

## Applications

- Treatment of early tumors and precancerous dysplasia
- Treatment of esophageal, breast, bladder, head and neck, skin, lung cancer
- Post-surgical excision treatment
- Light –enabled drug delivery
- Use with photodynamic therapy

## Advantages

- Targeted chemotherapy
- Non-invasive
- Control of drug permeability and cytotoxicity
- Lower dosages
- Not oxygen dependent, effective in hypoxic environments

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## Market Need

The discovery of anticancer agents that selectively target cancer cells is a longstanding goal in cancer research. Photodynamic therapy (PDT) aims to achieve this targeting by selectively killing cells upon illumination. PDT serves as a non-invasive treatment option for many types of non-metastatic, light-accessible cancers. A drawback is that moderate levels of oxygen are required, yet tumors are often in hypoxic environments. Moreover, during PDT treatment, oxygen levels drop even further as the singlet oxygen is consumed which can compromise treatment effectiveness. Other disadvantages include unpredictable drug uptake kinetics and long-term light sensitivity. PDT therefore is not likely to remove all pre-cancerous tissue.

## Technology Summary

Researchers at VCU have found a new approach to photodynamic therapy that allows light to control a drug's permeability. Highly hydrophilic molecules cannot typically pass through the hydrophobic lipid bilayer of cell membranes. Therefore, if one attaches a hydrophilic molecule onto a typically cell permeable molecule, it will render it impermeable. By attaching a cell permeable anti-cancer drug to a hydrophilic group via a light-cleavable linker, its permeability and activity can be controlled with light. This approach enables non-invasive, light targeted treatment of hypoxic tumors. The inventors have synthesized conjugates of the anti-cancer drug doxorubicin and shown that the toxicity of this compound in the presence of esophageal cancer cells can be controlled with light. Although many kinds of other molecular parameters have been controlled with light, this approach is the first to use light to control drug permeability. The current approach is far more versatile than PDT, can target a wide variety of cytotoxins in response to light and is not oxygen dependent.

## Technology Status

U.S. Patent Pending: 14/347,656.

Early proof- of-concept studies completed.

This technology is available for licensing to industry for further development and commercialization.