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Organic Nanoparticles as Anticancer and Theranostic Devices

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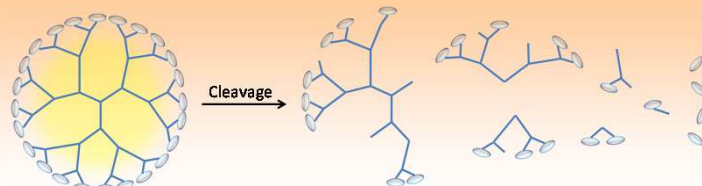
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Objectives :

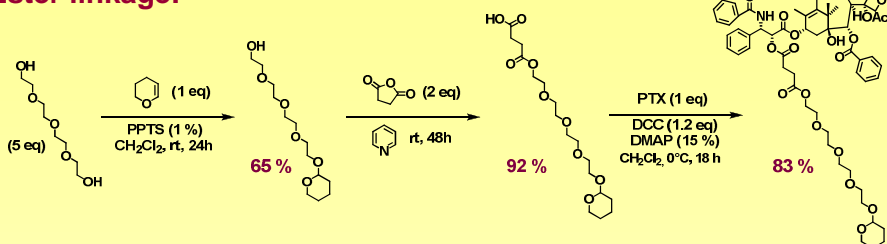
- Application of dendrimers^{1,2} in drug delivery and nanomedicine
- Development of dendritic nanocarriers to overcome the drugs' drawbacks (low solubility in water of paclitaxel)
- Dendrimers engineered to disassemble into non toxic small molecules easily eliminated from the body



Degradable anticancer device

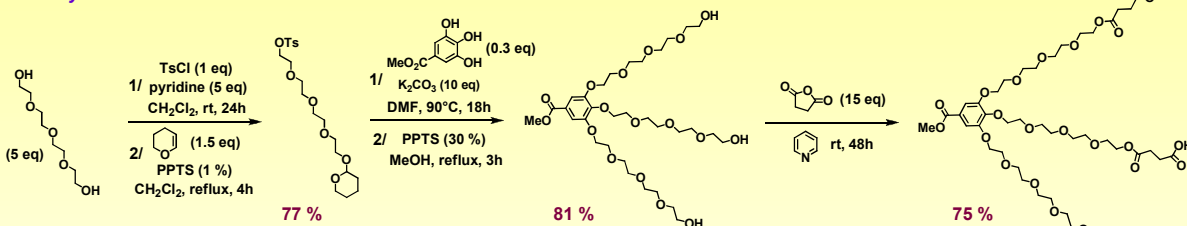
Synthesis of Dendrimers

Ester linkage:



Desymmetrization of PEG chain

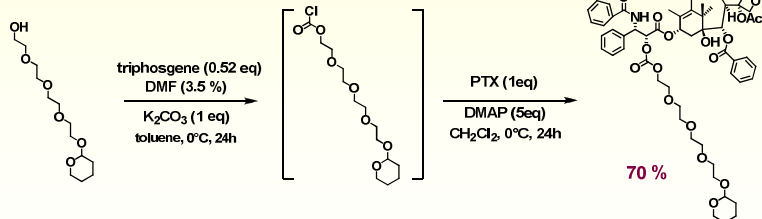
A three-branched dendron with a gallic acid core (non toxic) was synthesized



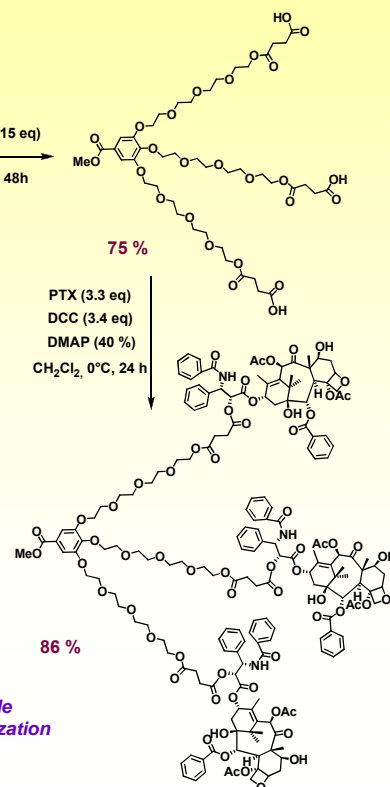
Monofunctionalization

- Branches of dendrimers are composed of:
- PEG chain (to increase hydrosolubility),
 - linker biologically cleavable (ester, carbonate...),
 - paclitaxel (one of the most efficient anticancer drug).

Carbonate linkage:

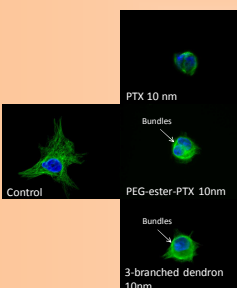


A carbonate linker can be used: comparison of the kinetics for the drug release in the biological medium



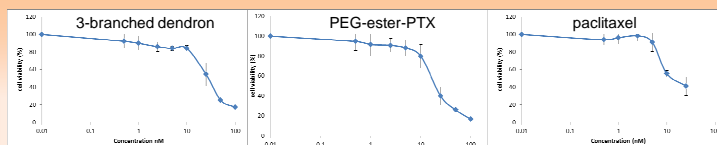
Multiple functionalization

Biological Evaluation



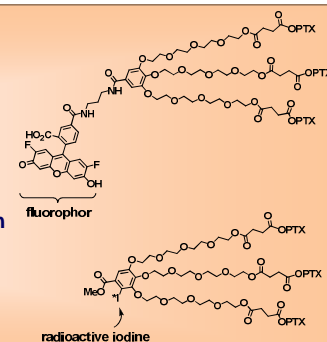
Without treatment: cells display individual microtubules (green).

With PTX or dendrimer-PTX: unattached and round cell phenotype.



Dendrimer-PTX complexes are cytotoxic on several cancer cell lines and display paclitaxel effect with prolonged drug delivery (slow drug release by ester cleavage).

Ongoing syntheses of dendron linked to a fluorophor (for *in cellulo* imaging) or bearing a radioactive iodine (for *in vivo* imaging)



¹ M. Gingras, *Designing Dendrimers* (P. Ceroni, S. Campagna, F. Puntoriero; Eds), John Wiley & Sons, chapter 13 *Degradable dendrimers*, 403-463 (2012)

² M. Gingras and M. Roy, *Dendrimer-based Drug Delivery Systems: from Theory to Practice* (Y. Cheng; Edr), John Wiley & Sons, chapter 7 *Degradable dendrimers for Drug Delivery*, 239-303 (2012)