



Molecular Probe for Intraoperative Breast Cancer Surgical Margin Assessment

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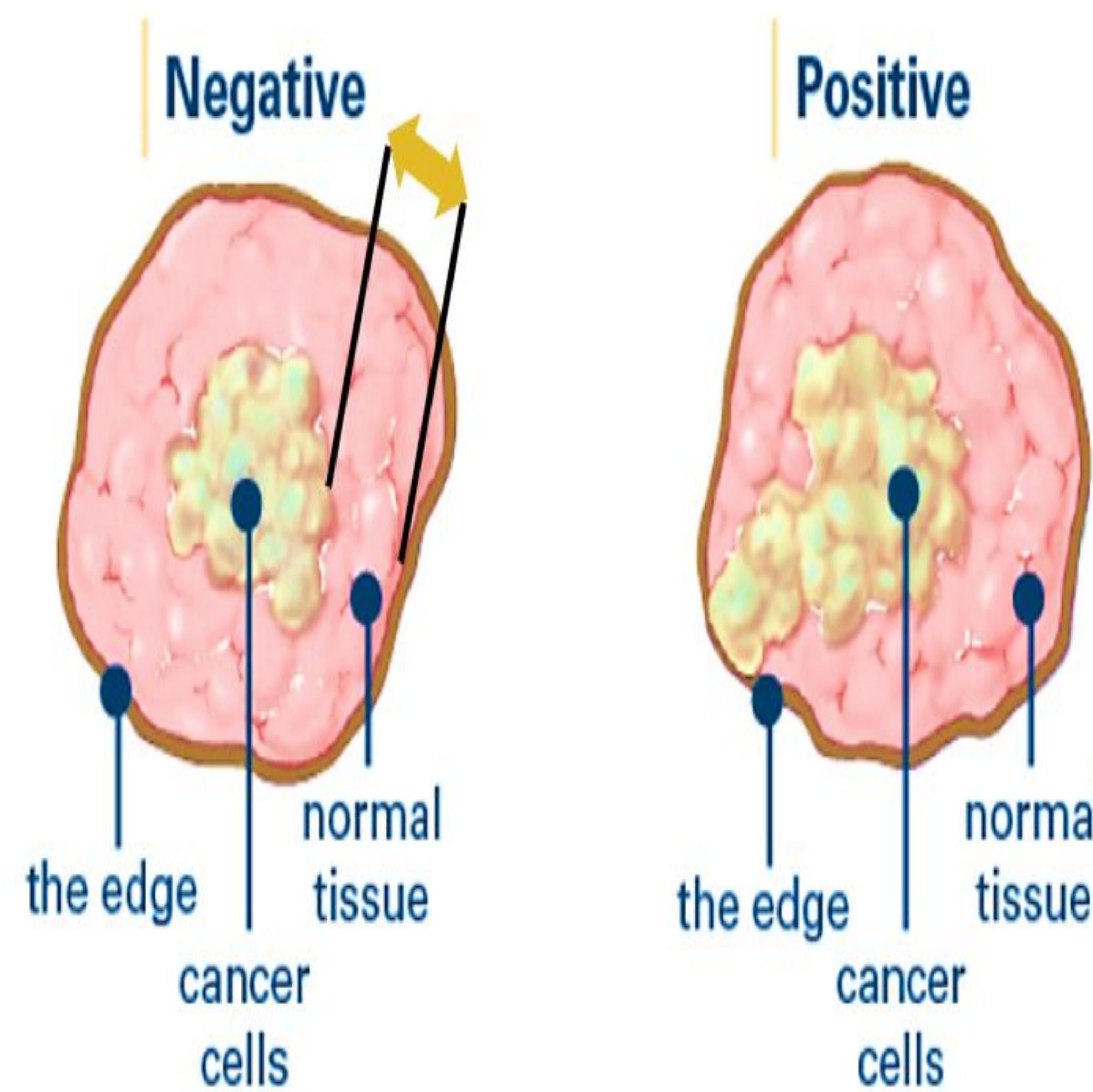
Team 16 ¹*School of Biomedical Engineering, Science and Health Systems*

Need

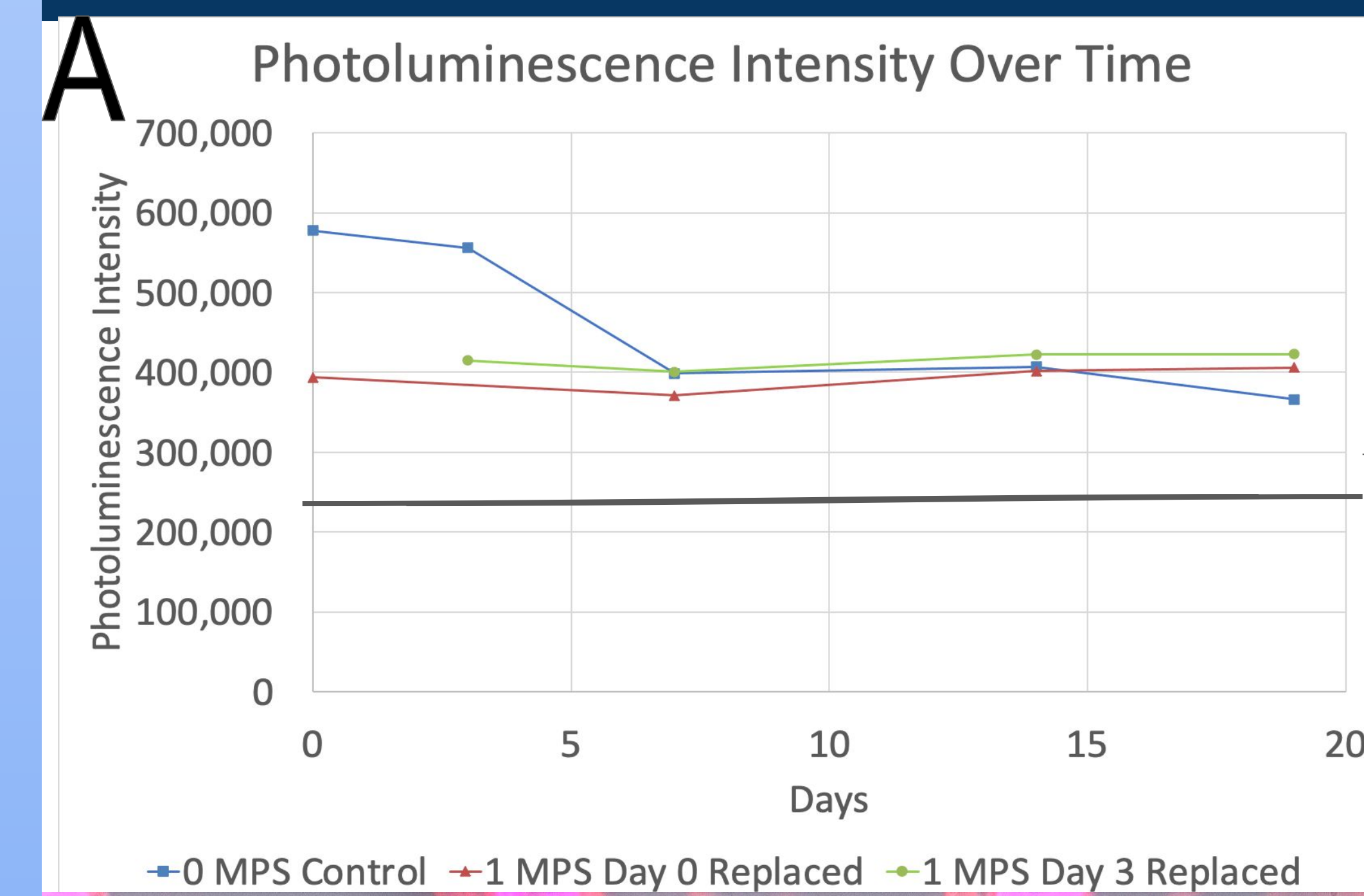
- Following Breast Conservation surgery, a pathologist examines rim of removed tissue known as the surgical margin.
- **Need a method to accurately identify positive margins during surgery**

Design Inputs:

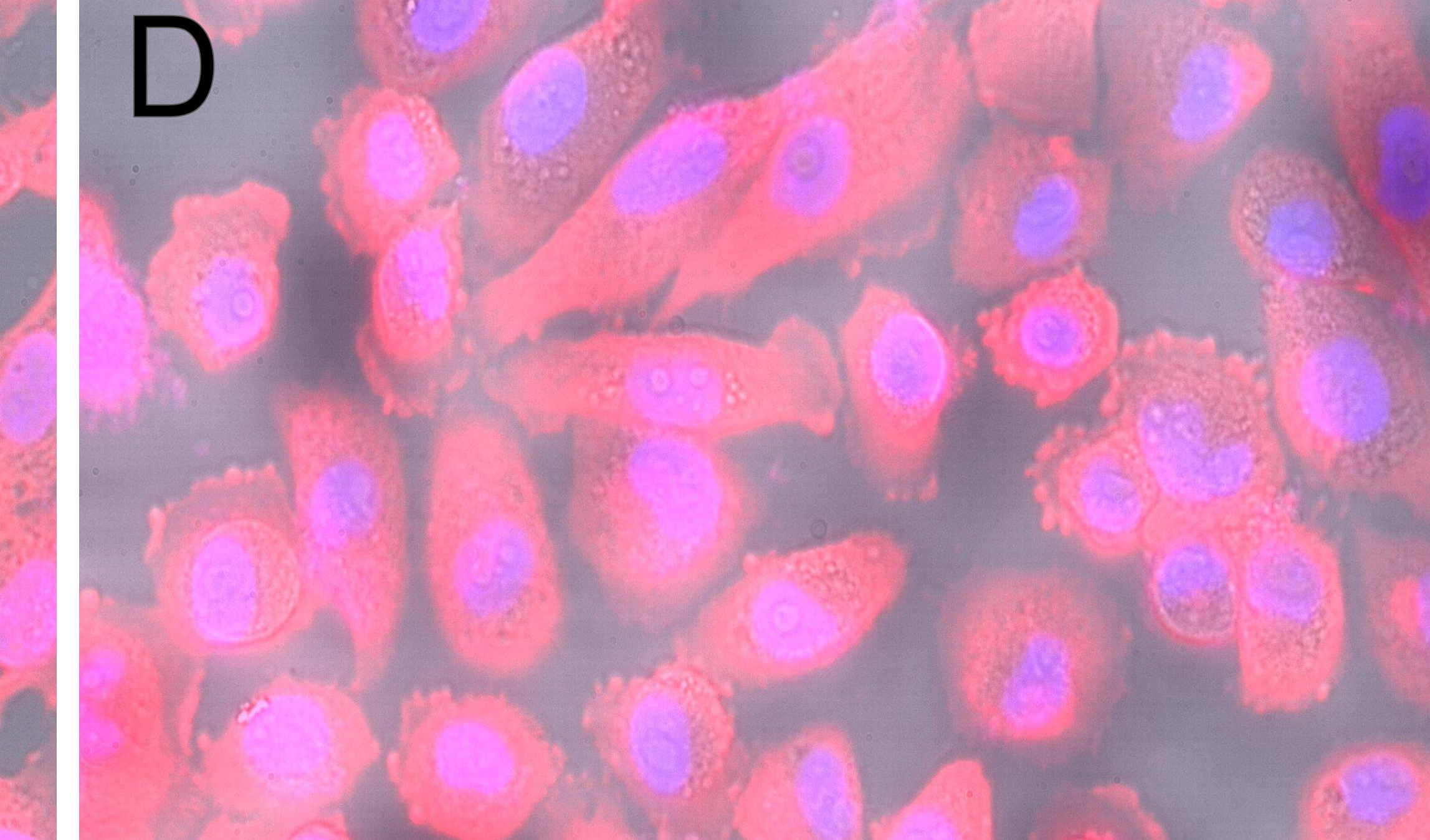
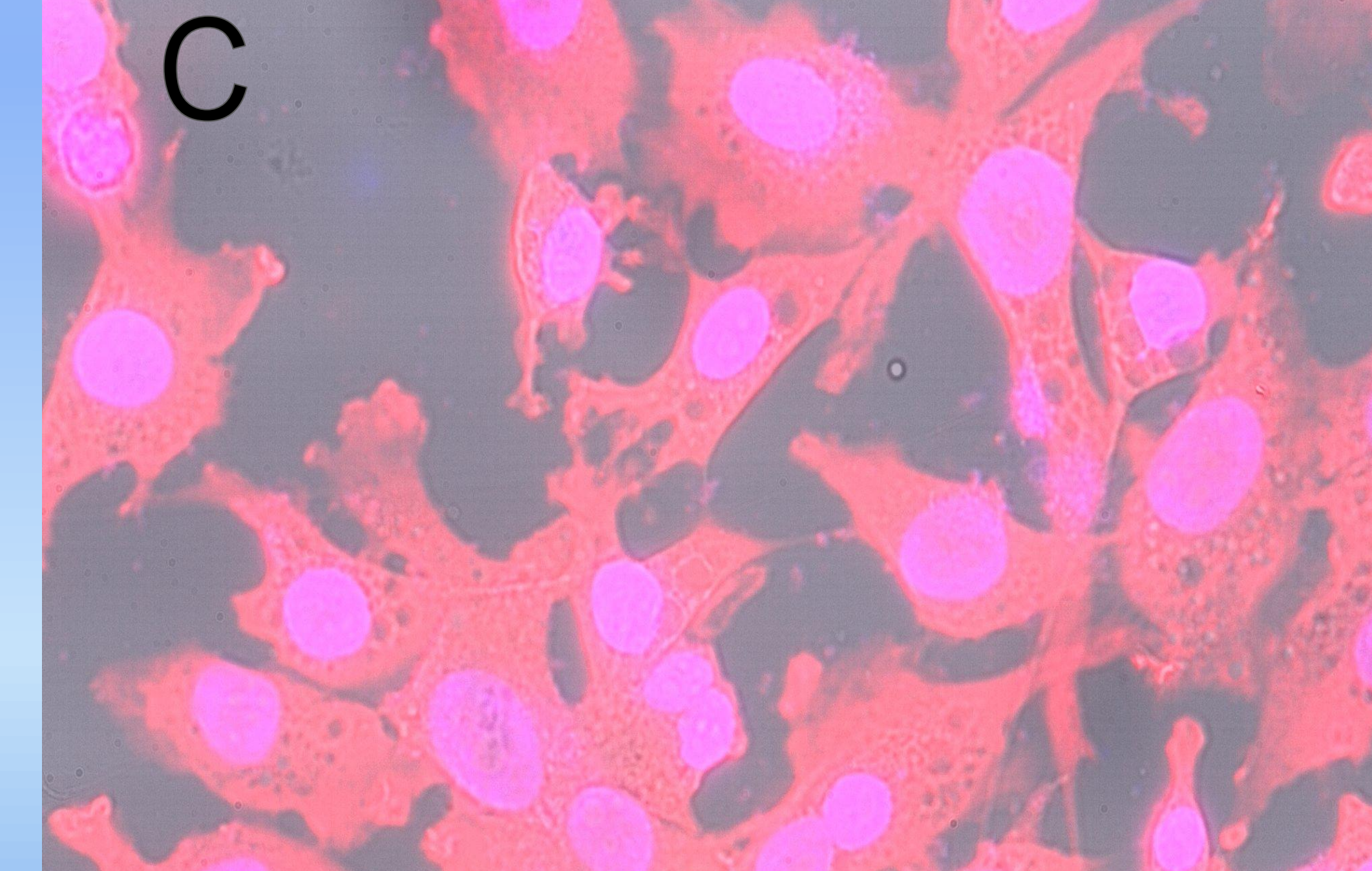
- High photoluminescence intensity: allows surgeon to observe cancer cells present
- Solution must have shelf life > 1 month
- Cancer specificity: Quantum Dots must only attach to cancer cells present



Testing Results



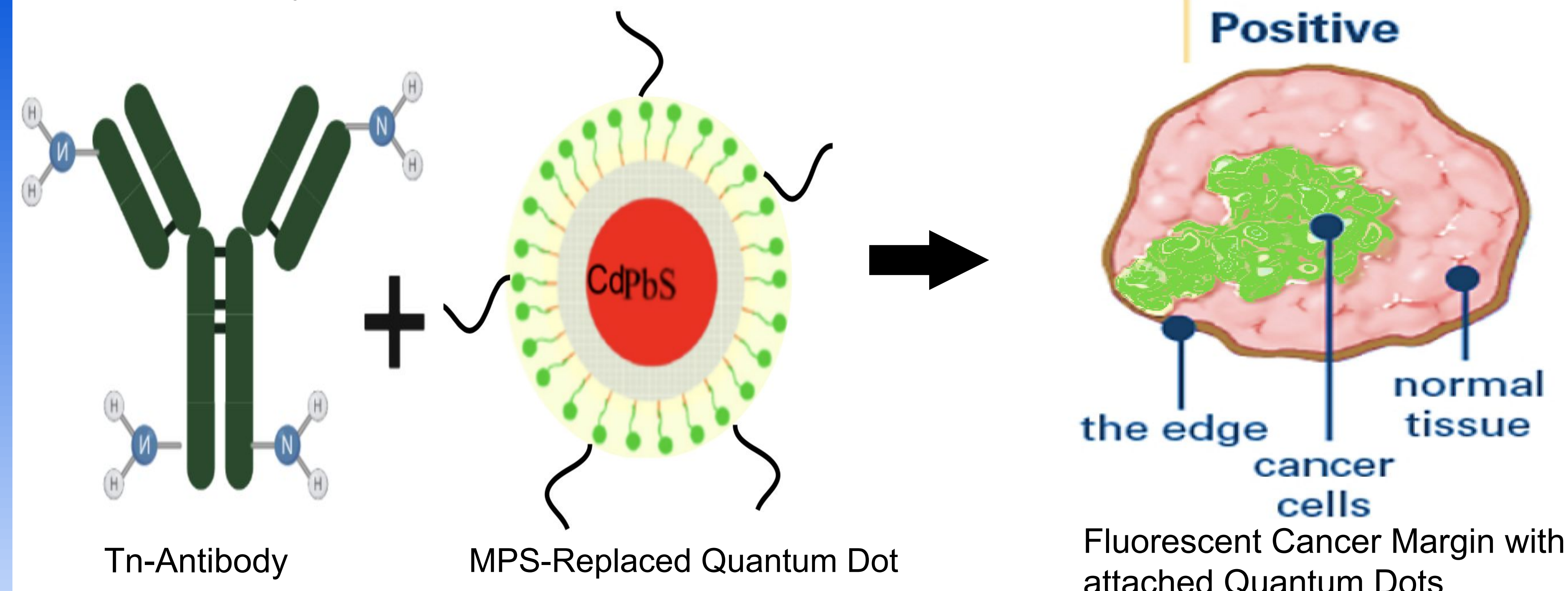
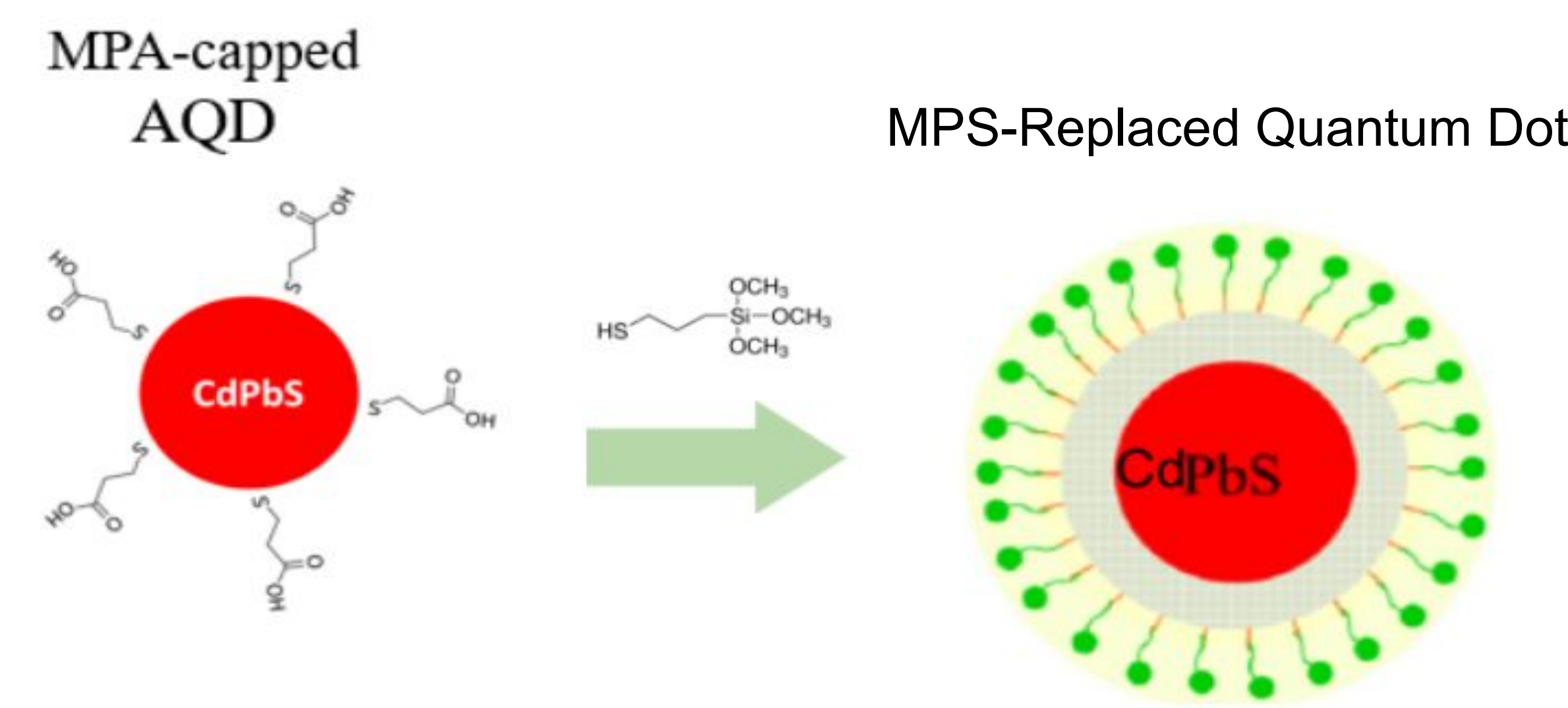
# Days from syn.	pH	# of Filters	Thiol Concentration	Zeta Potential
Day 2	pH 11	0 filters	1.44 mM	-
Day 2	pH 12	3 filters	0.84 mM	-
Day 2	pH 12	5 filters	0.5 mM	-
Day 16	pH 11	0 filters	0.85 mM	-
Day 16	pH 12	5 filters	0.66 mM	-36.63 mV
Day 16	pH 7	5 filters	0.82 mM	-16.43 mV



Solution

Design:

- Using Quantum Dots to bind to the cancer-specific tn-antibody to target and highlight any remaining cancer cells in the margin through the tn-antigen present on the cell-surface
- Optimize the conjugation to tn-antibody and decrease time required to synthesize Quantum Dots



The Quantum Dots met each of the requirements needed to complete conjugation, by maintaining a Photoluminescence Intensity over 250,000 (A), having >.15mM Thiol concentration on their surface after 5 filters (B), and having a zeta potential < -25 mV (B); however, the zeta potential was only met at pH 12 for these Quantum Dots. When fully conjugated and staining the cancer cells (C) the quantum dots appear bright in red surrounding the nucleus which is stained blue. The quantum dots do still, however, attach to the healthy MCF cells (D), showing that the specificity needed is not fully achieved.

Conclusion & Future Plan

- This model will allow for accurate cancer margins to be collected without the time-consumption of typical cell staining currently required, while also lowering the re-excision rate of Breast Conserving Surgery due to the photoluminescent properties
- Will reevaluate the conjugation conditions moving forward to get best results and avoid any aggregation occurring at the site. This will be done by lowering the amount of SM(PEG) used during the conjugation.