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Shedding Light on Cancer Surgery: A Near-Infrared Fluorescence Illuminating Technique

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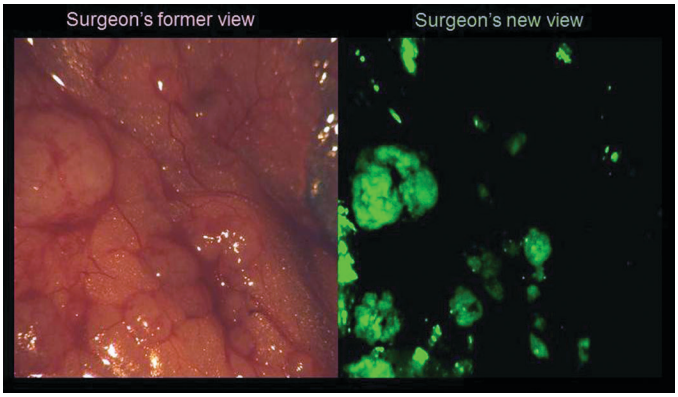
At On Target Laboratories, based in Purdue's Research Park, under direction of Professor Phillip Low, a new technique in cancer surgery is being developed which has the potential to innovate current clinical standards by improving surgery results and lower health-care costs. This technique is innovative in that it will provide surgeons an illuminated road map during surgery using the "Trojan Horse" method. This method specifically targets cancer cells and differentiates them from healthy cells. After cancer cells are targeted, they are illuminated by near-infrared (NIR) fluorescence. NIR is used because of its increased photon transportation. Photons can travel up to centimeters through blood and tissue, improving the identification of targets below the surface. This research consists of developing small molecules consisting of a near-infrared dye, linker, and cancer targeting ligand. Various ligands, including folate, are being developed to target different cancers such as ovarian, breast, colon, pancreatic, and prostate cancer. After the targeted NIR imaging agents have been developed, their photo-physical properties such as excitation, emission, quantum yield, and stability are analyzed using ultraviolet-visible spectroscopy and fluorometery. After assessing the molecules, their binding and specificity for cancer cells are evaluated both in vitro and in vivo using cultured cancer cells and tumor xenograft mice models. The targeted probes (consisting of the ligand linked to the NIR dye) are accumulated in the tumors with no uptake in other tissues leading to very high signal-to-noise ratio. The next steps in this research project involve further study in other animal models to evaluate any possible side effects and then progress into human clinical trials. Advancements in this image-guided technique could improve the ability of surgeons to diagnose cancer and surgically remove more cancer tissue than would have been otherwise possible. There are other potential uses for this technology including in inflammation related diseases.

Researcher advisor Sumith A. Kularatne says, "40% of patients undergoing cancer surgery each year in the U.S. have a recurrence of the disease within 5 years. Therefore, an unmet medical demand exists to develop techniques to remove primary malignant mass with entirely negative margins and remove all lymph nodes having metastatic cancer cells."



The fluorescent dye enters cancer cells through endocytosis. The dye will not enter healthy cells, which do not have the necessary receptor, thus creating a clear visualization of the cancer cells present among healthy cells.

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