# CRET-based Self-illuminating Nanoparticles in Cancer Phototheranostics

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# Reactive Oxygen Species (ROS)

## Targeting cancer cells by ROS-mediated mechanisms: a radical therapeutic approach?

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Abstract | Increased generation of reactive oxygen species (ROS) and an altered redox status have long been observed in cancer cells, and recent studies suggest that this biochemical property of cancer cells can be exploited for therapeutic benefits. Cancer cells in advanced stage tumours frequently exhibit multiple genetic alterations and high oxidative stress, suggesting that it might be possible to preferentially eliminate these cells by pharmacological ROS insults. However, the upregulation of antioxidant capacity in adaptation to intrinsic oxidative stress in cancer cells can confer drug resistance. Abrogation of such drug-resistant mechanisms by redox modulation could have significant therapeutic implications. We argue that modulating the unique redox regulatory mechanisms of cancer cells might be an effective strategy to eliminate these cells.

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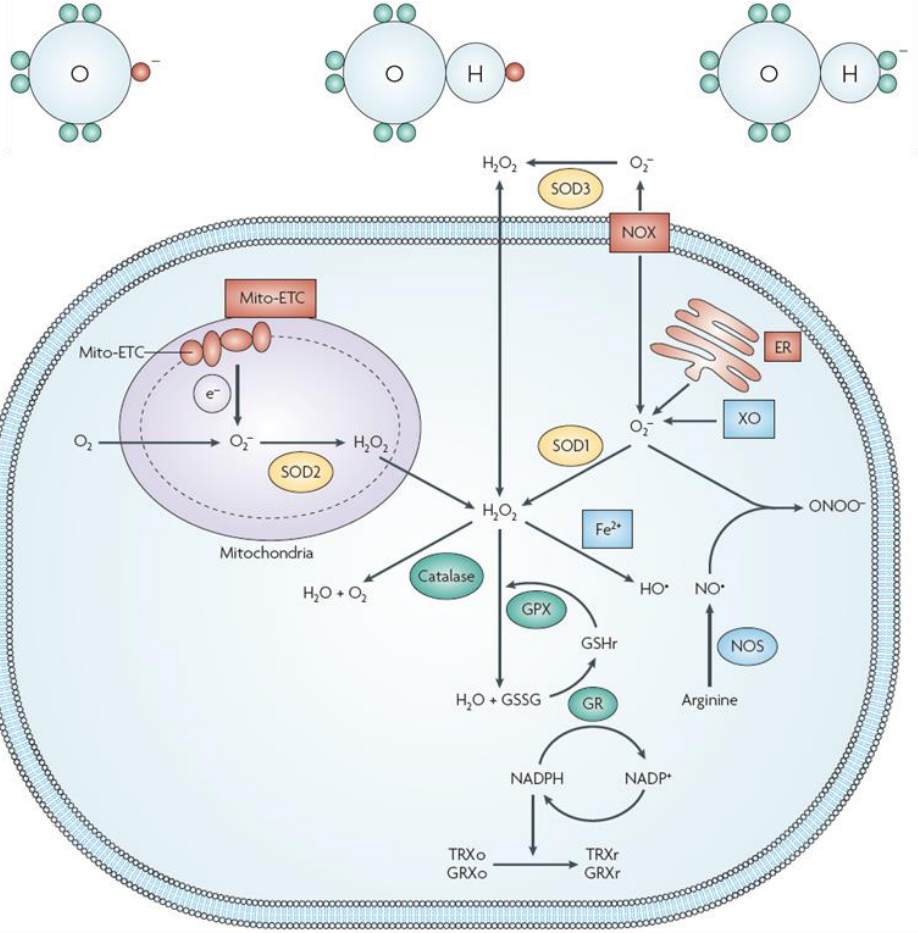



### Radical ROS

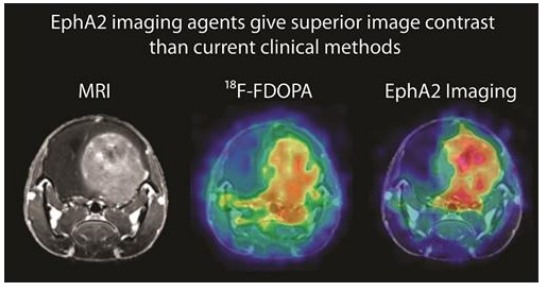
Superoxide, hydroxyl radicals, and nitric oxide

### Non-radical ROS

Peroxide, ozone, peroxynitrate, and hydroxide

# ROS in theranostics

## A. Molecular imaging

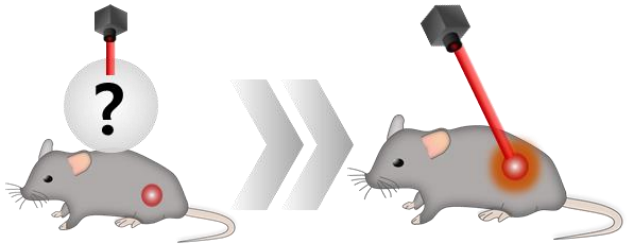



| | |
|---|---|
| CT imaging | Contrast agents |
| MR imaging | Target molecules |
| PET imaging | |

- Early/accurate diagnosis
- Molecular process in the body
- Visualization of cellular functions
- Detection / imaging in subcellular level

## B. Image-guided therapy

- Surgery
- Radiotherapy
- Photodynamic therapy




**Targeted therapy : Therapeutic efficacy ▲**

https://www.curebraincancer.org.au/

# Chemiluminescence Resonance Energy Transfer

ACCOUNTS of chemical research

Article

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## Aggregation-Induced Emission (AIE) Dots: Emerging Theranostic Nanolights

Guangxue Feng and Bin Liu*

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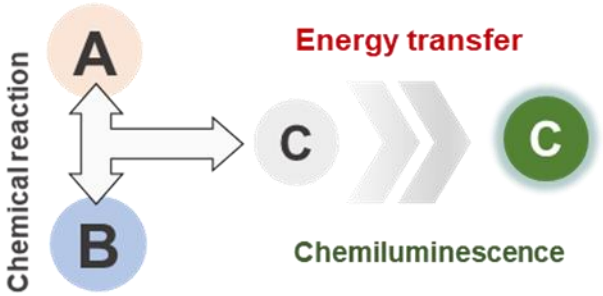
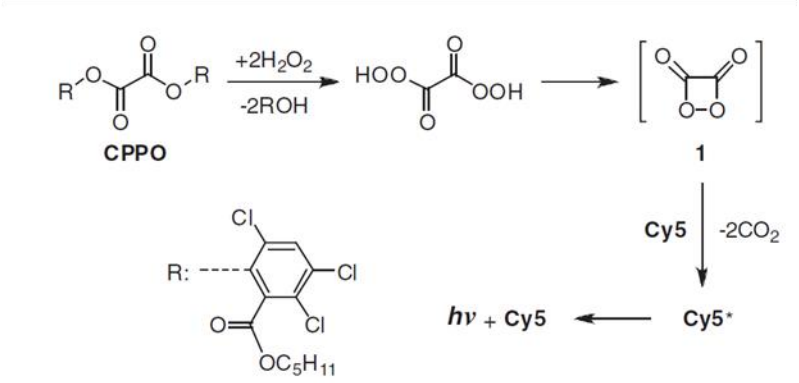



Chemiluminescence resonance energy transfer (CRET) refers to a non-radiative transfer mechanism between chemiluminescence (CL) donors and adjacent acceptors, usually located within 10 nm.

**High specificity**

**High signal-to-noise ratio**




**ROS imaging**

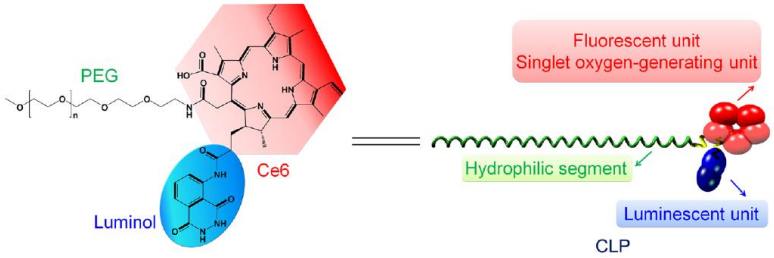
# Self-illuminating nanoparticles in cancer phototheranostics

SCIENCE ADVANCES | RESEARCH ARTICLE

HEALTH AND MEDICINE

## A self-illuminating nanoparticle for inflammation imaging and cancer therapy

Xiaoqiu Xu[1]*, Huijie An[1]*, Dinglin Zhang[2], Hui Tao[1], Yin Dou[1], Xiaohui Li[1], Jun Huang[3], Jianxiang Zhang[1†]



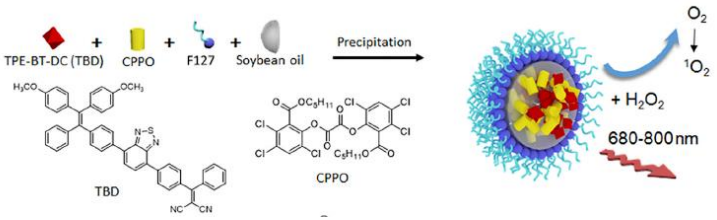

Chem

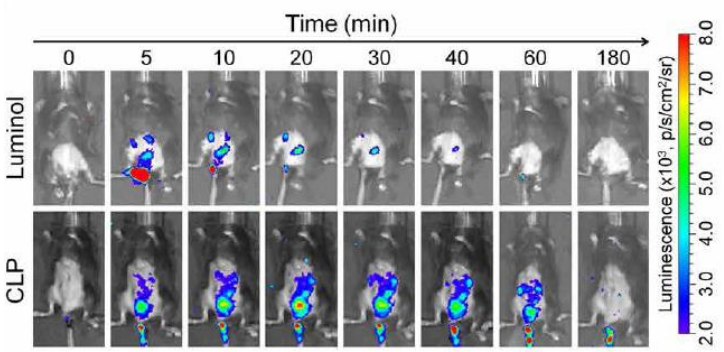
CellPress

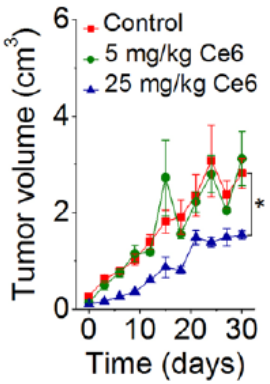
Article

## Chemiluminescence-Guided Cancer Therapy Using a Chemiexcited Photosensitizer

Duo Mao,[1,4] Wenbo Wu,[1,2,4] Shenglu Ji,[3] Chao Chen,[3] Fang Hu,[1] Deling Kong,[3] Dan Ding,[3] and Bin Liu[1,5,*]



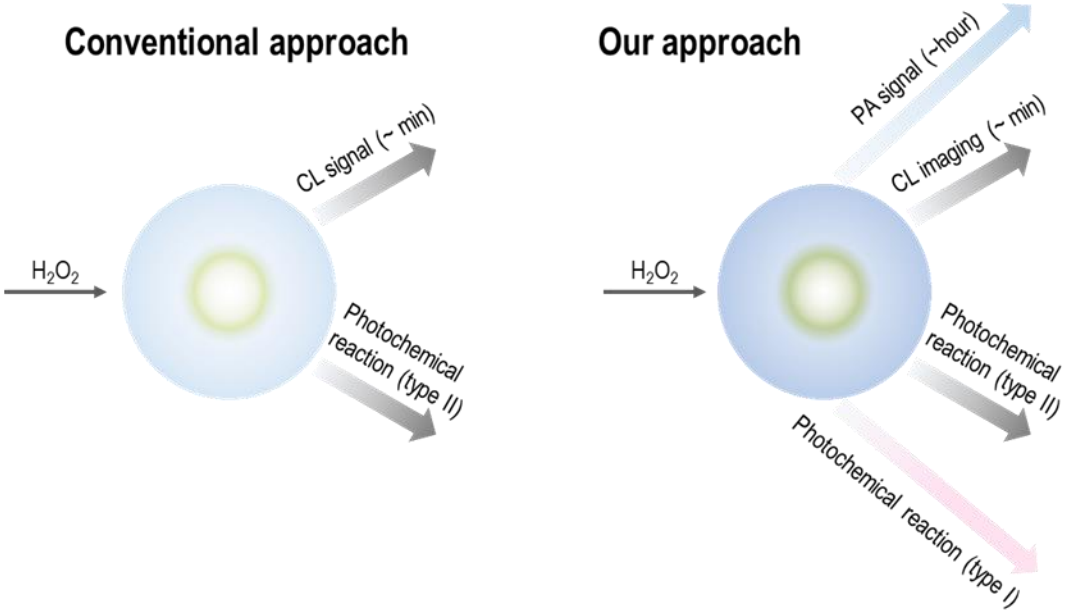




**Short duration of CL signal**

**Oxygen-dependency of the type II photoreaction**

# Strategy




To overcome the limitations of conventional CRET-NPs, we used a new approach by reinterpreting the hidden nature of CRET