Newsletter issue 21-2026, May 23, 2026
AI and Quantum Research Center (AIQRC), Asia University, Taiwan

Activities

[1] **2026/6/29** (coming soon) - INTERNATIONAL SYMPOSIUM ON QUANTUM AI & THE FUTURE OF LIFE (ISQAI-FoL)

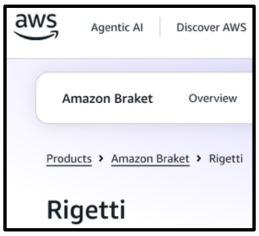
The International Symposium on Quantum AI and the Future of Life aims to create an interdisciplinary platform for thought leaders, practitioners, and researchers from diverse fields to explore the transformative potential of quantum computing and artificial intelligence (AI) in shaping the future of human well-being. This event will focus on cutting-edge applications of these groundbreaking technologies across four key domains: Biomedicine & Healthcare, Integrating Traditional Chinese Medicine and Western Medicine, Longevity and Anti-aging, and Life Optimization.

Click here for more information.

[2] **On May 7, 2026,** AIQRC published an article in the Economic Daily News; the English translation is included in the newsletter. Click here for the original contents.

[3] **On April 22, 2026,** AIQRC published an article in the Economic Daily News; the English translation is included in the newsletter. Click here for the original contents.

[4] **On April 8, 2026** AIQRC received approval to use the AWS cloud-based Rigetti Computing quantum computing system.



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[5] **Feb. 2026** - We recently secured approval for five Ministry of Education–funded programs in Taiwan, creating valuable learning pathways for young people. These programs support international exchange and advanced training at globally recognized universities, helping students build interdisciplinary knowledge, research skills, and global perspectives in fields such as artificial intelligence, quantum computing, biomedical science, systems medicine, and robotics.
Click here for more information.

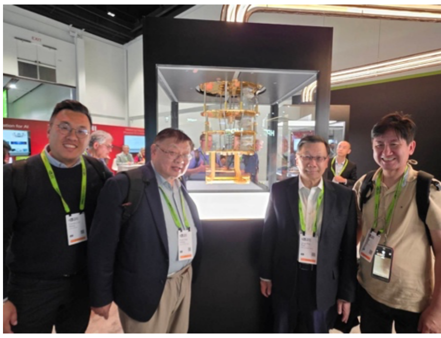
I-9-10	ⓘ	IBM量子夢：紐約研習營	美國紐約	(九)科技網絡及數位服務	制霸IBM量子科技巔峰	115年7月13日至7月28日，共計16日（含飛行日）
I-9-11	ⓘ	醫工量子：UCLA 菁英計畫	美國加州洛杉磯	(九)科技網絡及數位服務	探索腦科學與量子計算	115年7月6日至9月3日，共計60日（含飛行日）
I-9-12	ⓘ	量子金融：赴美職涯領航	美國大紐約區	(九)科技網絡及數位服務	跨足量子與AI金融實務	115年7月6日至8月9日，共計35日（含飛行日）
I-9-13	ⓘ	AI與石黑浩：探索擬真界	日本大阪	(九)科技網絡及數位服務	台日共創人形機器人新未來	115年8月1日至116年1月15日，共計168日（含飛行日）
I-9-14	ⓘ	勇闖 WVU：太空機器人實戰	美國摩根敦	(九)科技網絡及數位服務	太空採集機器人見習	115年7月6日至7月23日，共計18日（含飛行日）

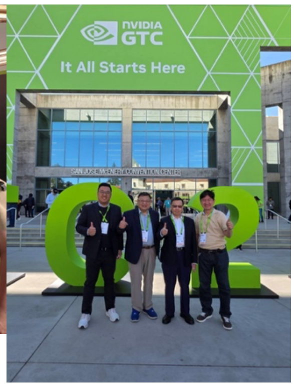
[6] **From March 16 to 19**, Asia University's AIQRC is actively advancing its forward-looking strategy. President Jeffrey J. P. Tsai, Honorary Chairman of AIQRC (third from the right in the photo) and Chair Professor, K.T. Huang, Director of AIQRC (fifth from the right in the photo), recently led a delegation to the United States to visit quantum technology firm Rigetti Computing, where they were hosted by Vice President Mike Piech (fourth from the right in the photo). The visit marks an important step in strengthening the university's quantum AI strategy, fostering connections with world-class technologies, and building a solid foundation for its vision of becoming an "AI University."

Click here for more information.

The Asia University delegation conducted an in-depth visit to Rigetti's laboratories, inspecting hardware facilities and system architectures such as superconducting quantum computers (superconducting qubits), and gaining firsthand insight into the latest technological developments shaping the global quantum industry. President Jeffrey J. P. Tsai, Honorary Chairman of AIQRC (third from the left in the photo), Chair Professor, K.T. Huang, Director of AIQRC (second from the right in the photo) and Rigetti Computing Vice President Mike Piech (fourth from the left in the photo).

[7] **From March 16 to 19**, President Jeffrey J. P. Tsai, Honorary Chairman of AIQRC (second from the right in the photo), led teams in quantum AI, robotics, and intelligent healthcare to Silicon Valley to attend NVIDIA GTC 2026, the world's premier annual AI conference, and engage with the global AI and semiconductor ecosystem. Tsai emphasized that the visit aimed not only to track cutting-edge technologies, but also to mark a major milestone in advancing Asia University's AI University vision and international collaboration strategy.





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[8] **On March 20, 2026** Deputy Director of AIQRC, Ka-Lok NG, delivered a presentation titled "Exploring the Potential Advantages of Quantum Machine Learning in Biomedical Research" at the 2026 Conference on Advanced Topics and Auto Tuning in High-Performance Scientific Computing.9Click here for more information.

[9] **Feb. 2026** - We successfully had a proposal accepted for the Fujitsu Quantum Simulator Challenge 2025–26 event.

Click here for more information.

Quantum Computing in Biomedicine: The Wellcome Leap Q4Bio Program and Its Implications for Computational Oncology

1. Introduction

The Wellcome Trust, headquartered in London, is a major global nonprofit organization supporting biomedical research and public health innovation. In 2020, it launched the Wellcome Leap initiative to accelerate high-risk, high-reward scientific programs through a milestone-driven funding model. One of its flagship programs, Quantum for Bio (Q4Bio), aims to evaluate the practical utility of quantum computing in solving biologically and clinically relevant problems.

2. Q4Bio: Evaluating Quantum Advantage in Biomedical Contexts

The central research question of Q4Bio is whether near-term quantum computing systems (NISQ devices) can provide computational advantage over classical methods in real-world biomedical applications.

To ensure rigor and translational relevance, the program imposes several constraints:

- Execution on physical quantum hardware (>50 qubits)
- Implementation of deep quantum circuits beyond trivial benchmarking
- Demonstration of algorithmic scalability
- Direct application to biomedical or clinical problem spaces

Two tiers of funding incentives are defined:

- Grand Prize ($5M): Demonstration of clear advantage over classical computation
- Milestone Award ($2M): Successful execution of meaningful biomedical workflows on quantum platforms

3. Hybrid Quantum-Classical Modeling in Photodynamic Therapy

A notable milestone achievement was obtained by a collaboration between Algorithmiq, Cleveland Clinic, and IBM, which developed a hybrid quantum-classical computational pipeline for modeling molecular processes in photodynamic therapy (PDT) [1, 2].

3.1 Problem Formulation

The study focuses on excited-state electronic structure calculations of photosensitizer molecules. These systems are characterized by:

- Strong electron correlation effects
- Multi-configurational quantum states
- High-dimensional Hilbert spaces

Such properties make them computationally intractable using classical methods (e.g., DFT or coupled-cluster approximations) at high accuracy.

3.2 Quantum Computational Contribution

The hybrid workflow integrates:

- Variational quantum algorithms (e.g., VQE-like paradigms)
- Classical post-processing for parameter optimization

This framework enables:

- Accurate estimation of excited-state energy spectra
- Modeling of transitions and energy transfer pathways
- Simulation of reactive oxygen species (ROS) generation potential

Given that ROS production is the primary cytotoxic mechanism in PDT, these simulations provide mechanistic insights for rational design and optimization of photosensitizers.

4. Photodynamic Therapy: Mechanistic Perspective

Photodynamic therapy is a spatiotemporally controlled therapeutic modality requiring three components:

1. Photosensitizer molecule
2. Light of a specific wavelength
3. Molecular oxygen

Upon photoexcitation, the photosensitizer undergoes intersystem crossing and energy transfer, generating ROS (e.g., singlet oxygen).

4.1 Multi-Scale Mechanisms of Action

- Direct cytotoxicity: Oxidative damage to cellular macromolecules (lipids, proteins, DNA)
- Vascular disruption: Impairment of tumor-associated vasculature, inducing hypoxia and necrosis
- Immunogenic response: Activation of anti-tumor immunity via damage-associated molecular patterns

These properties make PDT particularly suitable for localized tumor ablation with minimal off-target effects.

5. Cancer Metastasis: Systems-Level Challenges

Cancer progression involves genomic instability and epigenetic dysregulation, leading to malignant phenotypes with invasive potential.

Metastasis can be described as a multi-step biological process:

1. Local invasion and detachment from the primary tumor
2. Intravasation into blood or lymphatic circulation
3. Circulatory survival and extravasation
4. Colonization and clonal expansion at secondary sites

This cascade is governed by complex gene regulatory networks, signaling pathways, and microenvironmental interactions, making it difficult to model and therapeutically target.

PDT may contribute to early-stage intervention by reducing tumor burden and limiting dissemination.

6. Emerging Directions in Quantum-Enabled Bioinformatics

Beyond PDT, Q4Bio highlights several application domains relevant to bioinformatics:

- Quantum-enhanced genomics: Efficient processing of large-scale sequencing data
- Biomarker discovery: Pattern recognition in high-dimensional omics datasets
- Enzyme and metabolic modeling: Simulation of catalytic mechanisms at quantum resolution
- Structure-based drug design: Improved modeling of ligand–protein interactions
- Covalent inhibitor design: Target-specific drug binding prediction

These applications suggest potential integration of quantum computing into multi-omics analysis pipelines and systems biology frameworks.

7. Conclusion and Future Outlook

The Q4Bio initiative represents a transition from theoretical quantum computing research to translational biomedical applications. Early results indicate that hybrid quantum-classical approaches may address computational bottlenecks in molecular simulation and drug discovery. As quantum hardware matures and error mitigation techniques improve, potential impact areas include:

- Precision oncology
- Predictive disease modeling
- Next-generation drug discovery platforms

Ultimately, quantum computing may become a core computational paradigm in bioinformatics and systems medicine, complementing classical high-performance computing infrastructures.

References

[1] https://www.ibm.com/quantum/blog/q4bio-finalists
[2] https://wellcomeleap.org/q4bio/program/

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