Lecture 2: Molecular Design and Synthesis of Biomaterials I: Biodegradable Materials

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Chemistry of Biodegradable Materials:

I. *Hydrolytically degraded biomaterials*

Common hydrolytically unstable linkages:

Ester amide (STRUCTURES)

Example polymers explored for use as biomaterials: (STRUCTURES)

PLGA
Poly(D,L-lactide)
Poly(L-lactide)
Poly(ε-caprolactone)
Polyanhydrides
polypeptides
Stereochemistry of lactides: L- vs. D- vs. D/L

DRAWINGS OF STEREOSTRUCTURE, 3D animation?

Chemistry of hydrolysis:

Physical chemistry of hydrolysis:

-hydrolysis requires water to access the bonds: so structure has a strong effect on hydrolysis rates!

-Factors influencing hydrolysis rates:

1. Hydrophobicity
    a. Degradation rate of PCL < PLA < PLGA
2. steric interference
3. crystallinity

Controlling degradation behavior of solids for devices by choosing the right chemical structure:

Given the above factors in degradation rate, it is not surprising that biodegradable solids may have differing *modes* of degradation:

ETC ETC ETC

II. Enzymatically degraded biomaterials