ASBA SPOTLIGHT

The monthly news from the Asian Synthetic Biology community

Edition 1, March-April 2025 CURATED BY XIAOFANG HUANG & XINYI CHEN

SYNTHETIC CIRCUITS: A TOOL FOR MANAGING CELLULAR RATIO

EDITORIAL PICK

Report by Xiaofang Huang

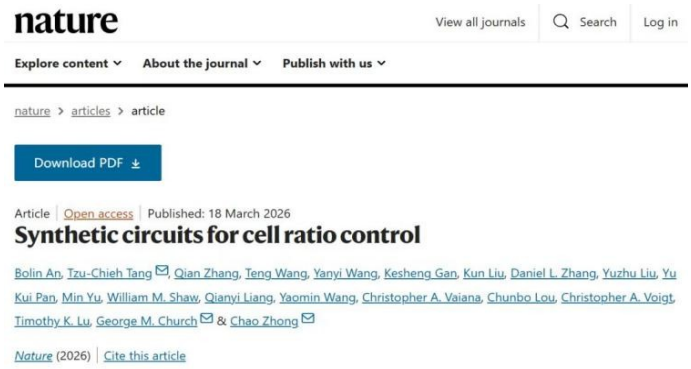
Synthetic biology makes fateful decisions

Cellular differentiation and a division of labor are essential to living systems, as distinct cell types performing specialized functions arise in defined proportions and spatial arrangements. A central challenge in synthetic biology has therefore been how to program cells to autonomously diversify into multiple functional subtypes while their relative abundance and task allocation remain precisely controlled.

A team led by Chao Zhong at the National Key Laboratory of Quantitative Synthetic Biology, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences (SIAT, CAS) and George M. Church's group at the Wyss Institute for Biologically Inspired Engineering at Harvard University reported in Nature a recombinase-based programmable platform for cell differentiation and proportion control. This system enables a single founder cell to autonomously generate multiple descendant cell types in controlled differentiation ratios and fate-branching to proceed according to preset genetic rules. This work establishes a rational framework for constructing multicellular systems, applicable to engineered living materials, organoid assembly, and next-generation biomanufacturing.

Engineering genetic "signposts" for precise differentiation

To precisely control the proportions of descendant cell-types, the researchers developed a recombinase-based differentiation device that directs bifurcation in cell-fate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Synthetic circuits for cell ratio control

Bolin An, Tzu-Chieh Tang, Qian Zhang, Teng Wang, Yanyi Wang, Kesheng Gan, Kun Liu, Daniel L. Zhang, Yuzhu Liu, Yu Kui Pan, Min Yu, William M. Shaw, Qianyi Liang, Yaomin Wang, Christopher A. Vaiana, Chunbo Lou, Christopher A. Voigt, Timothy K. Lu, George M. Church & Chao Zhong

Nature (2026) | Cite this article

decisions and validated it for bacterial, yeast, and mammalian cells. This strategy, as if installing genetic "signposts" that route induced cells along alternative trajectories toward distinct fates, yielded stable, quantifiable relationships among cell types. The tunable range of descendant ratios was expanded to approximately 0.1–99.9%, effectively creating a programmable "cellular palette" for specifying fate proportions. A supporting mathematical modeling framework directly links genetic design parameters to population composition.

"In simple words, now you can decide if you want a biological event to happen at one-in-three odds or one-in-a-thousand," says Tzu-Chieh Tang, a co-first author and corresponding author of this work. "We are teaching cells to do ratio computation."

From precise differentiation to programmable division of labor

By integrating these design principles into a platform that regulates both differentiation outcomes and the ratio-dependent division of labor among descendant cell types, these advances transform cell differentiation from an

empirical process into a predictive engineering discipline. As proof of concept, founder cells were programmed to differentiate into two populations producing distinct pigments; descendant cells displayed a continuous color gradient from deep purple to bright orange, visually demonstrating tunable phenotypes.

Distributing distinct enzymatic tasks for cellulose degradation across descendant cell types preserved system performance while reducing the metabolic burden that would otherwise fall on a single cell, demonstrating coupling of programmable differentiation to functional specialization.

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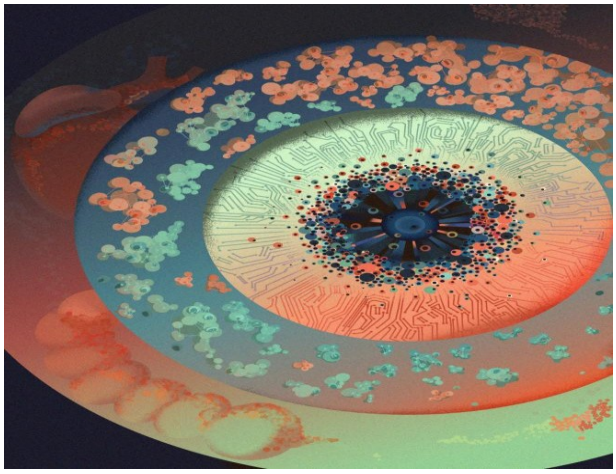


Figure. A synthetic gene circuit uses recombinase switches and feedback control to regulate population proportions (made by Olga Aleksandrova).

Toward building complex living systems

Beyond achieving precise differentiation, the platform developed here prescribes the emergence of cellular diversity from a single ancestor. “This work moves us beyond simply programming what individual cells do,"said corresponding author Chao Zhong. "It begins to address how cell populations can be designed to develop coordinated structure and function, which is essential for building more sophisticated living systems.”

Quantitative control over the differentiation, division of labor, and self-organization of engineered living materials, as demonstrated in this study, is essential to the development of new therapeutic systems.

This work was jointly led by Prof. Chao Zhong (National Key Laboratory of Quantitative Synthetic Biology, SIAT), Prof. George M. Church, and Dr. Tzu-Chieh Tang (Wyss Institute, Harvard University). Dr. Bolin An (SIAT) played a central role in experimental validation, platform construction, and application development. Important contributions were made by Prof. Chunbo Lou (SIAT), Prof. Timothy K. Lu, and Prof. Christopher A. Voigt (MIT). The authors thank Dr. Karen Pepper for manuscript editing assistance and acknowledge support from the Center for Instrumental Analysis at the Materials Synthetic Biology Center, the Shenzhen Synthetic Biology Infrastructure at SIAT, the US Department of Energy, and DARPA.

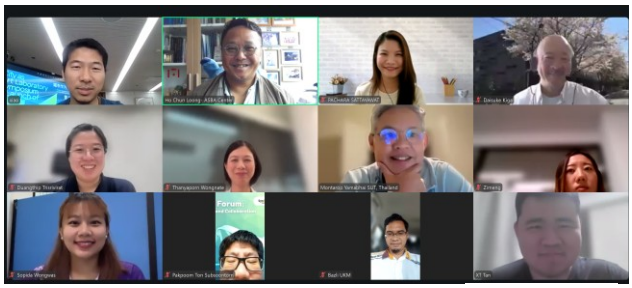
Reference: https://www.nature.com/articles/s41586-026-10259-3/

THE FIFTH SYNBIO CHALLENGES KICKS OFF IN EARNEST

NEWS

Report by Ho Chun Loong

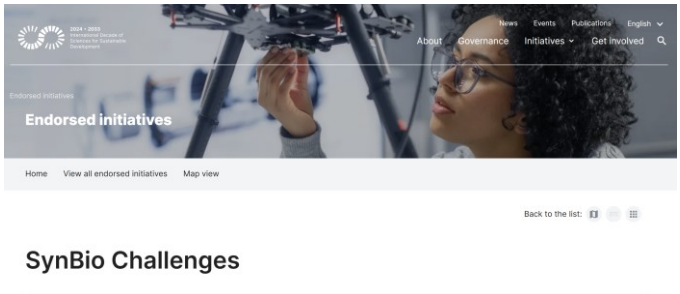
Following the success of the Fourth SynBio Challenges in 2025, the International Committee of the SynBio Challenges convened to discuss the topics and plans ahead of the Fifth SynBio Challenges. The previous four events have shown a steady increase in academic participation, with a large proportion of international participants from across Asia and Russia. Last year, a total of 265 teams joined the competition, consisting of over 1,800 students,



with approximately 15% from the international community.

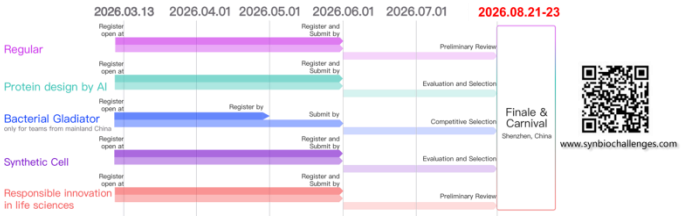
The SynBio Challenges 2026 International Committee discussion and the various industrial partners

The overwhelming participation in the competition among both international and local Chinese students has prompted recognition and endorsement by UNESCO (United Nations Educational, Scientific and Cultural Organization) as an initiative under the International Decade of Sciences for Sustainable Development. In the endorsement, it was noted that SynBio Challenges has addressed nine of the 17 Sustainable Development Goals (SDGs), including Zero Hunger; Good Health and Well-being; Quality Education; Clean Water and Sanitation; Decent Work and Economic Growth; Industry, Innovation and Infrastructure; Reduced Inequalities; Climate Action; and Partnerships for the Goals.



The UNESCO International Decade of Sciences for Sustainable Development endorsement of Synbio Challenges

This year's SynBio Challenges will include the standard tracks (Regular, Protein Design, Bacterial Gladiator, Synthetic Cell, and Responsible Innovation in Life Sciences), along with two newly added tracks: the Product Development and the Industry Challenge. Both new tracks aim to promote entrepreneurial skills among students while providing a platform for ideas to be fully developed into start-up companies with finished products. The Product Development, in collaboration with the National Industrial Innovation Center for Biomanufacturing (NIICB), invites academic members, graduate students, and undergraduate students to present technologies with a certain degree of technological readiness to compete against other entries. Ideas showing potential may then receive resource support from the NIICB to facilitate the launch of a start-up company. The Industry Challenge provides participants with key topics from industrial collaborators, requiring participants to design studies addressing these topics using a synthetic biology approach. Current industrial partners include Wanhua Chemical Group Co., Ltd., Kweichow Moutai Co., Ltd., and Anhui Huaheng Biotechnology Co., Ltd., with topics centered on bioprocessing and bio-sustainability. The competition will be judged by experts from these companies, and winners will receive venture funding to further develop their technology.



SynBio Challenges 2026 timeline

The 2026 SynBio Challenges is now open for registration until the end of May 2026. This year's competition Finale and Carnival will be held in Shenzhen from the 21st to the 23rd of August. Given the scale and reception of the previous year's competition, and with the growing involvement of governmental, industrial, and academic partners from around the globe, this year's SynBio Challenges promises to be more exciting than ever, with broader participation from all walks of life.

References: https://www.un-sciences-decade.org/en/endorsed-activities/synbio-challenges

ASBA : IBS2026 Call for Abstracts Now Open

ANNOUNCEMENT

Report by Xiaofang Huang

We are thrilled to announce the official call for abstracts for IBS2026 International Biotechnology Symposium, a premier global gathering for life sciences and synthetic biology innovation, hosted in Kobe, Japan this summer. As a key strategic partner of the symposium, ASBA (Asian Society for Synthetic Biology) is proud to support this landmark event and invite all our members to participate.

IBS2026 Key Conference Details

- **Dates**: June 28 – July 2, 2026
- **Venue**: Kobe International Conference Center, Kobe, Japan
- **Co-chairs**:

Akihiko Kondo (Kobe University / Bacchus Bio innovation Co.,Ltd.)
Haruyuki Atomi (Kyoto University)

ASBA & IBS2026: Strategic Partnership for Asian Synthetic Biology

This collaboration marks a pivotal milestone in ASBA's mission to advance synthetic biology and biotechnology across the Asia-Pacific region. IBS2026 aligns perfectly with ASBA's core goals:

Amplify Asian Research Impact: Provide a high-profile global platform for ASBA members to showcase cutting-edge work, connect with international peers, and drive regional innovation.

Foster Cross-Border Collaboration: Strengthen ties between Japan's leading biotech ecosystem and ASBA's pan-Asian network of researchers, industry leaders, and policymakers.

Shape the Future of Bioeconomy: Support the symposium 's focus on translating lab breakthroughs into industrial and societal impact, a priority shared by ASBA and Japan's national synthetic biology strategy.

KOBE CONVENTION BUREAU

IBS2026 brings together leading researchers, industry pioneers, and emerging talents from across the globe to share cutting-edge progress in biotechnology, synthetic biology, biomanufacturing, and advanced life sciences. The symposium will feature keynote lectures, parallel academic sessions, poster presentations, and exclusive networking opportunities to foster international collaboration and drive the future of the bioeconomy.

Abstract Submission Deadline: April 7, 2026 (Tue) 5:00 PM (JST)

Submission Note: Abstract submission requires online registration; no registration fee is required at the time of submission.

Event Highlights: Formal Opening Ceremony, official Conference Banquet, industry showcase, and cross-sector collaboration forums.

⚠ Important Security Notice

Please beware of fraudulent emails impersonating IBS2026.
Official contact: ibs2026@aeplan.co.jp

The secretariat will **never** request credit card, personal, or financial information.
Do not click suspicious links or share private data.
ASBA strongly encourages all members, researchers, and industry partners to submit your latest research abstracts and join us in Kobe for an inspiring week of science, innovation, and global collaboration!

References: https://aeplan.jp/ibs2026/

Breaking News! Daisuke Kiga's expanded role in SynBio Japan

ANNOUNCEMENT

Report by Xiaofang Huang

We are delighted to announce a major milestone for our ASBA community: Dr. Daisuke Kiga, a distinguished member of the ASBA Center, has been appointed as a Committee Member of the Synthetic Biology and Biotechnology Sector under Japan's newly announced "17 Strategic Sectors to Ignite Growth" national policy framework.

This landmark initiative, launched by the Japanese government, designates 17 critical areas essential for driving the nation's future economic growth, technological innovation, and global competitiveness. Synthetic Biology and Biotechnology have been placed at the core of this strategy, backed by a multi-billion-yen national investment plan designed to position Japan as a global leader in the bioeconomy.

The global synthetic biology market is projected to reach $100 billion by 2030, with Japan targeting a 10% share of this rapidly expanding market through targeted R&D,industrial scaling,and startup ecosystem development.This policy prioritizes breakthroughs in biomanufacturing, next-gen drug discovery, sustainable agriculture, and carbon-neutral bioproduction, sectors projected to add ¥5 trillion ($34 billion) to Japan's GDP by 2040.

As a key member of the working group, Dr. Kiga will play a decisive role in shaping Japan's 10-year strategic roadmap, coordinating public-private partnerships, and guiding the allocation of resources to accelerate synthetic biology innovation. He will advise on scaling lab-based technologies to industrial production, supporting small and medium-sized biotech startups, and fostering international collaboration—including deepening ties with ASBA's pan-Asian research and industry network.

A Professor at Waseda University and a leading voice in synthetic biology engineering, Dr. Kiga's appointment is a testament to his exceptional scientific expertise and international influence. With over 15 years of research experience and numerous high-impact publications in synthetic circuit design and biotechnological applications, he brings unparalleled insight to Japan's national strategy. This role not only honors his personal achievements but also strengthens the global standing of the ASBA Center, amplifying our collective voice in shaping the future of synthetic biology across Asia and beyond.

Please join us in extending our warmest congratulations to Dr. Kiga! We look forward to the transformative impact of his work on Japan's national strategy, the global synthetic biology community, and ASBA's mission to advance the field across the Asia-Pacific region.

References: https://www.asahi.com/ajw/articles/16137063

Programming Gut Microbial Metabolism through Synthetic Biology for Intestinal Health

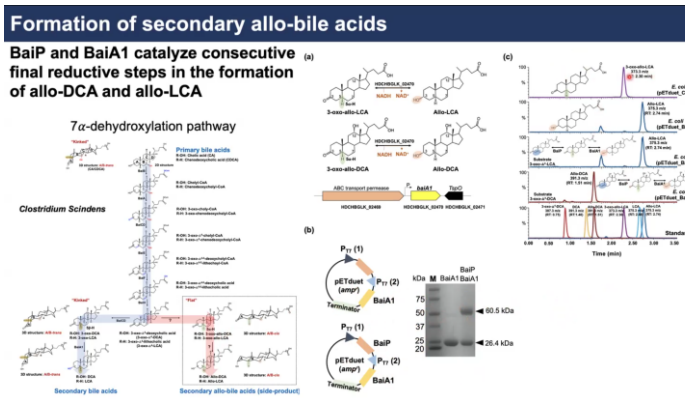
COMMENTARY

Report by Ting Tiew Yik

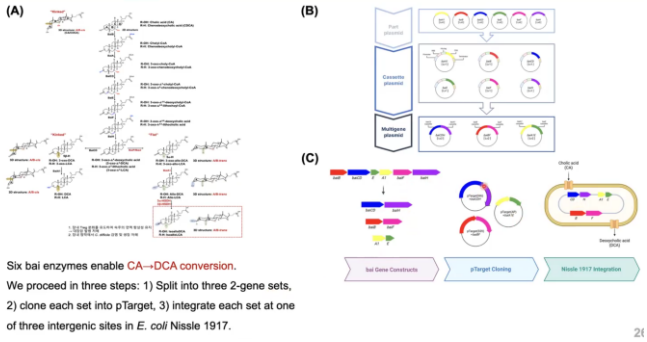
On 17 March 2026, the Asian Synthetic Biology Association (ASBA) hosted Assistant Professor Dr. Jaewon Lee from Sungshin Women's University, South Korea. His research uses synthetic biology to engineer microbes for sustainability and human health, with a focus on metabolic engineering of gut bacteria to regulate host-modulating metabolites, especially bile acids.

Bile acids such as cholic acid (CA) are cholesterol-derived molecules best known for lipid digestion. Most CA is recycled through the enterohepatic circulation, while the rest is converted by gut microbes into secondary bile acids including DCA and allo-DCA (ADCA). Beyond digestion, these molecules also act as signaling factors that shape host immunity. For instance, DCA is linked to colorectal cancer risk, while isoalloLCA and other ADCA isoforms regulate T cell differentiation and immune balance.

Recent studies further support the health value of specific bile acid isoforms. Centenarians have been found to carry gut microbes enriched in LCA derivatives such as isoallo-LCA, suggesting protective effects. Other work identified Clostridium scindens as a key producer of immune-modulatory bile acids. These findings motivated Dr. Lee to engineer gut microbes for the targeted production of beneficial secondary bile acids.



Despite these advances, key questions remain around microbial pathways for ADCA isoforms, especially isoalloDCA. While the bai operon in C. scindens converts CA to DCA, pathways for allo- and iso-ADCA remain unclear. Dr. Lee identified two critical enzymes in the final reductive steps: BaiP catalyzes 3-oxo-4-LCA to 3-oxo-alloLCA, and BaiA14 converts 3-oxo-alloLCA to allo-LCA. His team also discovered a functional 3β-HSDH that produces isoalloLCA from allo-LCA at physiological pH using NADH, completing the enzymatic pathway for isoalloDCA biosynthesis.



Dr. Lee's group is currently engineering the probiotic E. coli Nissle 1917 for isoADCA production. As an initial step, they constructed integrative plasmids carrying the C. scindens bai operon via MoClo assembly to enable stable chromosomal integration. However, they encountered significant challenges: constitutive aerobic expression of baiCD led to reactive oxygen species (ROS) and cellular toxicity. The team resolved this issue by using an anaerobic promoter to mimic the low-oxygen gut environment, demonstrating the critical role of physiological context in pathway engineering. Discussions also raised questions about metabolic burden from multi-enzyme expression and potential antimicrobial effects of DCA.

Overall, his work highlights both the potential and complexity of engineering gut microbes for bile acid metabolism, showing how synthetic biology and microbiome research can advance microbial therapeutics to regulate host immunity. This research lays a foundation for alternative treatments for metabolic and liver diseases such as fatty liver and cholestasis by adjusting bile acid profiles. In the future, dynamic genetic circuits responsive to bile acid levels may be needed to avoid overproduction and improve in vivo safety. We look forward to further progress from Dr. Lee's lab and future updates at ASBA meetings.

Date of seminar : 17th March 2026

SpotifyLink :

https://spotifycreatorsweb.app.link/e/ZjCMvKQOZ1b

The use of Aquatic Vaccines and Therapeutics in Aquaculture

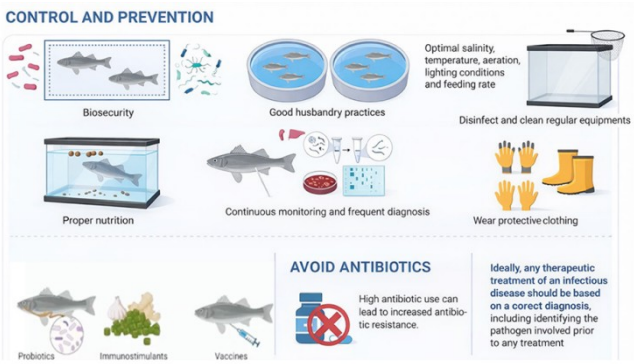
COMMENTARY

Report by Jian Peng Teoh

A recent ASBA online presentation on March 25, 2026, featured Dr. Aslah Mohamed from Xiamen University Malaysia's China-ASEAN College of Marine Sciences. He discussed advances in vaccines and therapeutics for disease control in aquaculture, a field critical to global food security, as over 3.2 billion people depend on fisheries and aquaculture for protein.

With the rapid intensification of aquaculture, infectious diseases have become a major threat to production, economics, and environmental stability. Dr. Mohamed noted that economically important species such as Asian seabass and tilapia are highly vulnerable to pathogens including Vibrio, Streptococcus agalactiae, and Aeromonas.

Outbreaks are driven by complex interactions among host, pathogen, and environment. Once established in aquatic systems, pathogens are nearly impossible to eliminate due to their ability to survive freely in water. Global trade, species translocation, intensive farming, and insufficient biosecurity further accelerate disease spread.



The presentation also noted major drawbacks of traditional disease control, especially the overuse of antibiotics. While antibiotics like florfenicol and tetracyclines are widely used, their misuse has accelerated antimicrobial resistance, threatening both aquaculture sustainability and public health. Antibiotic residues in aquatic environments and seafood can also disrupt ecosystems and cause health issues such as immunosuppression and allergic reactions in humans. These challenges underline an urgent shift from reactive treatment to preventive and sustainable management.

Integrated health management was highlighted as key to effective control. Biosecurity remains fundamental, including strict controls on fish movement, water sources, equipment, and human activity. Promising alternatives to antibiotics include probiotics, prebiotics, immunostimulants, and plant-based extracts. Medicinal plants such as garlic, neem, and Indian gooseberry show antimicrobial and immune-boosting effects, improving growth and disease resistance. However, inconsistent efficacy and potential toxicity call for standardized testing and optimized dosing.

Dr. Aslah's presentation focused on an oral feed-based vaccine for aquaculture vibriosis, which integrates inactivated Vibrio harveyi antigens, induces mucosal/systemic immunity, and boosts survival (70-80%) and growth via enhanced IgM and immune mediators.

Challenges include variable efficacy, cost, limited understanding of fish immunology, and unstudied long-term impacts; bacteriophage therapy and microbiome modulation need further research.

His work shifts aquaculture to prevention-driven strategies, positioning functional feed as an immunological platform, but gaps remain in vaccine durability, cross-protection, gut antigen processing, and long-term effects.

Future priorities: standardized multi-target vaccines, omics technologies, improved delivery, and stakeholder collaboration to build sustainable aquaculture.

Date of seminar : 25th March 2026

Spotify Link :

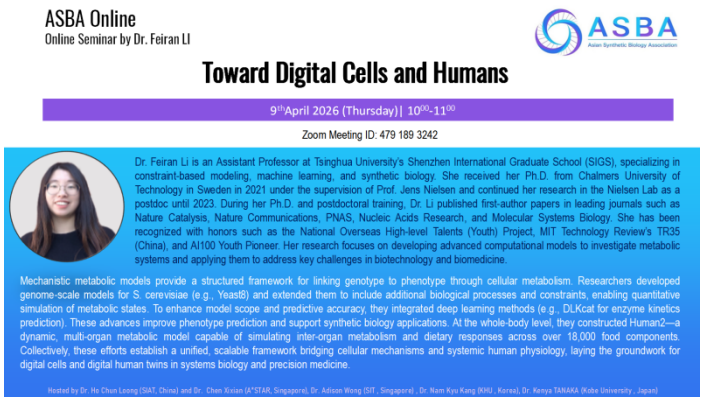
https://spotifycreators-web.app.link/e/lxDfw30OZ1b

UPCOMING EVENTS

Report by Xiaofang Huang

ASBA Online announcement

The Path to In Silico life: Toward Digital Cells and Humans



An upcoming ASBA Online Seminar will be held, featuring cutting-edge insights into synthetic biology and its practical applications. We invite all ASBA members, researchers, students, and industry partners with an interest in synthetic biology to join this engaging online session, where you can connect with peers and gain valuable knowledge shared by industry and academic experts.

Seminar Details

Event: ASBA Online Seminar

Time: 10:00 AM (GMT+8), April 9th

Format: Online (Zoom Meeting)

Zoom Meeting ID: 479 189 3242

Zoom Link:
https://us06web.zoom.us/j/4791893242?omn=87495638734

Theme: Frontier developments in synthetic biology, with a focus on practical applications in sustainable development and human health (a detailed agenda will be released shortly).

This seminar is open to all ASBA members, researchers, students, and industry partners interested in synthetic biology and related fields. Distinguished speakers will deliver presentations, followed by an interactive Q&A session to facilitate in-depth discussions and knowledge exchange.

Further updates, including speaker profiles and additional Zoom registration details, will be shared via official ASBA channels soon. Please stay tuned for more information.

We sincerely look forward to your active participation in this upcoming ASBA Online Seminar!

If you would like to share your work in the next ASBA Online or feature your latest work in our future ASBA Spotlight edition, please contact us at asba.center@siat.ac.cn or reach us at our social media platforms *(Linkedin, Facebook, Instagram, X and Rednote)*

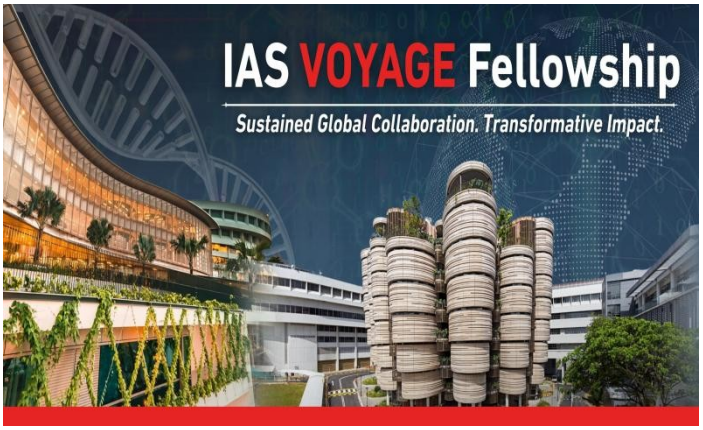
RECRUITMENT

Report by Xinyi Chen

IAS@NTU VOYAGE Fellowship Recruitment | Global Research Opportunity

Outstanding international researchers are invited to apply for the IAS@NTU VOYAGE Fellowship, a prestigious program hosted by Nanyang Technological University (NTU), Singapore. Organized by NTU's Institute of Advanced Studies (IAS), this fellowship is designed for researchers seeking sustained academic engagement and impactful interdisciplinary collaboration.

The VOYAGE Fellowship differs from short-term academic visits, focusing on long-term residency to foster deep integration into NTU's world-class research ecosystem. It serves as a key platform for advancing frontier research, building global academic networks, and driving impactful innovations across diverse fields.



Fellowship Core Details

- **Eligibility**: Outstanding overseas researchers with no current affiliation to any Singaporean institution

- **Residency Duration**: 3–12 months of continuous academic engagement

- **Collaboration Scope**: Partner closely with NTU faculty across Science, Engineering, Computing, Medicine, and interdisciplinary areas

- **Research Impact**: Pursue frontier research, develop joint grant proposals, mentor peers, and strengthen global academic partnerships

- **Long-Term Value**: Establish enduring collaborative relationships that extend beyond the fellowship period

Ideal for researchers in synthetic biology, biotechnology, and cross-disciplinary fields—including from the ASBA community—the fellowship offers a unique opportunity to elevate research impact, expand global networks, and engage with top-tier academic resources at NTU.

For complete eligibility criteria, application guidelines, and key deadlines, refer to the official fellowship page:

Official Application Link:

https://www.ntu.edu.sg/ias/research/ias-ntu-visiting-outstanding-young-and-advanced-global-expert-voyage-fellowship

This is a rare chance to advance your academic career through impactful research collaboration at one of the world's leading universities. Share this opportunity with colleagues and peers who may benefit from this prestigious fellowship.

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