Genome Institute of Singapore

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MEDIA RELEASE
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SINGAPORE SCIENTISTS DISCOVER NEW BIOLOGICAL SENSORS FOR VITAMINS AND ESSENTIAL MOLECULES

New ways to use biological sensors in the human body to detect environmental changes and monitor our health more closely.

Singapore – In a pioneering study, scientists led by Dr Wan Yue (Senior Research Scientist) and Professor Niranjan Nagarajan (Associate Director and Senior Group Leader) at the Agency for Science, Technology and Research's (A*STAR) Genome Institute of Singapore (GIS), developed the first rapid, large scale structure-probing screening method for biological sensors known as riboswitches, or RNA sensors. The new high-throughput method for screening RNA sensors could lead to a better understanding of how the human body detects and responds to environmental changes, and aid the monitoring of our health more closely and effectively.

RNA sensors are important regulatory elements which enable organisms to sense and respond to environmental changes. For example, if your body lacks food, your RNA sensors will inform you by causing you to feel hungry. The ability to comprehensively identify these RNA sensors could expand the toolbox for synthetic biology, which combines science and engineering in order to design and build new biological parts, devices or systems.

Using data analysis provided by Professor Niranjan Nagarajan, the study also discovered two new RNA sensors that sense Vitamin B2, and showed that genes undergo changes in protein levels in the presence of Vitamin B2. Previously, it was generally thought that riboswitches mostly exist in bacteria, and the only known class of eukaryotic (complex organisms such as mammals) riboswitches was for Vitamin B1. The discovery of a Vitamin B2 riboswitch in *Candida albicans*, a yeast-like parasitic fungus, opened the door to potentially new classes of riboswitches regulating gene expression in other organisms. It showed that RNA sensors play a more widespread role in controlling gene expression than previously expected. In addition, the novel approach also provided a platform to rapidly screen new RNA sensors in complex organisms.

Dr Wan Yue said, "A thermometer can tell us whether the temperature is too hot or cold, and we can then decide what to do in response. RNA sensors act as biological thermometers to detect environmental changes to inform us how to react under such environmental fluctuations. They can be linked with light emitting substances to monitor metabolic changes within our cells, informing researchers and clinicians of our cellular metabolic states in real time."

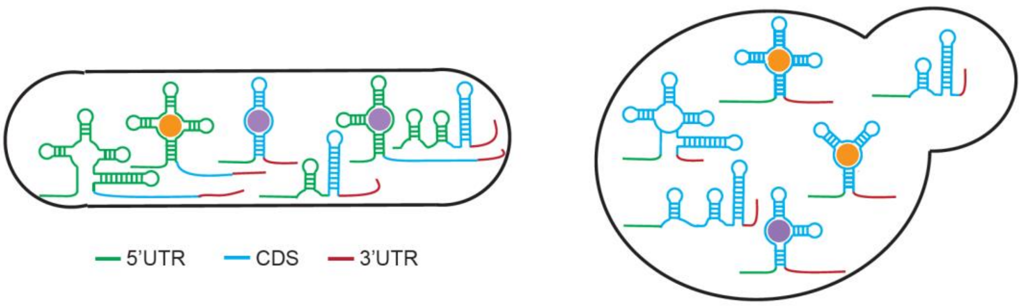
Most research uses computational strategies to focus on only one particular output of riboswitches, such as transcription termination. This study used both experimental and computational approaches, and identified many new riboswitches in the process. As riboswitches are known to change structure upon ligand binding, the study leveraged

GIS' high-throughput structural probing expertise to use these structural changes as markers for detecting and identifying the riboswitches.

GIS' Executive Director, Professor Ng Huck Hui said, "With the invention of this novel approach to screening and the discovery of new RNA sensors, we can explore innovative ways of employing these biological sensors to detect environmental changes, monitor our health, and design interventions where needed."

These results were published in *Nature Communications* on 29 March 2018.

IMAGES



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Known and new RNA sensors are found in bacteria and fungi, expanding our understanding of RNA-based gene regulation.

Notes to Editor:

The research findings described in this media release can be found in the scientific journal Nature Communications, under the title, "Genome-wide identification of natural RNA aptamers in prokaryotes and eukaryotes" Sidika Tapsin[1], Miao Sun[2], Yang Shen[2], Huibin Zhang[3], Xin Ni Lim[1], Teodorus Theo Susanto[1], Siwy Ling Yang[1], Gui Sheng Zeng[4], Jasmine Lee[4], Alexander Lezhava[5], Ee Lui Ang[3], Lian Hui Zhang[4], Yue Wang[4], Huimin Zhao[3,6], Niranjan Nagarajan[2] and Wan Yue[1].

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About A*STAR's Genome Institute of Singapore (GIS)

The Genome Institute of Singapore (GIS) is an institute of the Agency for Science, Technology and Research (A*STAR). It has a global vision that seeks to use genomic sciences to achieve extraordinary improvements in human health and public prosperity. Established in 2000 as a centre for genomic discovery, the GIS will pursue the integration of technology, genetics and biology towards academic, economic and societal impact.

The key research areas at the GIS include Human Genetics, Infectious Diseases, Cancer Therapeutics and Stratified Oncology, Stem Cell and Regenerative Biology, Cancer Stem Cell Biology, Computational and Systems Biology, and Translational Research.

The genomics infrastructure at the GIS is utilised to train new scientific talent, to function as a bridge for academic and industrial research, and to explore scientific questions of high impact.

For more information about GIS, please visit www.gis.a-star.edu.sg.

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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.

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