Synthesis of Polylactide-*b*-Polylysine Copolymers

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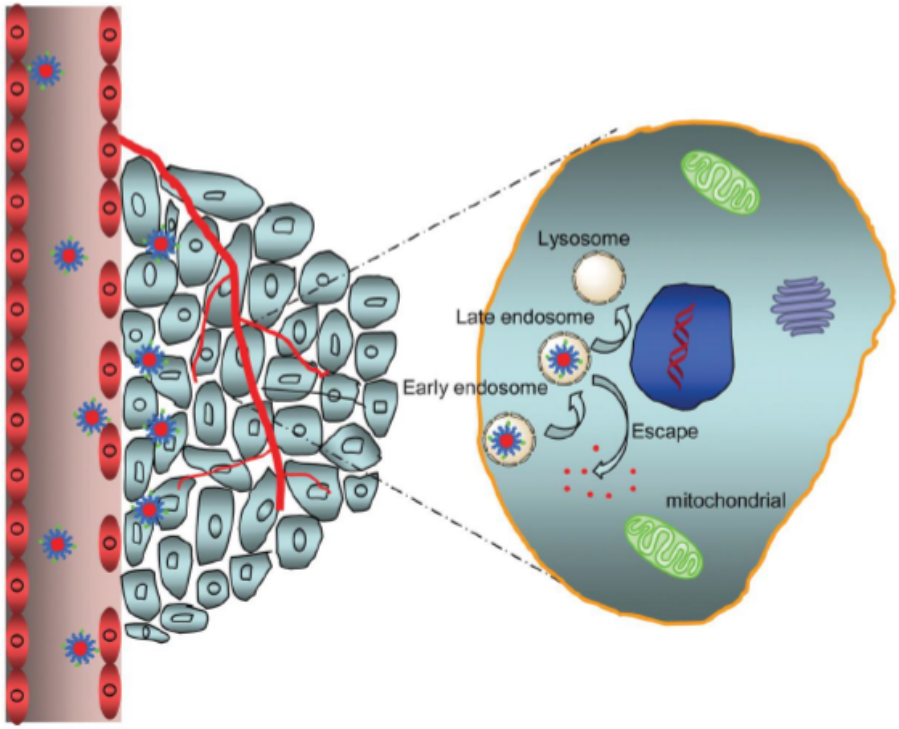
Date: May 3, 2017

Introduction



Blood Vessel
- EPR effect
- Long circulation

Tumor Tissue
- Weakly acidic (~pH 6.8)
- Abnormal temperature
- Overexpressed enzymes (MMPs, glycosidase *etc.*)

Cancer cell
- Lower pH values (pH 4.5~6.5) in endosome and lysosome
- Reductive in cytoplasm, endolysosome
- Oxidative mainly in mitochondrial
- Abundant biomolecules (proteins, ATP, *etc.*)

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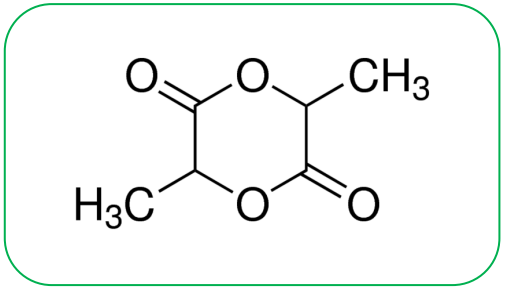
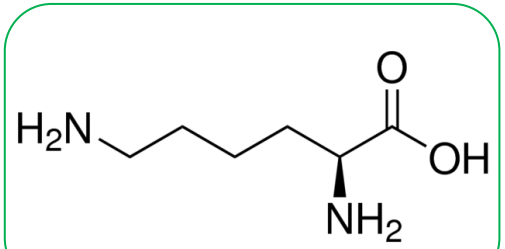
Monomers selected



Lactide



L-Lysine

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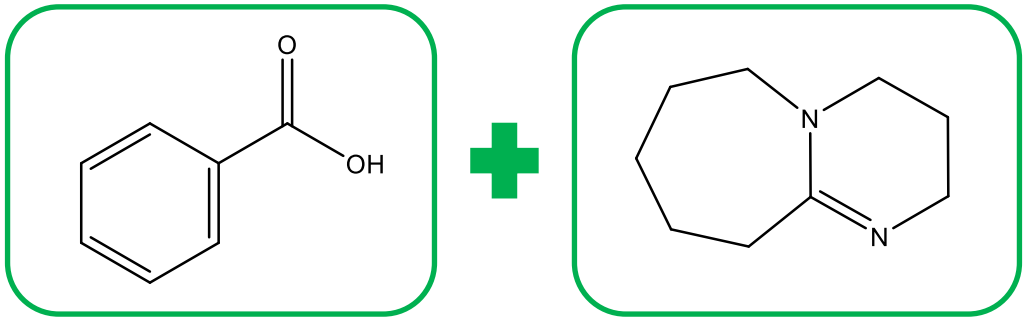
Synthesis of Polymers

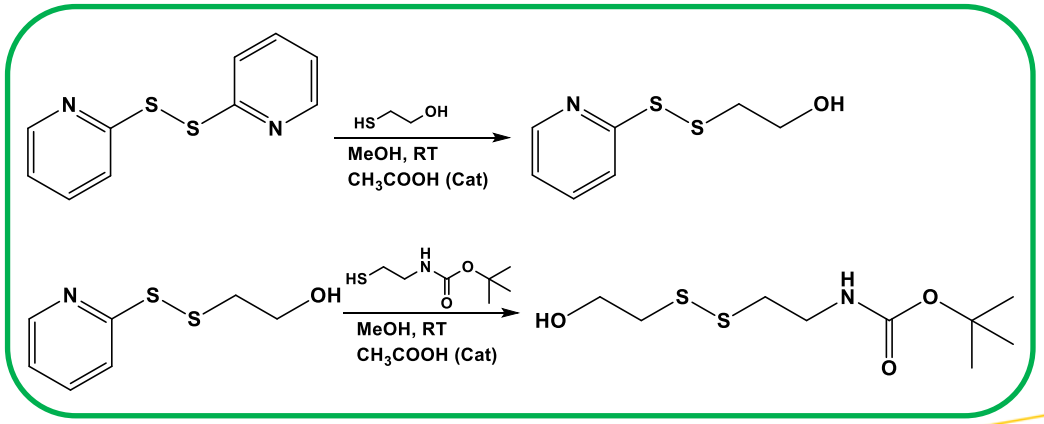
Catalyst selected:

- Yields low polydispersity index (PDI)
- Green, nontoxic
- Low cost



Initiator:

- Redox-sensitive
- Cleavable by glutathione, present in tumors



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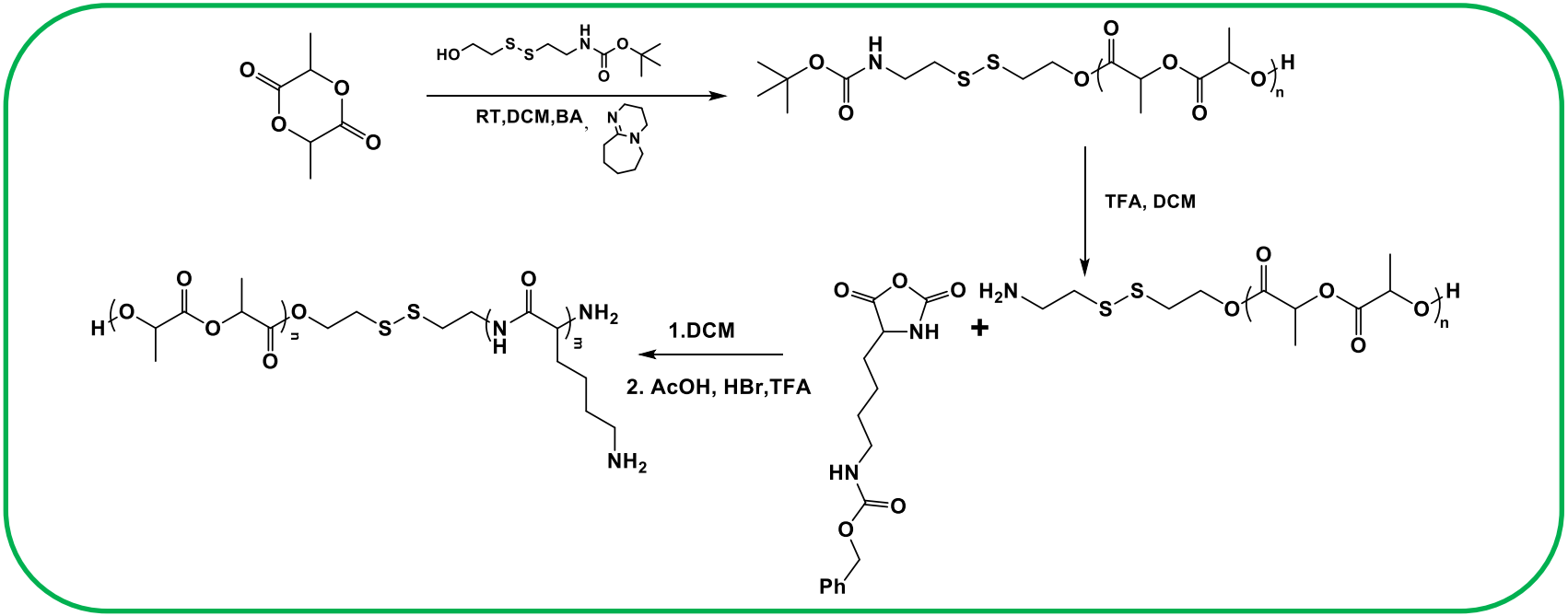
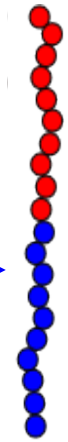
Ghosh, S.; Basu, S.; Thayumanavan, S. *Macromolecules* **2006**, *39* (17), 5595–5597.



Hydrophobic Part:
M_n of the PLA block: 2.5-5k

Hydrophilic Part:
M_n of the PLL block: 2.5-40K



Polymer	Target M_n [g/mol]	Measured M_n [g/mol]	PDI
2.5K PLA	2500	2900	1.08
5K PLA	5000	4900	1.07
PLA-b-PLL (1)	30000	28600	1.25
PLA-b-PLL (2)	76000	92000	1.28

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Whitton, G.; Gauthier, M. *J. Polym. Sci. Part A: Polym. Chem.* **2013**, *51* (24), 5270–5279.
Isono, T.; Kondo, Y.; Otsuka, I.; Nishiyama, Y.; Borsali, R.; Kakuchi, T.; Satoh, T. *Macromolecules* **2013**, *46* (21), 8509–8518.
Weikel, A. L.; Cho, S. Y.; Morozowich, N. L.; Nair, L. S.; Laurencin, C. T.; Allcock, H. R. *Polym. Chem.* **2010**, *1* (9), 1459.

Conclusions

- Novel redox-sensitive initiator successfully synthesized
- PLA and block copolymers with different M_n synthesized
- Both PLA segment and block copolymers have low PDI

- ***Future Work:***
- Investigation of degradation of the block copolymers
- Studies of copolymers with different segment lengths

Acknowledgements

Prof. Mario Gauthier

Prof. Jean Duhamel

Prof. Xiaosong Wang

Dr. Deepak Vishnu

All the labmates in Prof. Gauthier's group

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