugs and agricultural chemicals. The analysis was performed using an automated image analysis software called “cellXpress” that was developed by Dr Loo’s team at BII.

Dr Daniele Zink, Team Leader and Principal Research Scientist from IBN who co-authored the paper, added, “This novel software platform reduces the reliance on existing laborious and time-consuming methods currently available for testing of nephrotoxic compounds, enabling much faster predictions. We will continue to work together to improve and further validate the use of this approach, and hope that our work will help to make products safer for consumers and patients”.

\(^1\) Singapore Researchers Develop First Animal-Free Screening Platforms To Predict Toxic Kidney Injury, Oct 2015
Figure 1. “cellXpress”, an automated imaging analysis software, is able to efficiently and accurately detect cellular responses (reflected in green) to nephrotoxic compounds.

Figure 2. BII and IBN researchers who developed the world’s first high-throughput imaging platform for predicting kidney toxicity (clockwise from bottom left: Dr Ran Su, Dr Lit-Hsin Loo, Dr Daniele Zink and Dr Sijing Xiong).
Notes to Editor:

The research findings described in this media release can be found in the journal:

Archives of Toxicology, under the title, “High-throughput imaging-based nephrotoxicity prediction for xenobiotics with diverse chemical structures” by Ran Su¹, Sijing Xiong², Daniele Zink², Lit-Hsin Loo¹,³

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About the Bioinformatics Institute (BII)

The Bioinformatics Institute (BII) is an institute of the Agency for Science, Technology and Research (A*STAR) set up in July 2001. With a multi-disciplinary focus and collaborative outlook, BII recognises the need for depth and breadth in all its activities for building a thriving world-class biomedical research, graduate training and development hub in Singapore. In addition, BII is
proactively involved in building a national resource centre in bioinformatics to meet the evolving needs of the scientific community in Singapore. The spectrum of research activities in BII includes theoretical approaches aimed at understanding biomolecular mechanisms that underlie biological phenomena, the development of computational methods to support this discovery process, and experimental verification of predicted molecular and cellular functions of genes and proteins with biochemical methods. BII also has a division of translational research aimed at enhancing applied research and industry collaborations.

For more information on BII, please visit: www.bii.a-star.edu.sg

About the Institute of Bioengineering and Nanotechnology (IBN)

The Institute of Bioengineering and Nanotechnology (IBN) is the world’s first bioengineering and nanotechnology research institute. Established in 2003, IBN’s mission is to conduct multidisciplinary research across science, engineering, and medicine for breakthroughs to improve healthcare and quality of life. IBN’s research activities are focused on Nanomedicine, Synthetic Biosystems, Biodevices and Diagnostics, and Green Chemistry and Energy. The Institute has published over 1,000 papers in leading scientific journals, filed over 300 active patents and patent applications on its inventions, and established 9 spin-off companies. To nurture young research talents, IBN runs a Youth Research Program that offers students research attachment opportunities and exposure to biomedical research.

For more information on IBN, please visit www.ibn.a-star.edu.sg.

About the Agency for Science, Technology and Research (A*STAR)

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As a Science and Technology Organisation, A*STAR bridges the gap between academia and industry. Our research creates economic growth and jobs for Singapore, and enhances lives by contributing to societal benefits such as improving outcomes in healthcare, urban living, and sustainability.

We play a key role in nurturing and developing a diversity of talent and leaders in our Agency and Research Institutes, the wider research community and industry. A*STAR oversees 18 biomedical sciences and physical sciences and engineering research entities primarily located in Biopolis and Fusionopolis.

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