# **Project Title:**

Development of AI-assisted high-throughput antibody design and Secure Cancer diagnosis with encrypted cancer genome analysis

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## **Project Abstract/Proposal Summary:**

#### Project 1

Antibodies are essential for research and therapeutic applications, but the lack of high-quality, openaccess antibodies hinders scientific advancements and contributes to irreproducibility in science. Establishing a validated, open-access antibody database is crucial for addressing these challenges and improving reproducibility. AI-assisted antibody design offers a transformative approach, but its success is limited by the lack of robust training datasets.

We have successfully established an AI antibody design pipeline capable of designing nearly 10,000 antibodies daily, along with an in silico selection platform able to filter out over 90% of potential inactive antibody sequences. For the Open Antibody Database, we have collected 546 high-quality antibody datasets with manual validation from the original publications. The data includes structural data validated through PDB and literature checks, experimentally measured affinities, binding free energy data, as well as antigen-antibody types, article links, and other relevant information.

### Project 2

The rapid rise of chronic and complex diseases such as cancer presents a pressing global health challenge, compounded by limited public awareness, fragmented healthcare services, and underutilization of personal health data. We develop an AI- and blockchain-based, public-centric health and healthcare data management system designed to address these limitations through a decentralized, transparent, and incentive-driven architecture. The system integrates personalized AI models with privacy-preserving blockchain protocols to support early disease (e.g., cancer) screening, risk prediction, and dynamic treatment recommendations based on individual multi-omics and healthcare data. The system empowers individuals to own, manage, and selectively share their anonymized health data with research and clinical stakeholders, fostering a trusted and high-quality data ecosystem. Incentive mechanisms using cryptographic tokens are embedded to reward data contribution, participation in screening, and community governance. Additionally, a decentralized service marketplace is incorporated to provide accessible and verifiable preventive and therapeutic services. This architecture enhances health

data accessibility, protects user privacy, and promotes equitable participation in precision medicine, offering a new model for scalable, citizen-driven digital healthcare systems.