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“Design and Development of an Advanced Tissue Imaging Device for Surgical Oncology”

INTRODUCTION: Incomplete tumor removals remain a prevalent problem in cancer surgical treatments. Machine-learning Assisted Gigantic-Image Cancer Margin SCANner (MAGIC-SCAN) is a diagnostic imaging device currently under development that addresses this problem. The device is designed to detect any residual cancer cells in removed tumors within a 15 minute timeframe. This would allow surgeons to better predict if a cancerous tumor is still in the body, drastically reducing the number of unsuccessful surgical removals. The project aims to improve the accuracy and efficiency of the cancer margin assessment, addressing the problem of incomplete tumor removal during surgery.

METHODS: The current research and development phase has many different aspects; I primarily focused on sample imaging and handling. My contributions have included designing and 3D printing components for research devices and experimental setups, assisting with chemical experiments related to the histopathology process, and contributing to a camera attachment that helps determine the location of the sample. I helped develop strategies to mark specific tumor regions with fluorescent dyes visible to the naked eye and used multiple 3D modeling programs to fabricate parts and model tumor samples for imaging trials.

RESULTS: The camera model has been attached to the main MAGIC-SCAN machine as well as the Instapath Luci model and can take clear photos and videos of the sample in any light setting. The next step is to have the camera analyze the image and move the sample holder accordingly. Along with this, further research is being done to determine the best sample handling procedures to produce high quality models and images of the tumor and its cellular makeup.

CONCLUSIONS: The MAGIC-SCAN project has the potential to transform intraoperative decision-making by delivering accurate, high-resolution cancer detection within a short timeframe. Continued development will focus on refining imaging accuracy and sample handling procedures. Participating in this project has provided hands-on experience in biomedical engineering, collaborative research, and the design of impactful medical technology.