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Advancing Singapore's Quantum Hub in Life Sciences

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Alexandra Beckstein, CEO of QAI Ventures Bridging Biotechnology and Compute Power for Next-Generation Innovation

Singapore is strengthening its position as a global leader in quantum computing by focusing on the life sciences cluster, a critical area where biotechnology meets computational power. The Quantum Hub aims to bridge the gap between advanced molecular simulations and high-performance computing, enabling breakthroughs in drug discovery, molecular research, and R&D timelines. The initiative aligns with Singapore's strategic emphasis on leveraging quantum-classical hybrid technologies to address complex challenges in healthcare and pharmaceuticals.

By integrating quantum innovation into life sciences, the cluster seeks to optimize processes such as protein folding simulations, genomic analysis, and personalized medicine development. The focus on reducing R&D timelines through quantum-driven solutions supports Singapore's broader economic vision of fostering innovation-driven industries. This effort also complements the nation's S$37 billion RIE2030 roadmap, emphasizing the role of quantum computing in transforming traditional research into scalable, industrial-grade applications. With a strong emphasis on commercialization, the Quantum Hub is set to catalyze Singapore's transition from a research-focused ecosystem to a globally competitive hub for quantum-enabled life science advancements, reinforcing its infrastructure for next-generation healthcare solutions.

A multi-stakeholder partnership in Singapore is building a Quantum Hub to bridge the gap between biotechnology and computing power, aiming to move quantum innovation from labs to commercial applications in key sectors like life sciences, communications, finance, and industrials. SoftBank and HorizonX have joined QAI Ventures in launching the Industry Clusters Program to support this initiative. **Alexandra Beckstein, CEO of QAI Ventures**, elaborates on this multi-stakeholder efforts to grow Singapore's Quantum-AI ecosystem by fostering innovation and partnerships to advance quantum computing's commercial potential.

1. **How do you envision quantum computing transforming drug discovery and molecular simulation processes in Singapore's pharmaceutical sector?**

Quantum computing is a new way of solving scientific problems that are too complex for today's computers. Unlike classical systems, which have to make guesses when simulating how molecules work, quantum computers use the same rules that molecules follow in the real world. This means quantum computers could help scientists create much more accurate models of how new drugs interact at the molecular level.

When scientists in the pharmaceutical industry search for new drugs, they need to predict how molecules will behave, how a potential drug will stick to proteins in the body, and how stable these molecules are. High-performance computing and AI have greatly improved these predictions, but even the best computers still have to make rough estimates for very complex problems. Quantum computing could help remove some of this guesswork.

Quantum computers could give drug researchers more accurate answers for how and why molecules interact. In the future, scientists will likely use both quantum computers and classical computers together. Classical computers will still process large amounts of data and run AI, while quantum computers will help with the hardest calculations that are out of reach today.

For Singapore's pharmaceutical industry, which already uses advanced computational models, quantum computing could make early drug discovery more accurate. Even a small boost in prediction could help companies avoid expensive mistakes later in the process.

2. **What specific challenges in healthcare R&D do you aim to address through the Quantum Hub, emphasizing the Life Sciences cluster?**

Healthcare R&D is characterised by long timelines and high attrition rates, often due to the inherent complexity of biological systems. The main problem isn't a lack of ideas; it's that today's computers can't always handle the complexity of understanding how the body works.

Singapore already has strong research organizations, like the Centre for Quantum Technologies and A*STAR. There's a great opportunity to help experts from different backgrounds, whether a quantum scientist, chemist, doctor, or representative from a pharmaceutical company, to work more closely together.

A Quantum Hub would be a place for trying new projects, sharing tools, and training leaders. It could help solve tough problems in drug design, planning clinical trials, and making new medicines. As quantum computing technology improves, it will offer new tools to support the systems we already use.

It's also important that companies and research groups get ready now. Industries sometimes think quantum technology will take longer than it actually does. By learning and experimenting early, Singapore's healthcare sector will be ready to use these new tools as soon as they become practical.

3. **Can you elaborate on how the partnership with HorizonX and MIT will bridge the executive knowledge gap for deep tech applications in biotechnology? How is QAI Ventures bridging the gap between biotechnology and computing power in Singapore's Life Sciences sector?**

One big reason new technology is slow to be adopted is that executives feel unsure. Leaders in biotech have to consider regulations, capital, and business operations when deciding whether to invest in a new venture. Without clear information on quantum computing, it's hard for them to make good decisions.

Collaboration with institutions like MIT and HorizonX facilitates structured executive programs that focus on the fundamentals of quantum technology, realistic timelines, and sector-specific use cases. This training helps connect people across research, business, and government, so innovation is not done in isolation.

Bridging the gap between biotechnology and advanced computing in Singapore requires integration at multiple levels. Currently, quantum computing is largely accessed through cloud-based hybrid systems, so ensuring compatibility with existing high-performance computing environments is crucial. Interdisciplinary collaboration is vital, as physicists typically develop quantum algorithms, while chemists and clinicians frame biomedical challenges. These different areas of expertise need to be expressible in a comprehensive software and data infrastructure that is able to handle and distribute between classical and quantum workloads.

Additionally, there is a structured intellectual property component to consider. Globally, there are more than 50,000 patents related to quantum technology, of which more than 3,000 originate from universities and research institutes. QAI Ventures maintains a proprietary database of all relevant and active patents that could be commercialized, creating opportunities to translate promising technologies into Singapore-based ventures. This emphasis on venture building supports commercialisation and strengthens the Life Sciences ecosystem.

4. **How do Singapore's efforts on integrating quantum computing contribute to reducing R&D timelines in biotechnology and healthcare?**

Singapore’s national strategy offers a structural advantage. The National Quantum Strategy, backed by nearly S$300 million in funding, combines research, talent development, and commercialisation pathways.

Developing new drugs can take more than ten years, and it takes even longer to add new technology in healthcare because of strict rules. If we wait until quantum computers are perfect, we could miss important opportunities. By starting now, Singapore will be ready to use new quantum tools as soon as they are practical.

Institutions like the National University of Singapore and Nanyang Technological University maintain strong collaborations with industry, which facilitates pilot deployments and translational research. Around the world, scientists are already combining quantum and conventional computers to solve hard problems. By building expertise and systems now, Singapore can speed up future healthcare research and breakthroughs.

5. **What role does Singapore's advanced infrastructure play in positioning the Life Sciences cluster to achieve breakthroughs in areas like molecular simulation and precision medicine?**

Singapore's strength lies in its coordinated infrastructure and secured data infrastructure. A combination of research excellence, a robust intellectual property regime, regulatory clarity, and global connectivity supports the commercialisation of deep-tech innovations.

The Centre for Quantum Technologies is a leader in quantum science, and A*STAR helps bring new science into healthcare. Other institutions and universities such as SIT and SUTD aid this development by developing talent around enabling technologies,infrastructure, and adjacent disciplines that need to be part of the conversation to create- and implement compelling use cases. Singapore’s legal system makes it easier to license new inventions and start companies, which speeds up turning research into real-world solutions.

Digital infrastructure is also crucial. Because Singapore has powerful computers and access to online quantum tools, biotech companies can test new ideas without buying expensive quantum hardware themselves.

For precision medicine, which means tailoring treatments to each patient, scientists need to analyze huge amounts of genetic and medical data. Combining AI and quantum computing could help make these models more accurate, especially for cancer and rare diseases. Singapore’s global connections also mean it can stay up to date with the latest technology as it becomes available.

6. **How does this initiative align with Singapore's broader economic, science and technology goals for 2030?**

Singapore’s long-term plans are to be a leader in advanced manufacturing, biomedical science, and developing its own technology. Adding quantum computing to the Life Sciences field will help by making research more valuable and speeding up the path from lab to marketplace.

By encouraging new startups and helping organizations work together, Singapore is creating more specialized, high-skill jobs and making its economy more diverse. This fits the national quantum strategy’s idea of helping industries get ready for big changes before they happen.

Quantum computers won’t replace classical computers anytime soon. But by building the right systems, learning new skills, and working together now, Singapore will stay ahead as technology moves forward.

Hithaishi Bhaskar