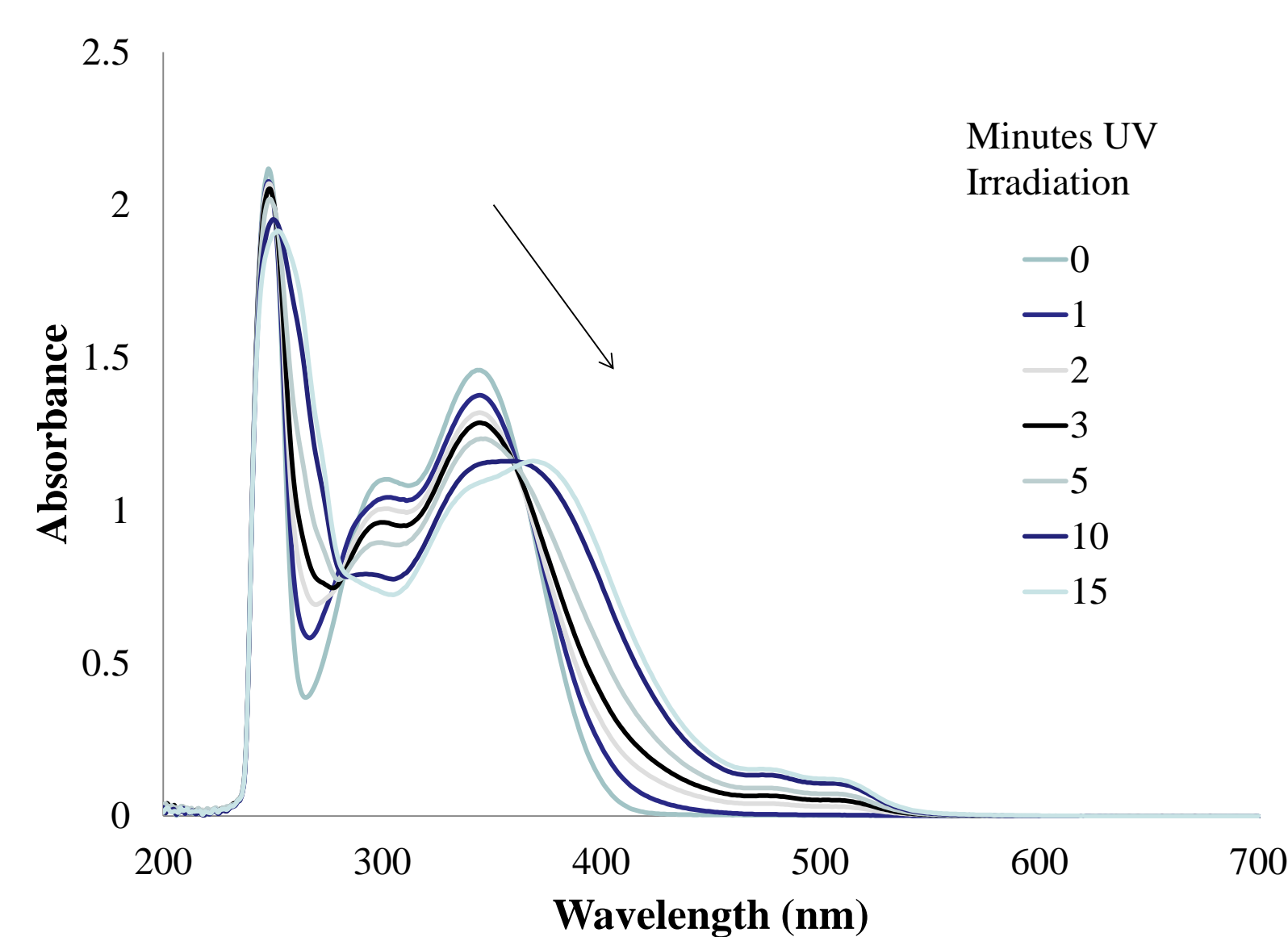
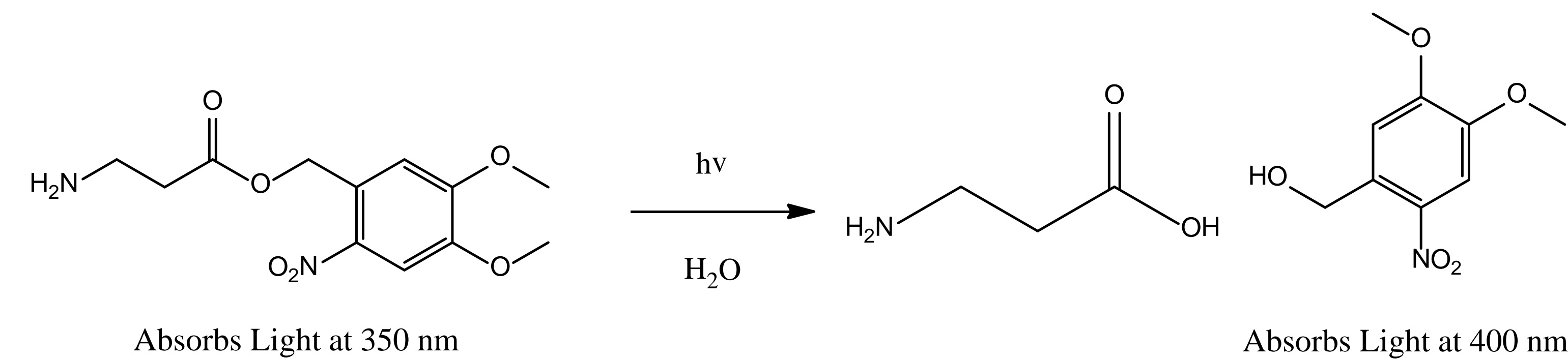


# Designing a Near IR-Sensitive Nanoparticle for Drug Delivery

Caitlyn Lim, Madeleine Grossman, Adah Almutairi

Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, 9500 Gilman Drive, La Jolla, California 92093-0378

## Light Can Be Used To Do Chemistry

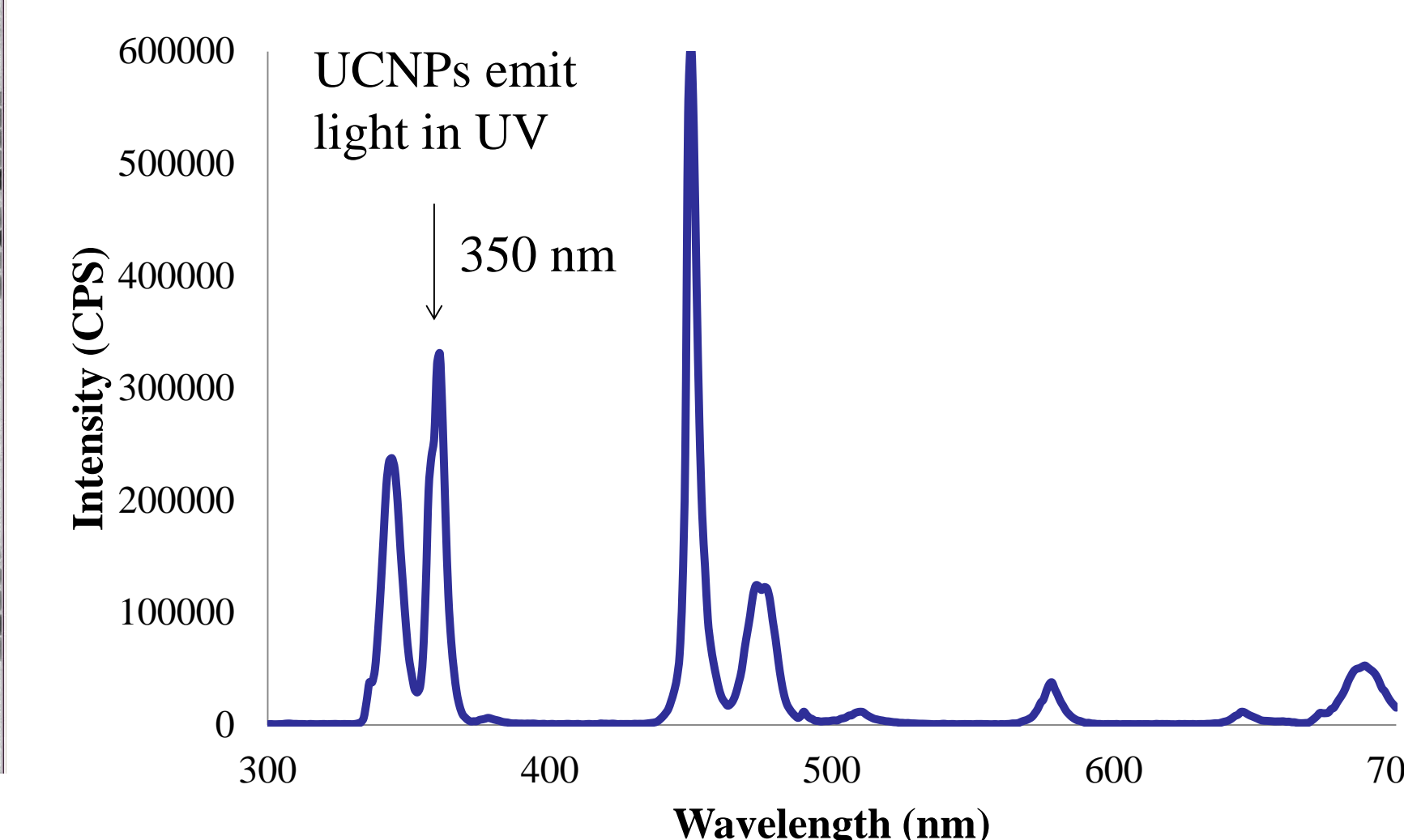
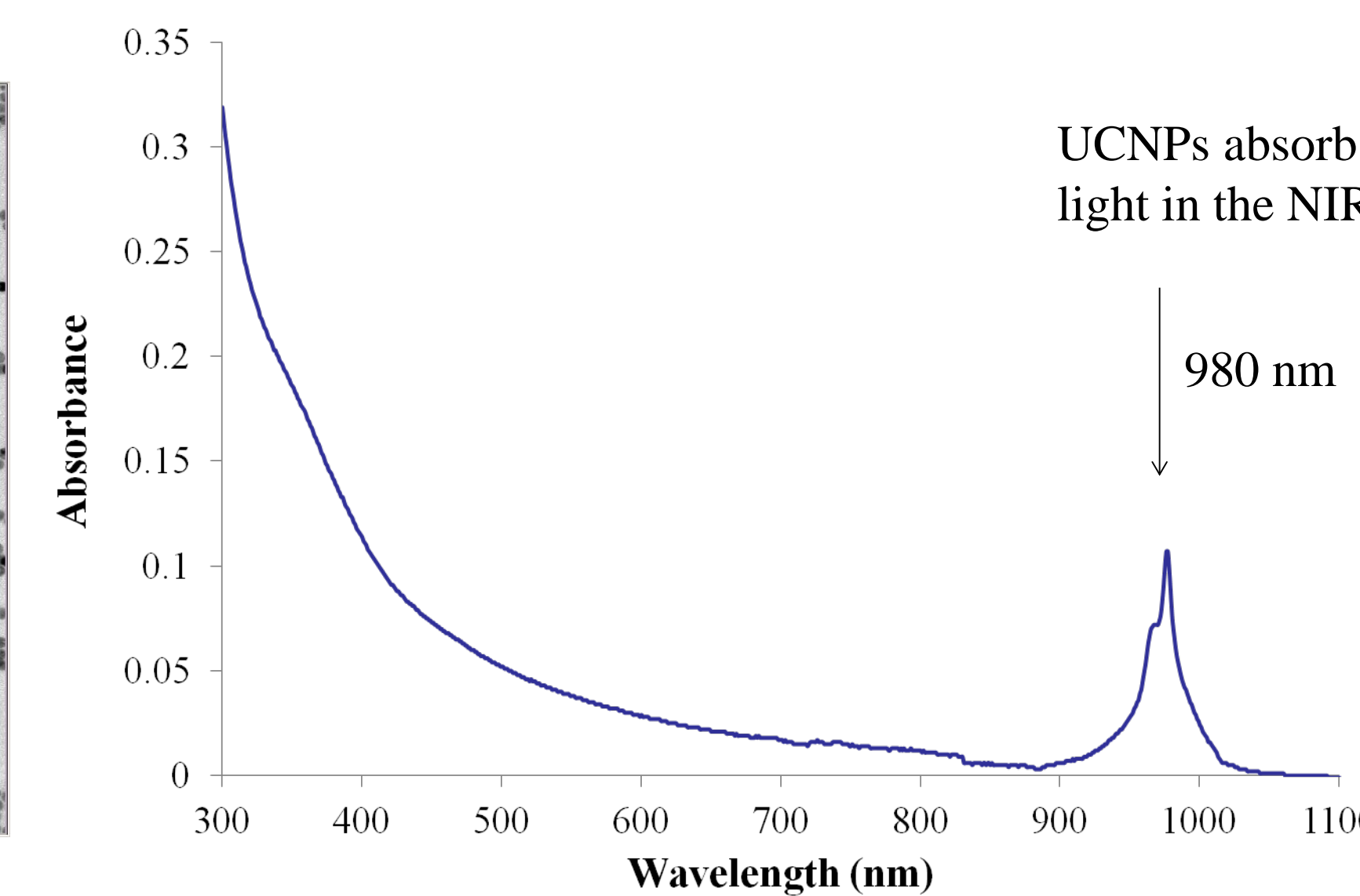
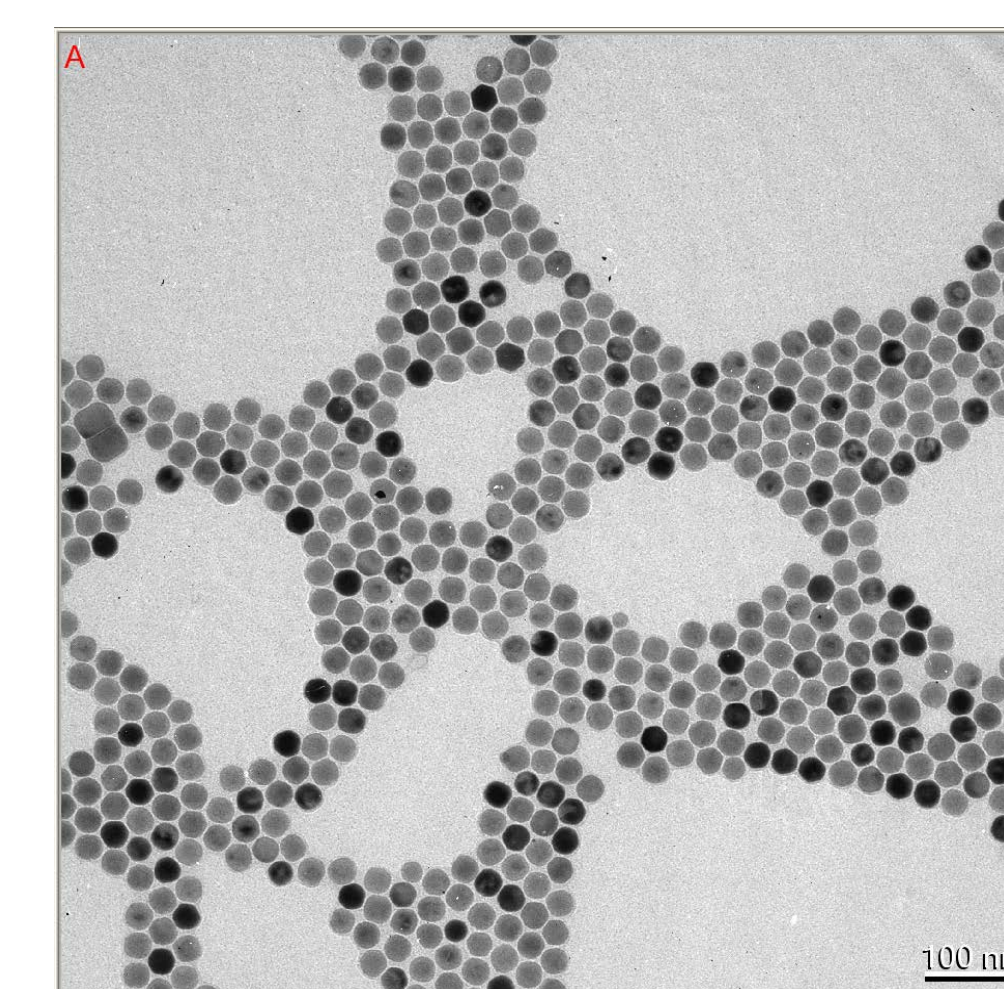
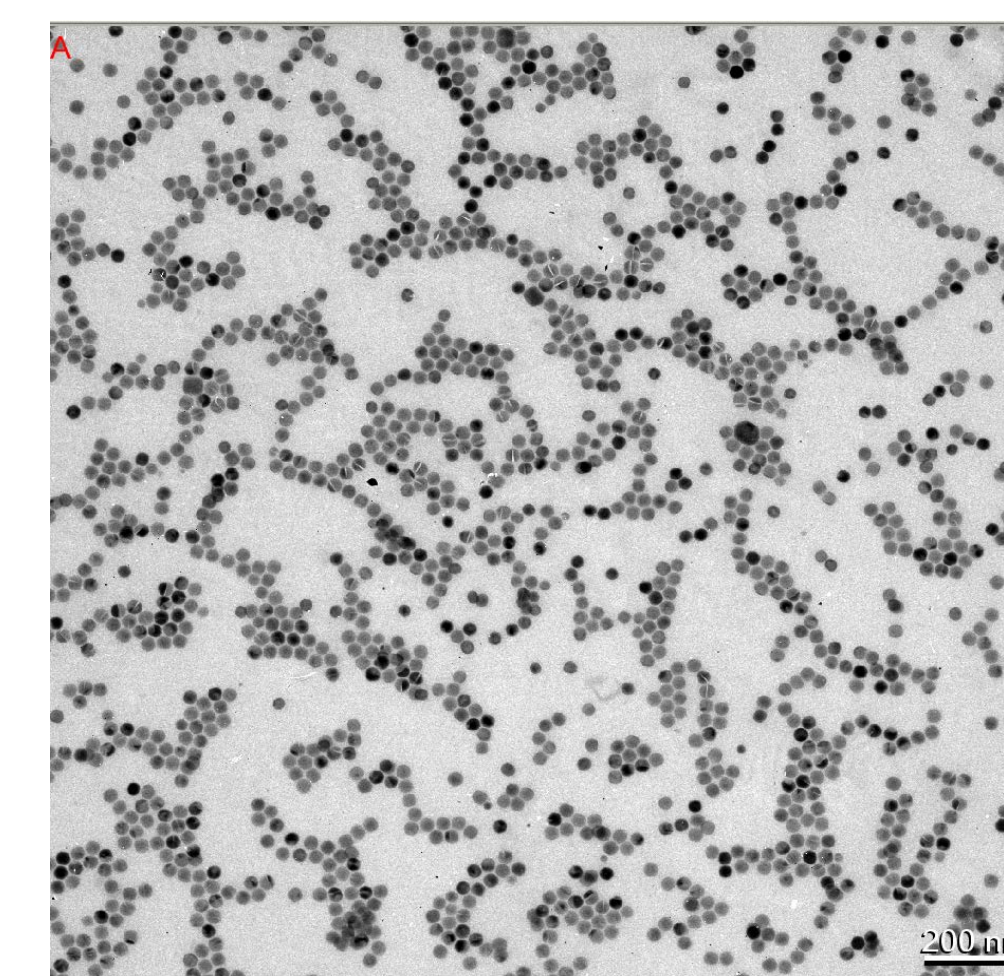


Photocages mask active functional groups and release them on command when exposed to the right wavelength of light. Using photocages, we want to make new polymer nanoparticles that deliver drugs where they are needed inside the body, but only when they are exposed to light.

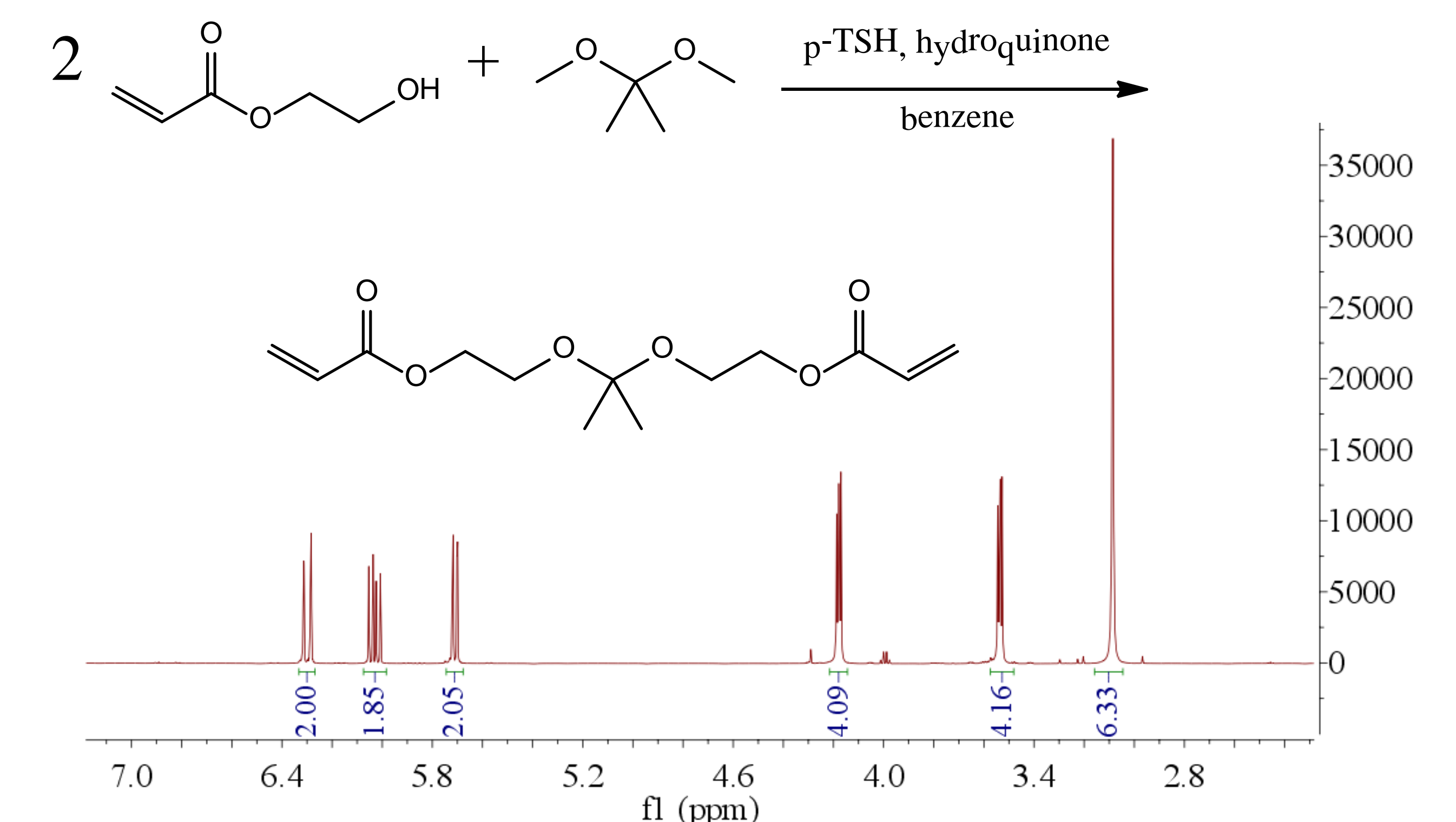
Ultraviolet light (below 400 nm) is usually required to do photochemistry. Unfortunately, UV light does not penetrate tissue, so it is very difficult to do photochemistry inside the body.

## Upconverting Nanoparticles

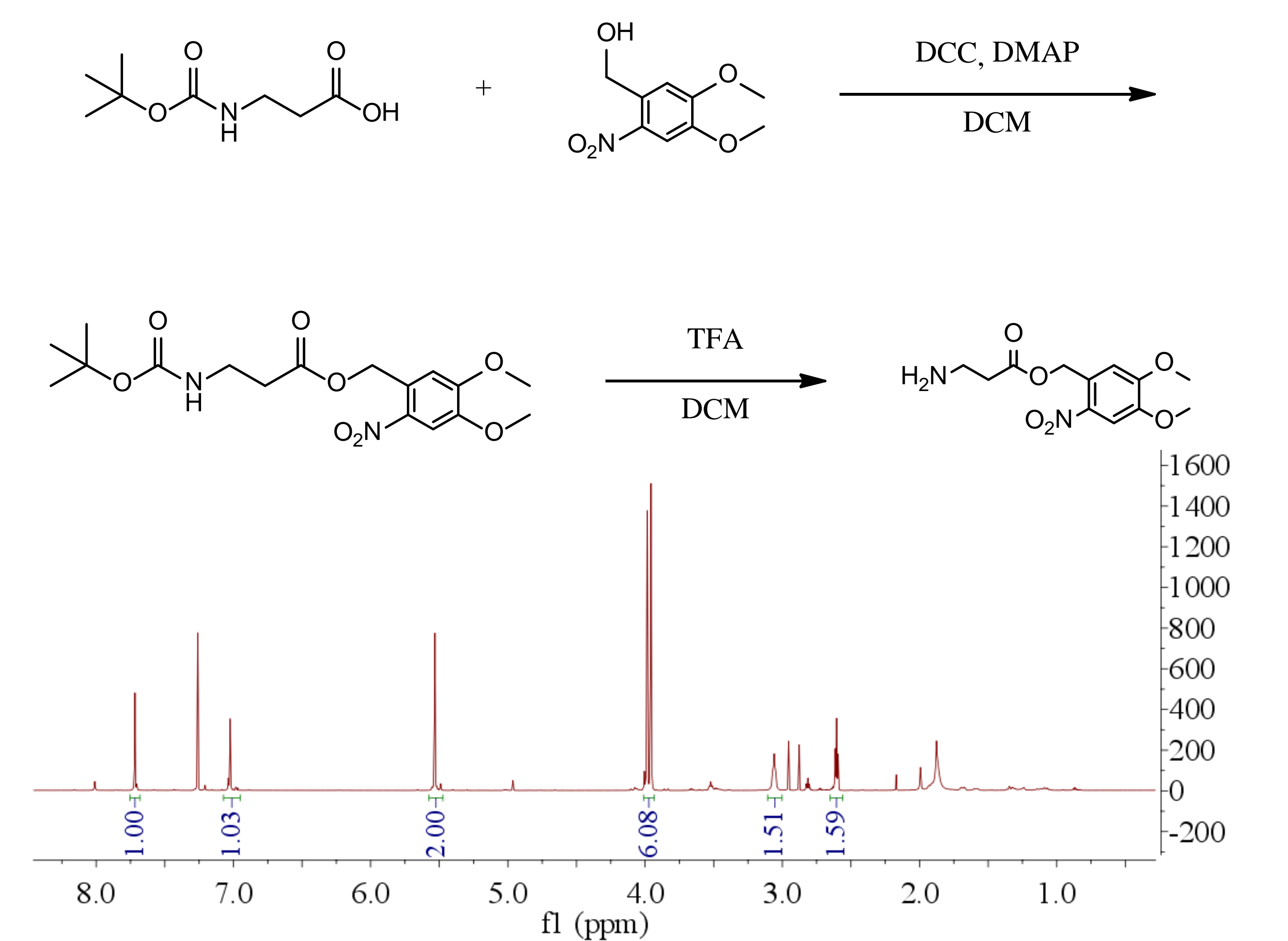
NaYF<sub>4</sub>:Yb 20%, Tm 1.5% nanocrystals have a special physical property: in a process called upconversion, they absorb multiple photons of 980 nm light and re-emit them as one photon of a higher energy.



## Acid-Sensitive Monomer Synthesis



## Light-Sensitive Monomer Synthesis



## Next Steps

- Co-polymerize light sensitive and acid sensitive monomers
- Formulate UCNPs and new polymer into payload bearing nanoparticles
- Irradiate new formulation with NIR light to evaluate release

## Acknowledgements

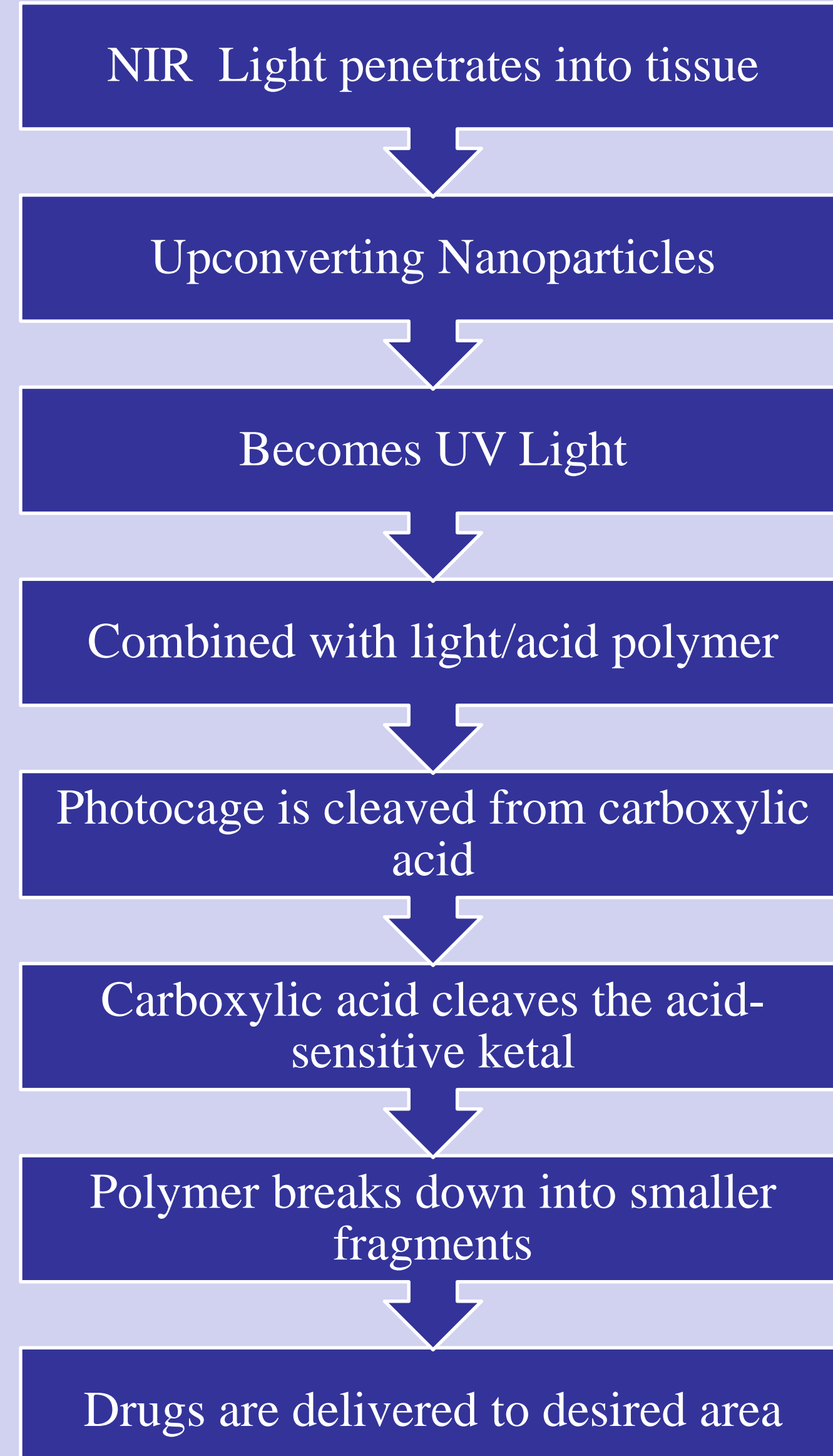
This research was supported by the NIH Director's New Innovator Award 1DP2OD006499-01 and a King Abdulaziz City for Science and Technology center grant to the Center of Excellence in Nanomedicine at UC San Diego.

## How Can We Do Photochemistry Inside the Body?

UV light does not penetrate the skin, but near infrared light does. Unfortunately, NIR is too low in energy to do photochemistry.

In order to make a nanoparticle that can deliver drugs when exposed to NIR we use upconverting nanoparticles which can absorb NIR and emit UV inside the body.

We also need to make a polymer that is sensitive enough to UV light that it falls apart and releases a drug in response to the small amount of UV released by upconverting nanoparticles when exposed to NIR.



## Designing a Light-Sensitive Polymer That Will Respond to Upconverting Nanoparticles

Polymers that degrade and release a drug payload when exposed to UV light already exist, however, UCNPs do not produce enough UV to degrade quickly.

We designed a new polymer, alternating acid-sensitive monomers and monomers with a catalytic photocaged acid in hopes of generating a system that is more responsive.

