

PET probes for imaging apoptosis

Stanford researchers at the Rao Lab have developed apoptosis imaging probes with an improved new molecular structure enabling high sensitivity and stability with better performance *in vivo*.

These probes can image the activity of caspase-3, the executioner enzyme, via a uniquely designed caspase-3-triggered molecular self-assembly process by positron emission tomography (PET).

The early assessment of treatment-induced tumor cell death is of great prognostic value and allows oncologists to timely select the most efficacious treatment using a personalized medicine approach. Since apoptosis is one of the common cell death pathways, there has been strong interest in developing imaging strategies for non-invasive imaging of treatment-induced apoptosis in tumor cells.

Figure

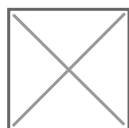
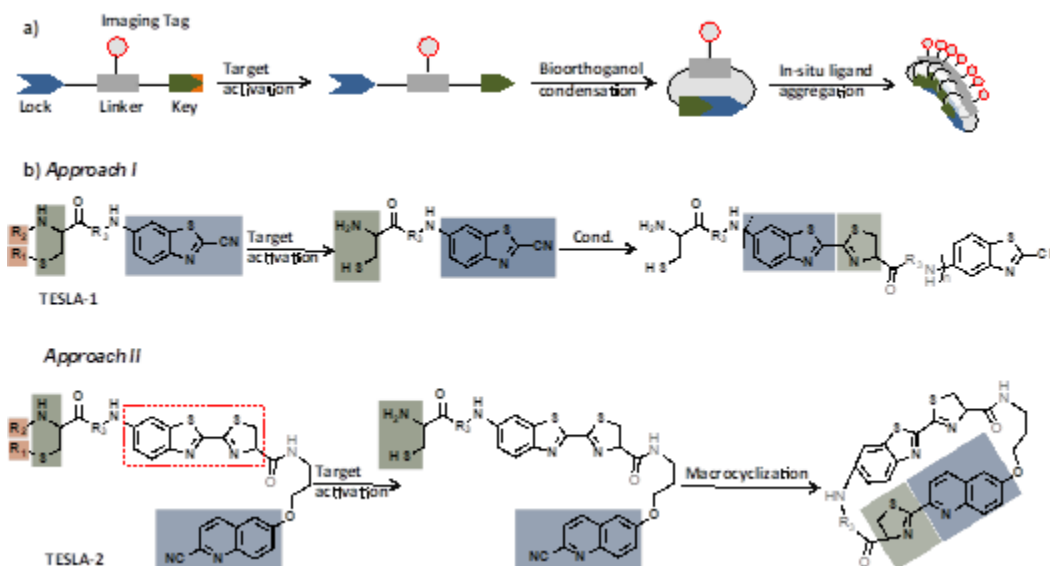


Figure description-a) Illustration of the mechanism of target enabled in-situ ligand aggregation (TESLA); b) approach I through intermolecular bioorthogonal

condensation of CBT with cysteine, and approach II via intramolecular cyclization of CHQ with cysteine

Stage of Research

- Successfully designed and synthesized fluorescent and PET probes and imaged anti-cancer drug induced tumor apoptosis in mice
- Filing FDA eIND for human clinical by end of year
- Applying approach to develop probes to image other disease markers

Applications

- **Imaging apoptosis:**
 - Drug research to validate the drug efficacy in subjects non-invasively
 - Clinical practice to monitor therapeutic efficacy in cancer patients

Advantages

- Improved imaging probe with new structure, higher sensitivity, better stability
- High specificity for caspase-3
- Non-invasive
- Biocompatible
- Simple to make
- Small size of probe allows:
 - Deep tissue penetration
 - More extensive biodistribution
- PET probes:
 - High tumor/muscle ratio in apoptotic tumors
 - High uptake value in apoptotic tumors
- Fluorescent probes:
 - Possess NIR spectral properties
 - Promotes personalized cancer medicine
 - Potential for probe design strategy to be applied to other enzyme targets

Patents

- Published Application: [20200085980](#)
- Published Application: [20240042066](#)
- Issued: [11,679,168 \(USA\)](#)

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