News Release

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Merck KGaA, Darmstadt, Germany, to Lead BAIQO Quantum Computing Project Funded by the German Federal Ministry of Education and Research

- **The QAR-Lab at Ludwig-Maximilians University in Munich, Germany, is a partner in this joint project**
- **Partners want to use quantum computing models to optimize clinical studies**

Darmstadt, Germany, December 9, 2021– Merck KGaA, Darmstadt, Germany, a leading science and technology company, today announced today announced its membership of the research project BAIQO (Bayesian Network Analysis and Inference via Quantum-assisted Optimization), which is being funded by the German Federal Ministry of Education and Research (BMBF). This three-year project will be carried out in collaboration with the Quantum Applications & Research Laboratory (QAR-Lab) at Ludwig-Maximilians University in Munich (LMU), Germany. This research project focuses on creating a basis for the use of quantum computing in the modeling of clinical studies. Together, the partners will investigate the potentials of various quantum algorithms for optimizing models generated with the aid of machine learning from large data sets.

"The algorithms are to be integrated into our existing optimization platform and investigated. Together, we are approaching the topic of how drug candidates can move through clinical development more purposefully, more quickly, more safely, and of course, more sustainably," said Thomas Ehmer, project manager on the side of Merck KGaA, Darmstadt, Germany. "Of course, BAIQO offers the potential for new innovative jobs in this technology field."

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Informatics Professor and Institute Chair Claudia Linnhoff-Popien, who heads the QAR-Lab at LMU, is convinced by the BAIQO project: "We at the QAR-Lab see enormous application potential for quantum computing in the optimization of clinical trials. With our many years of expertise in the areas of artificial intelligence and quantum computing, we want to support Merck KGaA, Darmstadt, Germany, in the development and implementation of beneficial algorithms."

Machine-derived models for clinical studies (known as Bayesian models) are often highly complex, with a very large number of variables and dependencies between those variables. The research partners want to evaluate the extent to which these kinds of models can generally be translated into optimization problems to define the best possible parameter distribution for modeling successful clinical trials.

A further question that the BAIQO project aims to answer is the extent to which different kinds of quantum algorithms can be applied under the existing limitations of current quantum computing hardware, i.e. so-called NISQ devices (NISQ: noisy intermediate-scale quantum). The evaluation of currently available NISQ devices will also clarify whether a "quantum advantage" exists compared with classic approaches for optimizing clinical trials.

The BMBF will fund 73.3% of the € 1.5 million project volume via the "Application Network for Quantum Computing" funding announcement, a measure for implementing the government program "Quantum Technologies – From basic research to market".

About the QAR-Lab at LMU
The QAR-Lab at LMU was founded in 2016 and, since then, has been bringing the initial use cases of companies to the computers of the future. Over the last few years, the QAR-Lab has built up in-depth proficiency in the practical application of quantum computing technology, enabling companies to benefit from this scientific expertise. For students, the QAR-Lab is a one-of-a-kind port of call for practice-oriented events in which calculations can be made – via the cloud – on four quantum computers worldwide.
Moreover, as a founding member of the Europe-wide lighthouse project PlanQK ("Platform and Ecosystem for Quantum-Supported AI"), the QAR-Lab is doing pioneering work in using quantum computing technology in the area of artificial intelligence. The experts at the QAR-Lab collaborate on the implementation of quantum-supported AI algorithms for industrial use cases as part of the research collaboration.

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About Merck KGaA, Darmstadt, Germany
Merck KGaA, Darmstadt, Germany, a leading science and technology company, operates across healthcare, life science and electronics. Around 58,000 employees work to make a positive difference to millions of people's lives every day by creating more joyful and sustainable ways to live. From advancing gene editing technologies and discovering unique ways to treat the most challenging diseases to enabling the intelligence of devices – the company is everywhere. In 2020, Merck KGaA, Darmstadt, Germany, generated sales of € 17.5 billion in 66 countries.
The company holds the global rights to the name and trademark "Merck" internationally. The only exceptions are the United States and Canada, where the business sectors of Merck KGaA, Darmstadt, Germany operate as EMD Serono in healthcare, MilliporeSigma in life science, and EMD Electronics. Since its founding in 1668, scientific exploration and responsible entrepreneurship have been key to the company's technological and scientific advances. To this day, the founding family remains the majority owner of the publicly listed company.