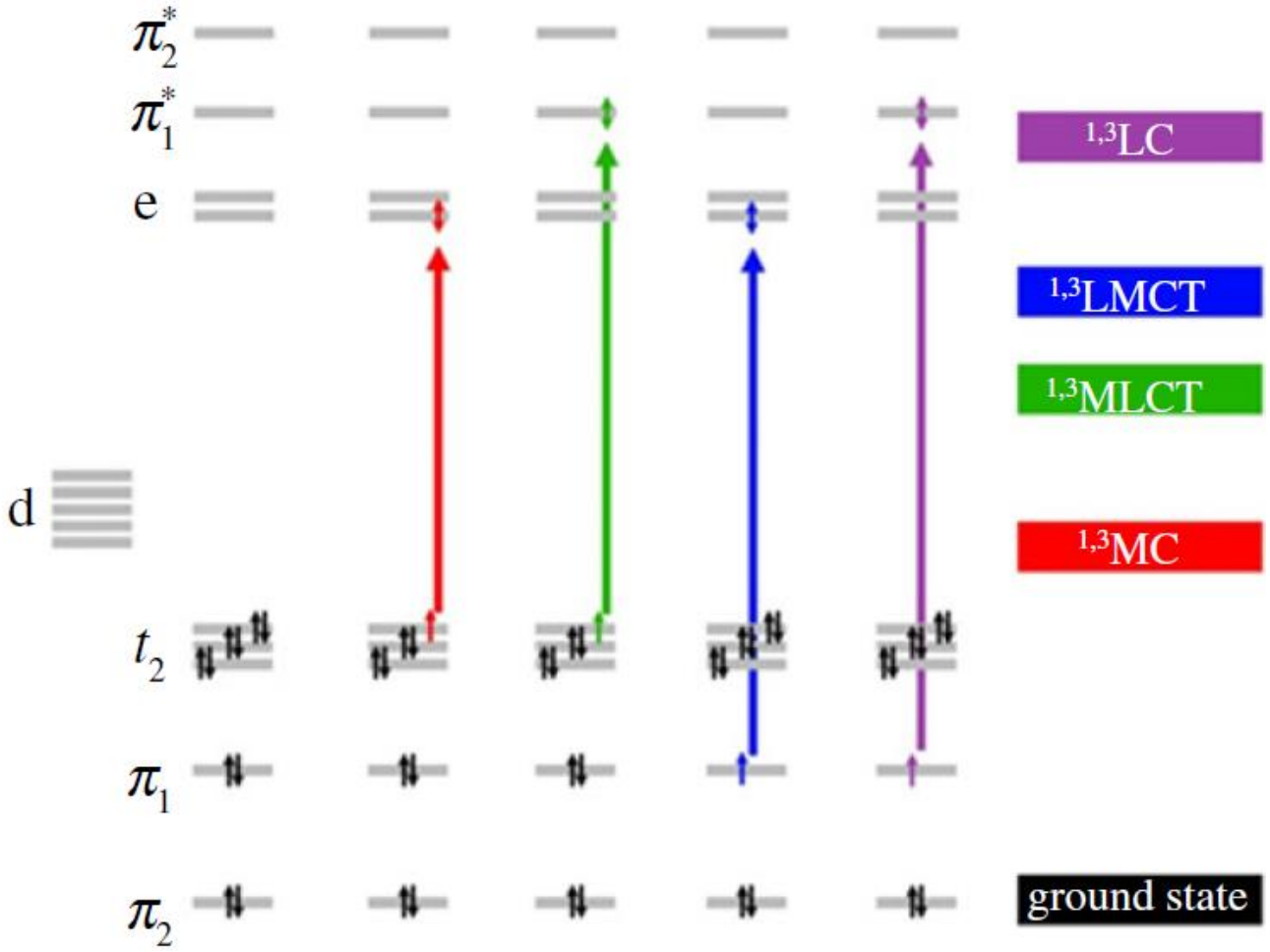
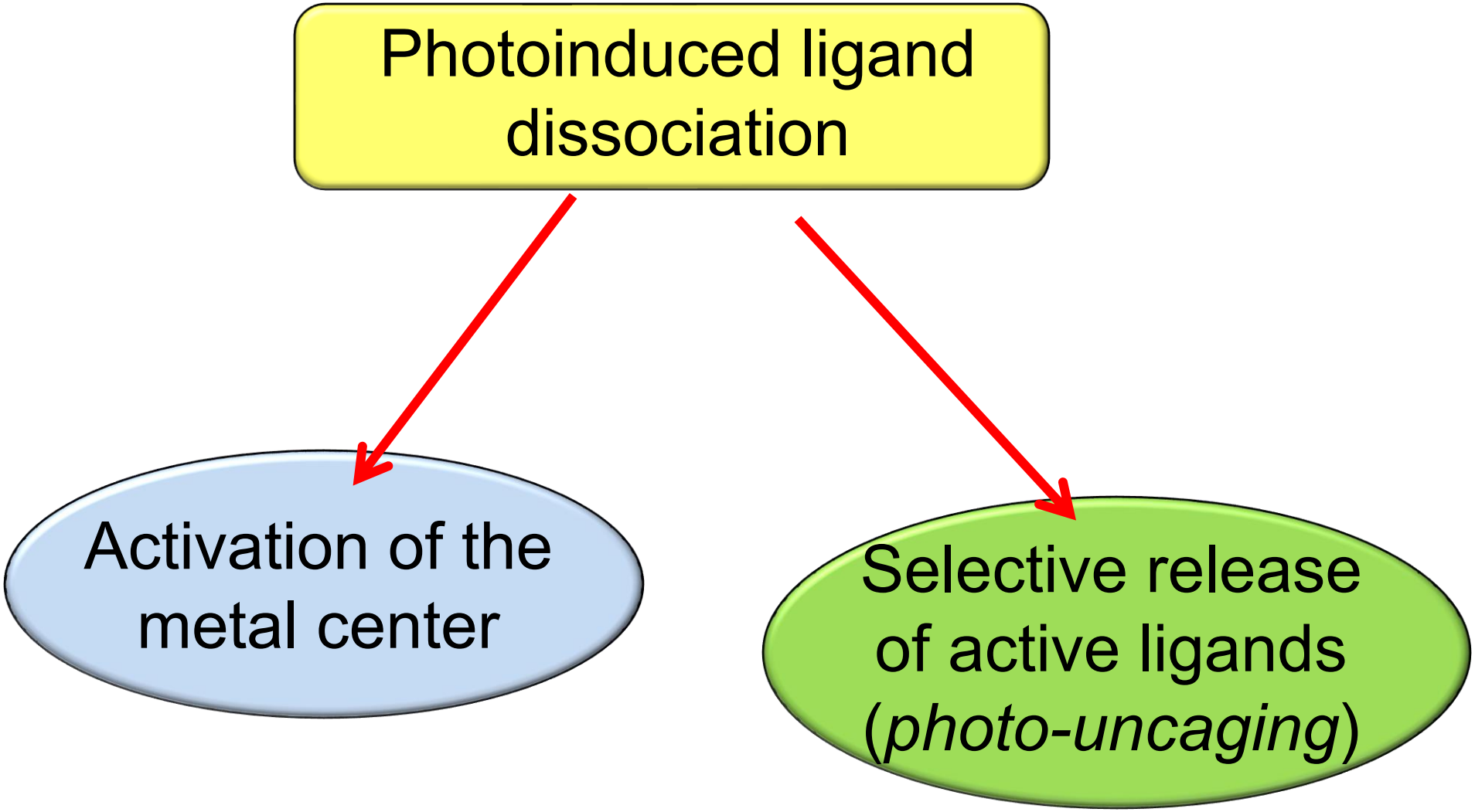
Photoactivatable metal compounds



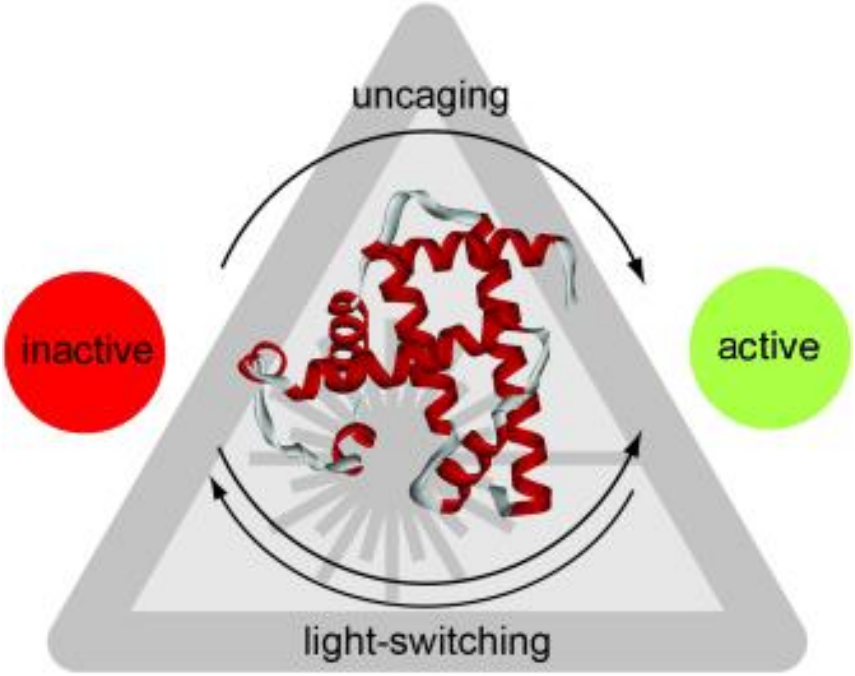
Photoactivatable metal compounds

These complexes are inert and non-toxic to cells in the dark.
Upon irradiation at the tumor site, they undergo various photochemical reactions, including isomerization, substitution, and reduction.

The photoactivation pathway of metal complexes does not rely on O_2, which is a significant advantage over the photosensitizers used in current PDT. However, photoactivation – contrary to PDT – is a stoichiometric proces.

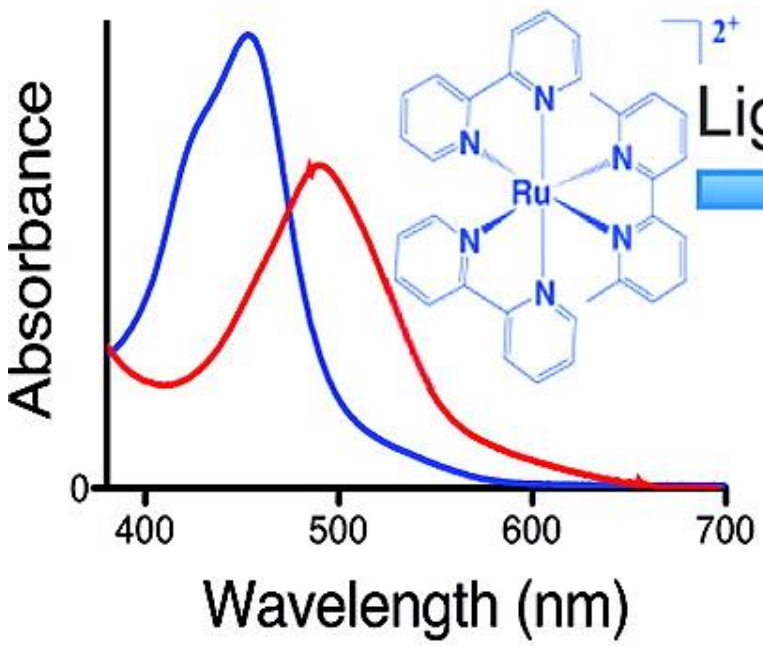

Photoinduced ligand dissociation
Activation of the metal center
Selective release of active ligands (*photo-uncaging*)

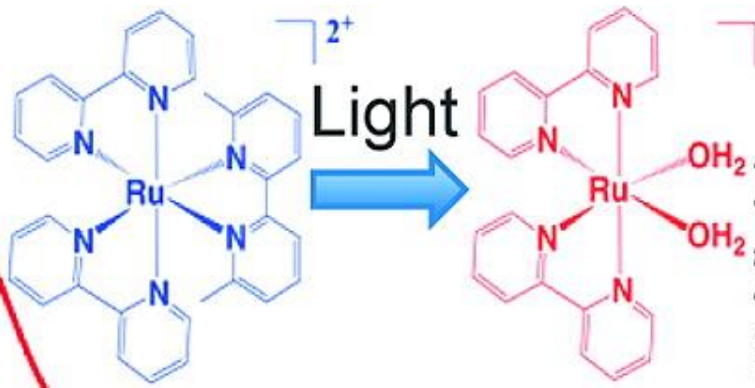
Caged compounds and photo-uncaging

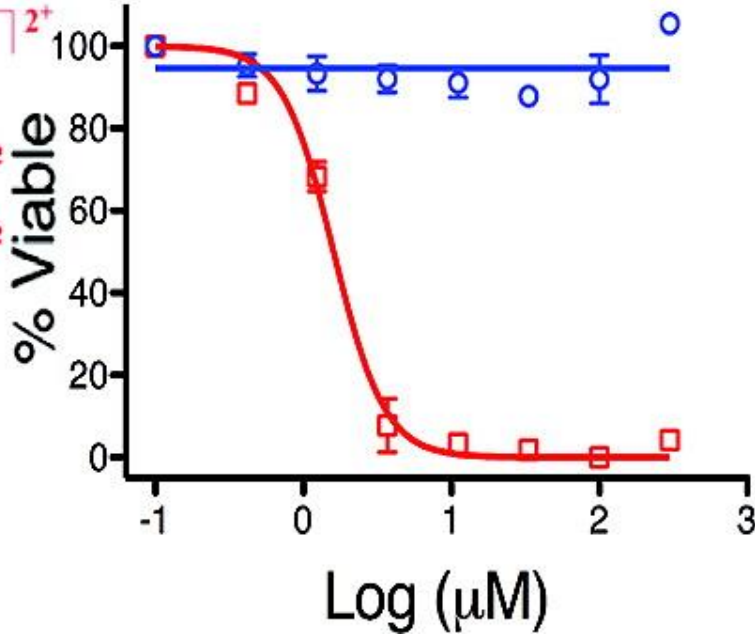


Photolabile protecting groups, attached to a defined position of a molecule, can be used to gain spatio-temporal control over the concentration of the active form of a molecule.

Photoactivatable Ru compounds

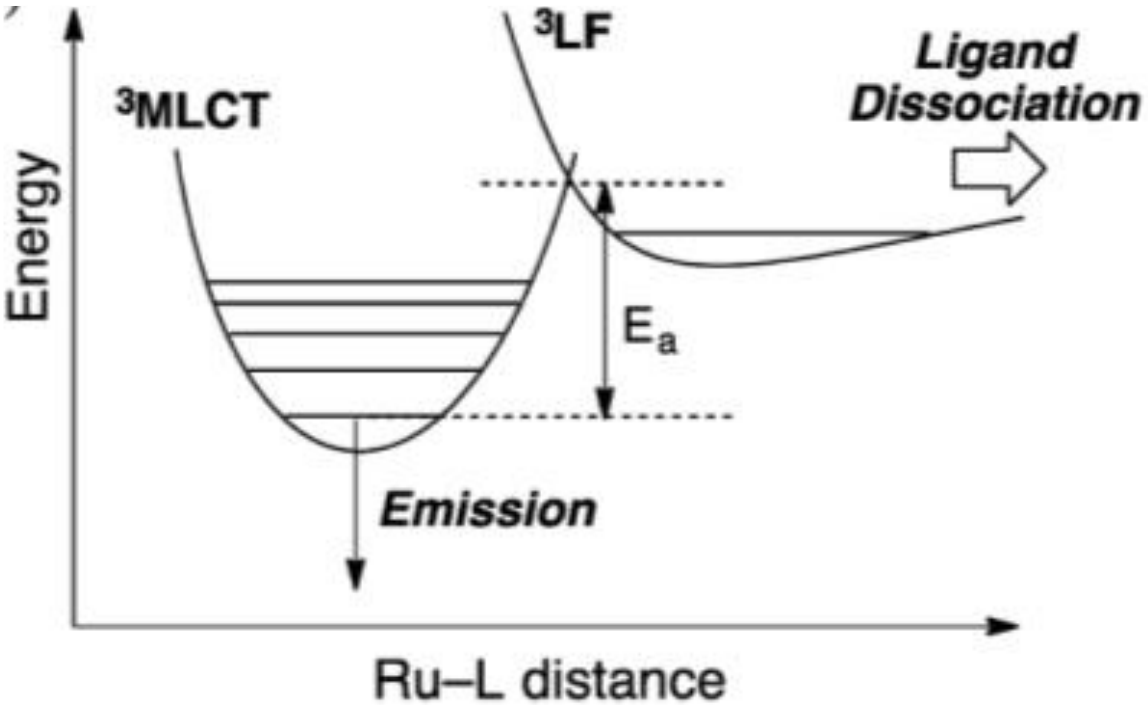


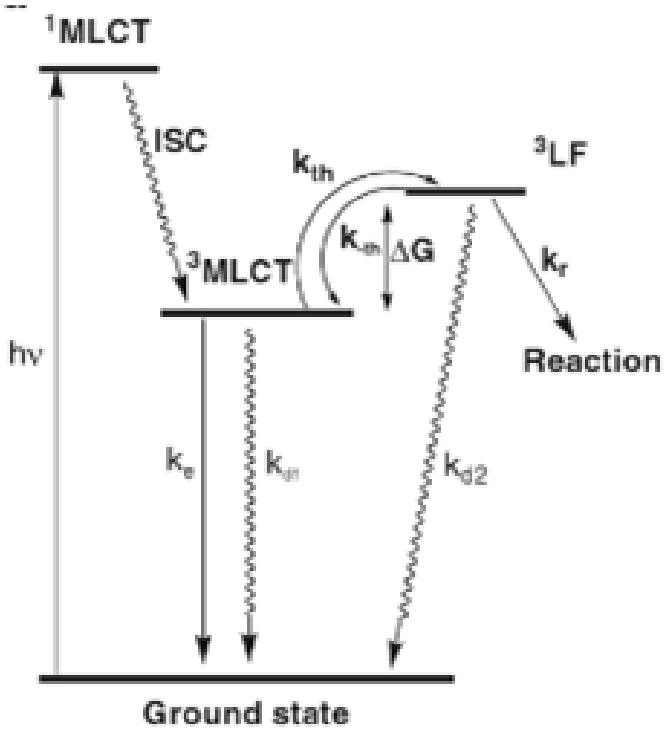


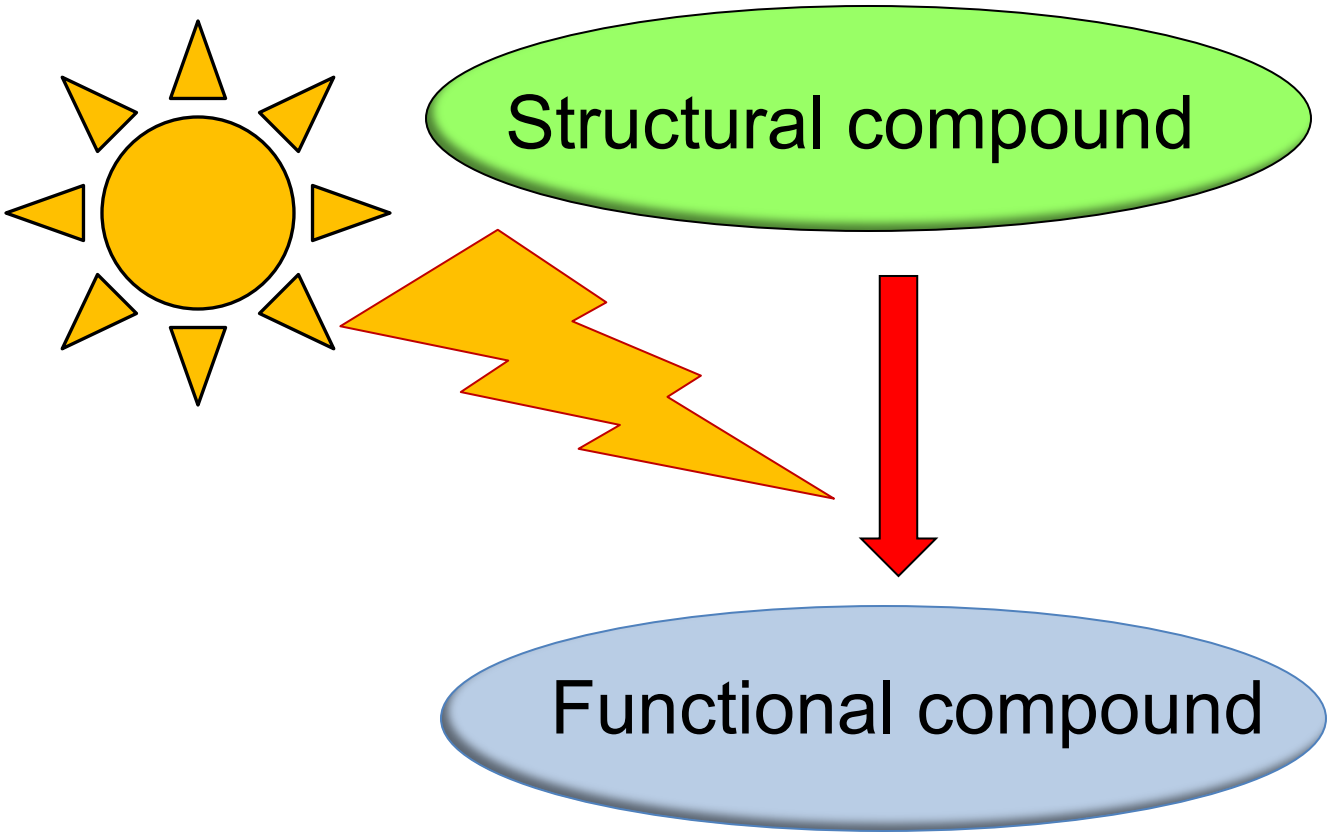


Phototoxicity Index, PI

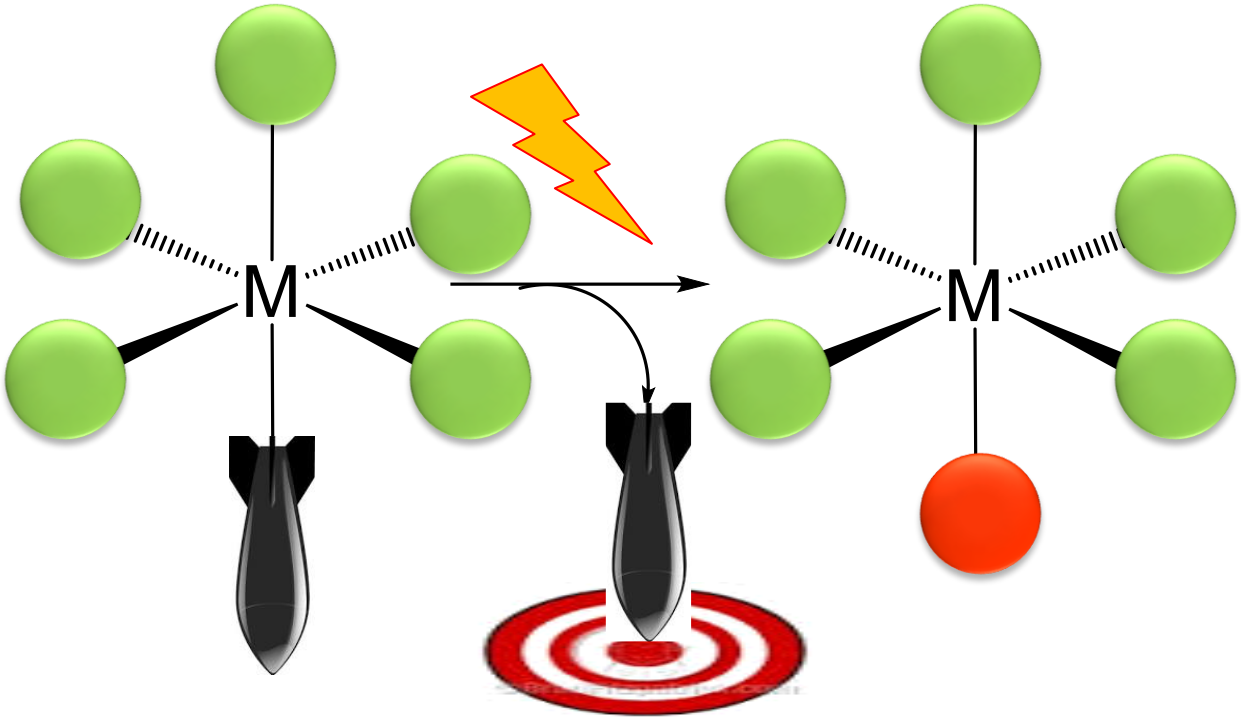
Photoactivatable Ru compounds






Structural compound
Functional compound

Metal compounds for the delivery of active molecules



= NO, CO, 4-aminopyridine (4-AP, K^+ channel blocker), γ-aminobutyric acid (GABA, a neurotransmitter),…

Caged compounds and photo-uncaging

NO Releasing Molecules = NORM
CO Releasing Molecules = CORM

Photo-NORM
Photo-CORM

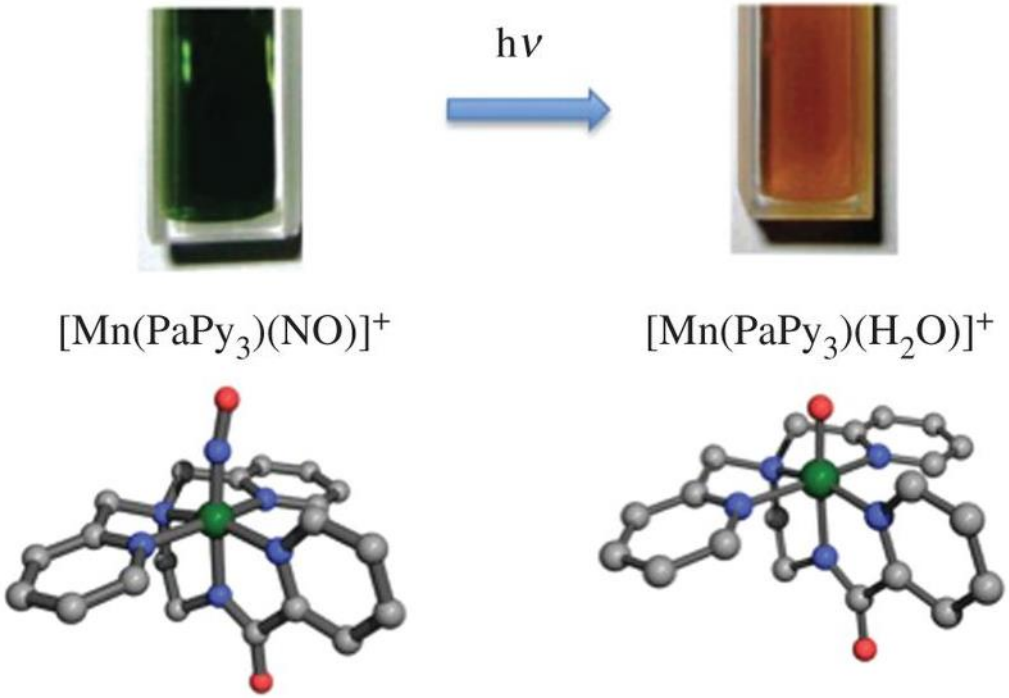
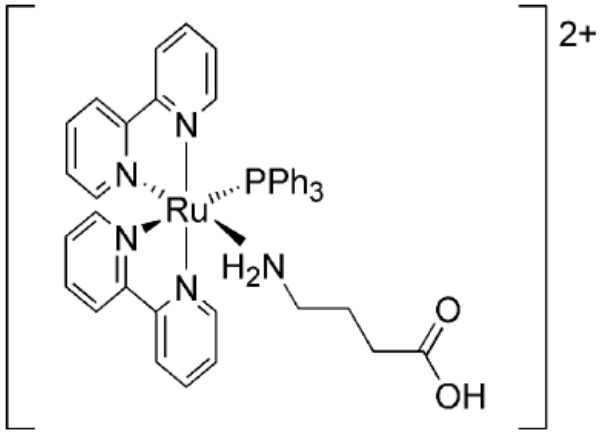
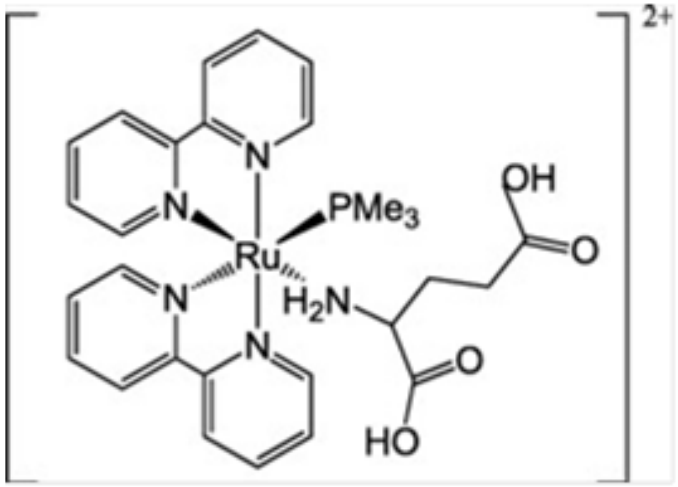
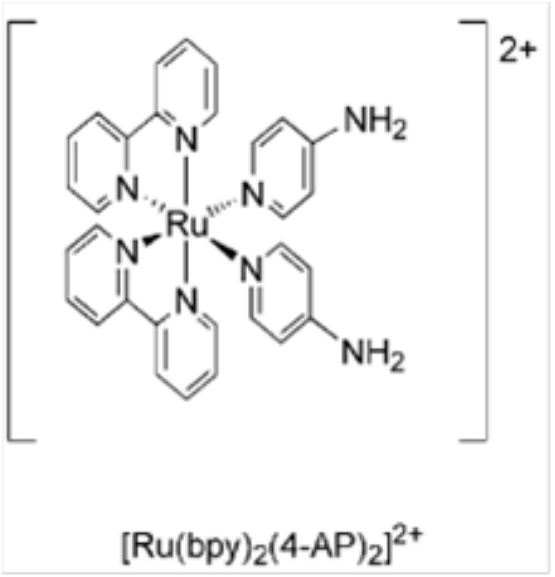


Photo-release of neurotransmitters



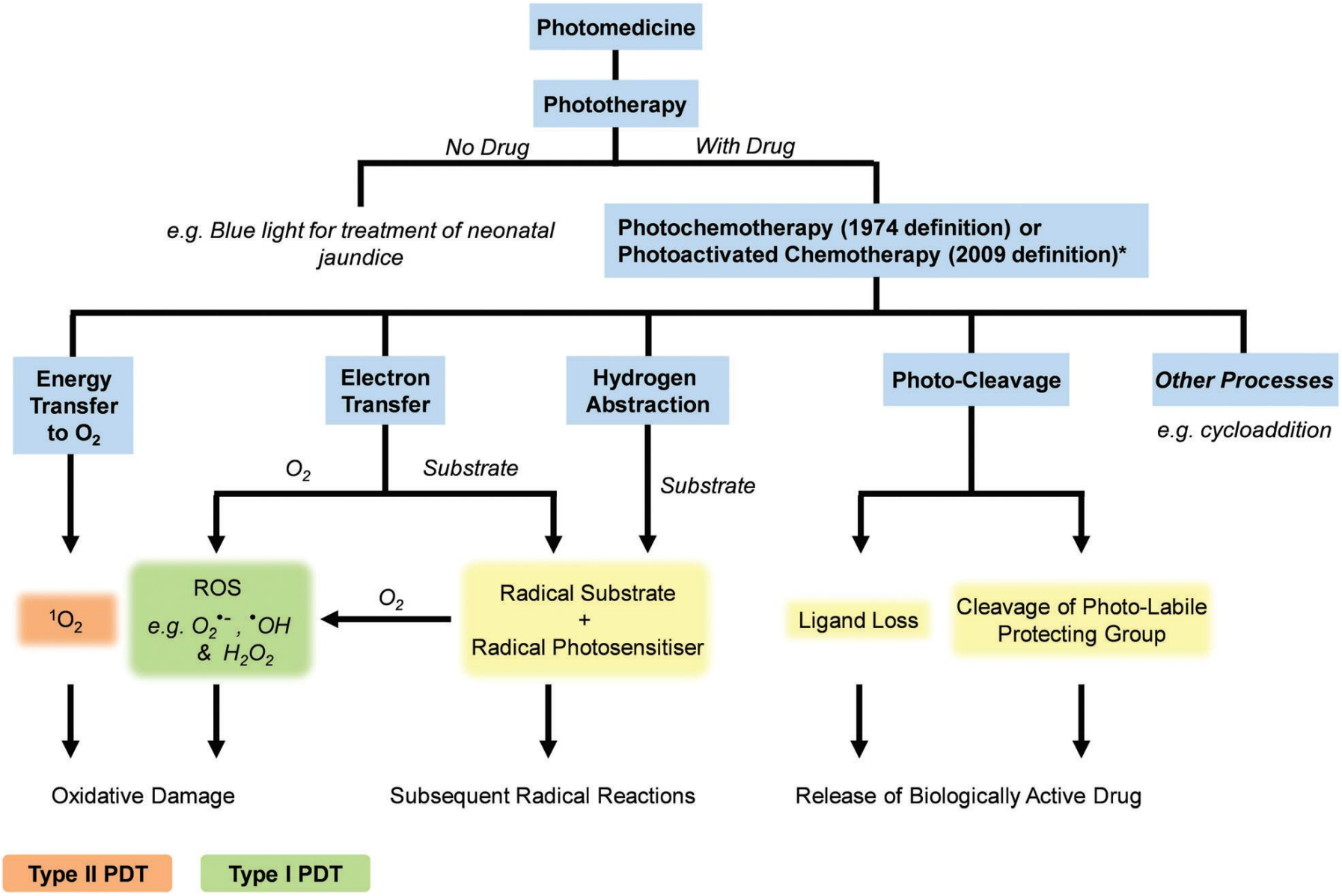
$[Ru(bpy)_2(PPh_3)(GABA)]^{2+}$





$[Ru(bpy)_2(4\text{-}AP)_2]^{2+}$

GABA = γ-aminobutyric acid: inhibitory neurotransmitter
Glutamic acid: excitatory neurotransmitter
4-AP = 4-aminopyridine: K^+ channel blocker


Photomedicine
Phototherapy
No Drug
With Drug
e.g. Blue light for treatment of neonatal jaundice
Photochemotherapy (1974 definition) or Photoactivated Chemotherapy (2009 definition)*
Energy Transfer to O_2
Electron Transfer
Hydrogen Abstraction
Photo-Cleavage
Other Processes
e.g. cycloaddition
O_2
Substrate
Substrate
$^1O_2$
ROS
e.g. $O_2^{\bullet-}$, $^{\bullet}OH$ & H_2O_2
O_2
Radical Substrate + Radical Photosensitiser
Ligand Loss
Cleavage of Photo-Labile Protecting Group
Oxidative Damage
Subsequent Radical Reactions
Release of Biologically Active Drug
Type II PDT
Type I PDT