



Absorbable Polyurethanes from Functionalized Phenylalanine

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INTRODUCTION

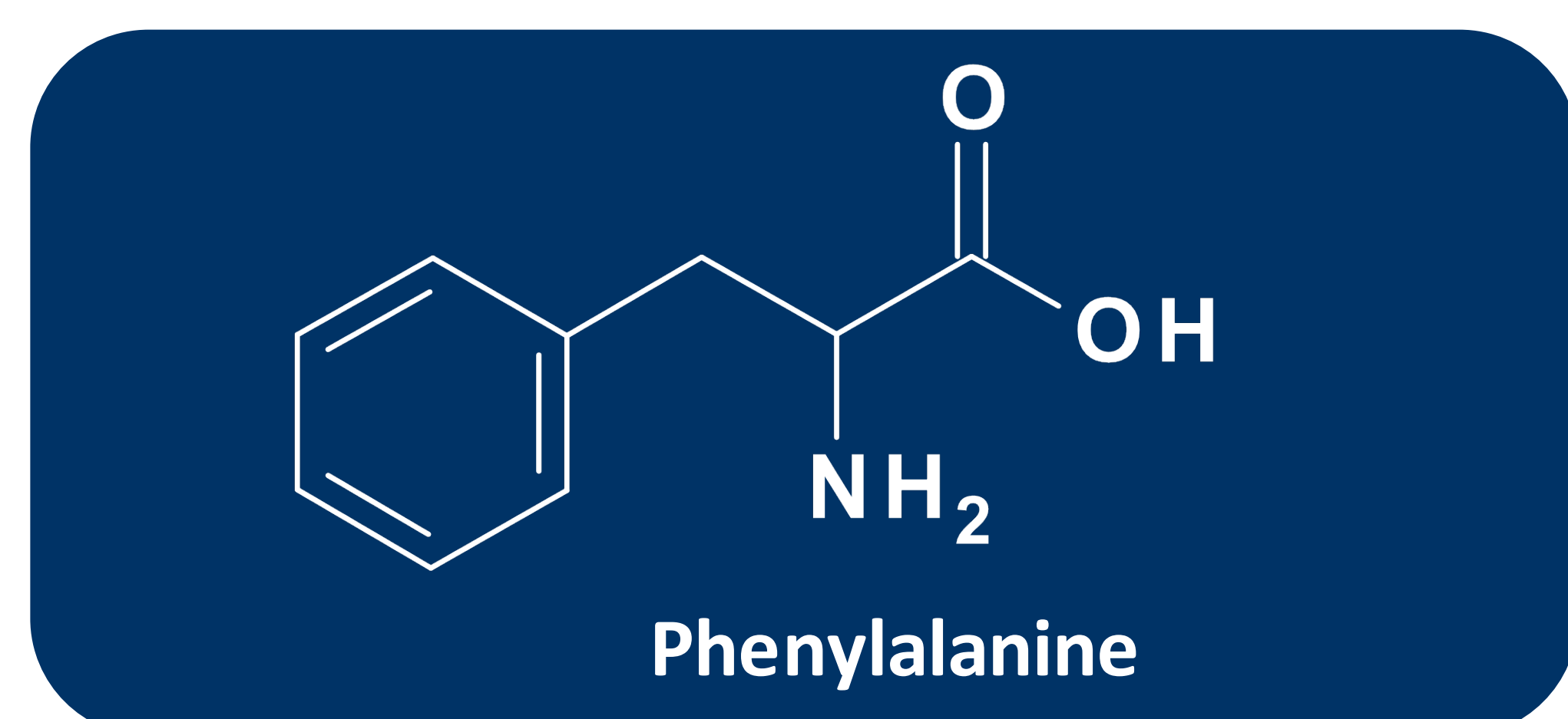
❖ Phenylalanine is an essential amino acid used by cells to make proteins.

❖ Phenylalanine is an important precursor of tyrosine, neurotransmitters epinephrine, nor epinephrine and dopamine and hence plays an important role in transmission of nerve impulses and serve as an antidepressant.

❖ Phenylalanine is also the precursor amino acid for Skin pigment Melanin.

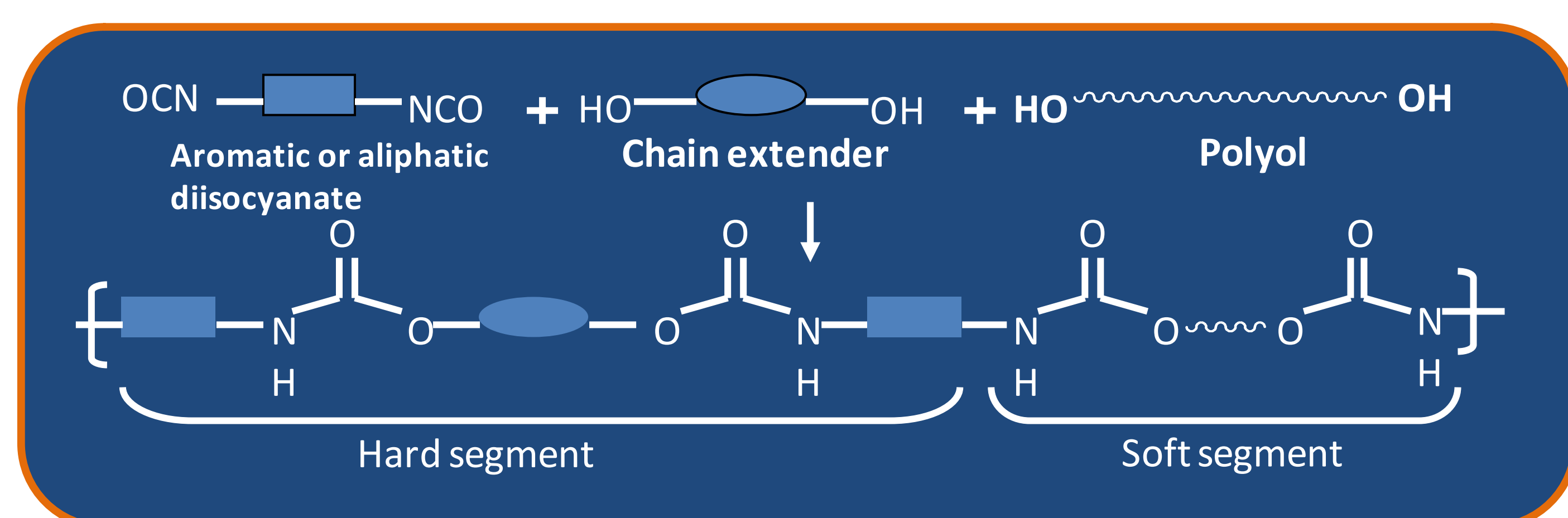
❖ Phenylalanine is also used in the manufacture of food and drink products. It is used as a nutritional supplement for its analgesic and anti-depressant effects.

Hence, it is highly beneficial to have absorbable polyurethanes that incorporate Phenylalanine in the polymer main chain for various biomedical applications



Polyurethanes:

Importance and Biomedical Applications



Commercial Biomedical grade polyurethanes and their various applications

Trade Name	Manufacturer	Isocyanate	Chain extender	Polyol
Duraflex	VASCOR, Inc.	HMDI	1,4-butanediol	Non-polyether
Tecoflex	Noveon	HMDI	1,4-butanediol	Polyether
Tecothane	Noveon	MDI	1,4-butanediol	PTMEG
Biomer	Ethicon	MDI	Ethylene diamine	PTMEG
Elasthane	Polymer Tech Group	MDI	1,4-Butanediol	PTMEG
Bionate	Polymer Tech Group	MDI	1,4-Butane diol	Polycarbonate
Pellethane	Dow Chemical	MDI	1,4-butanediol	PTMEG

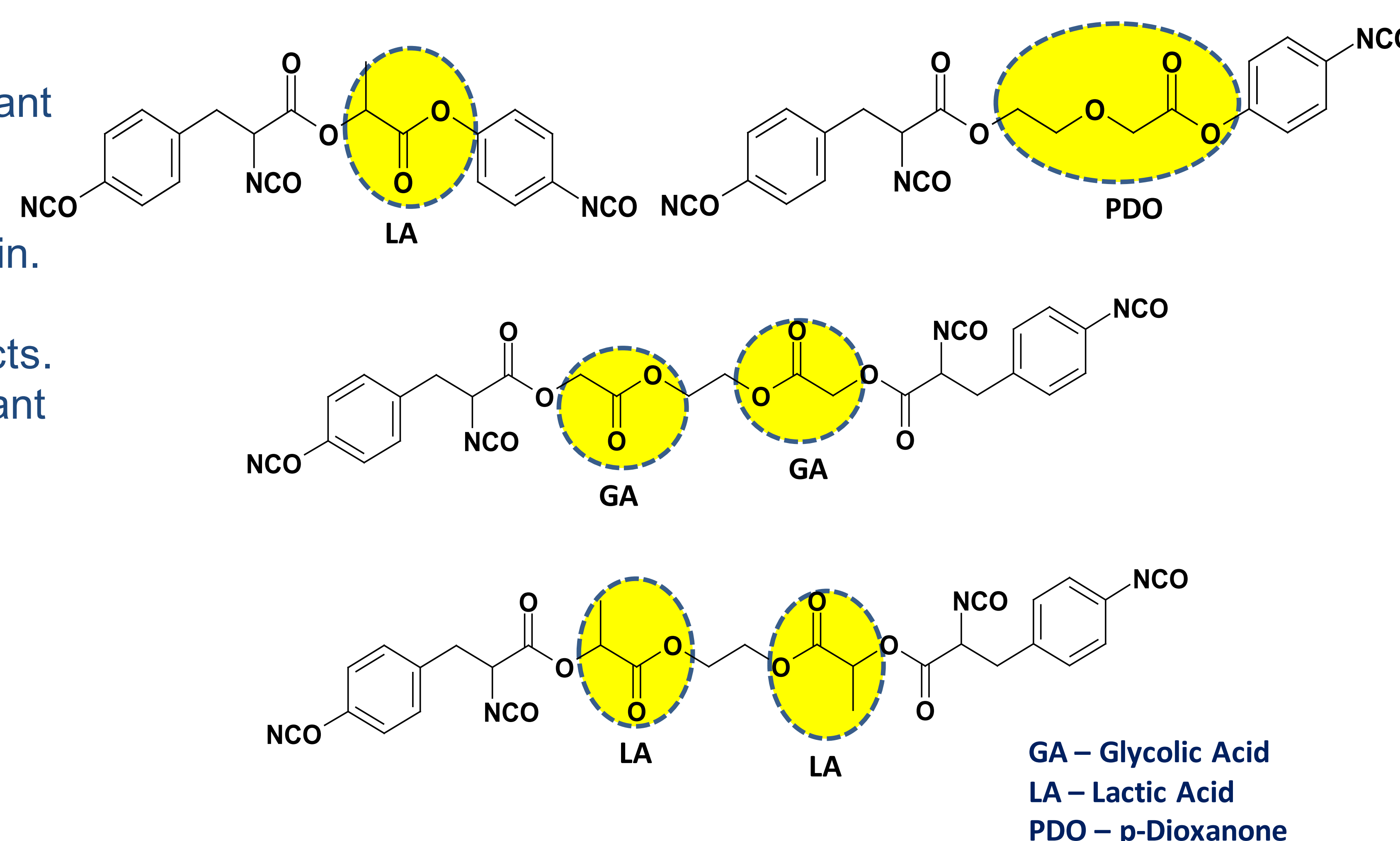
Applications

Cardiac pacemakers
Infusion pumps
Dialysis catheters
Blood contact materials
Bandages
Cardiovascular catheters



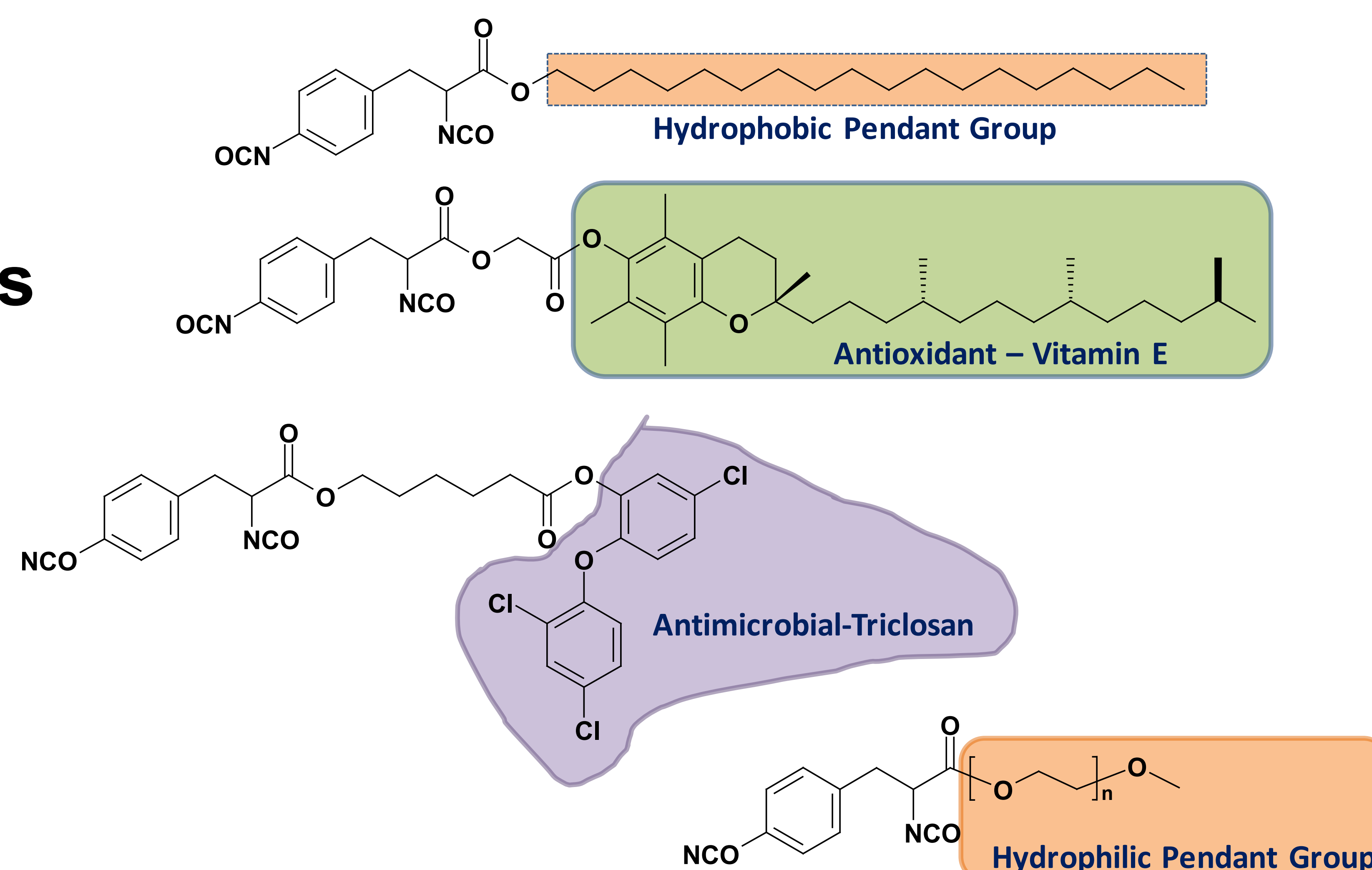
Non-Hydrolysable

Selected Examples of Absorbable Phenylalanine based isocyanates



GA – Glycolic Acid
LA – Lactic Acid
PDO – p-Dioxanone

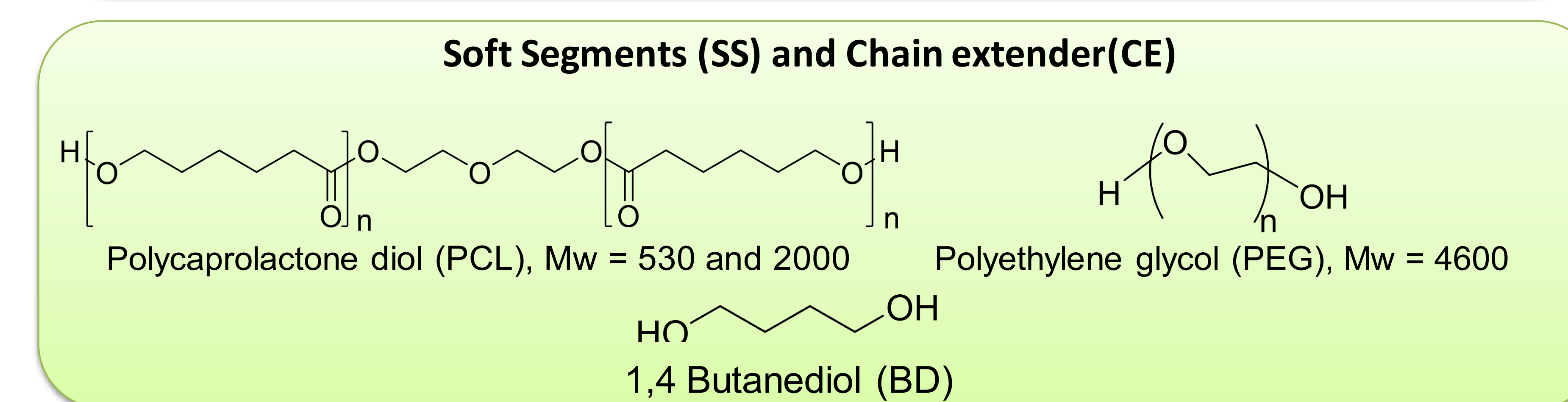
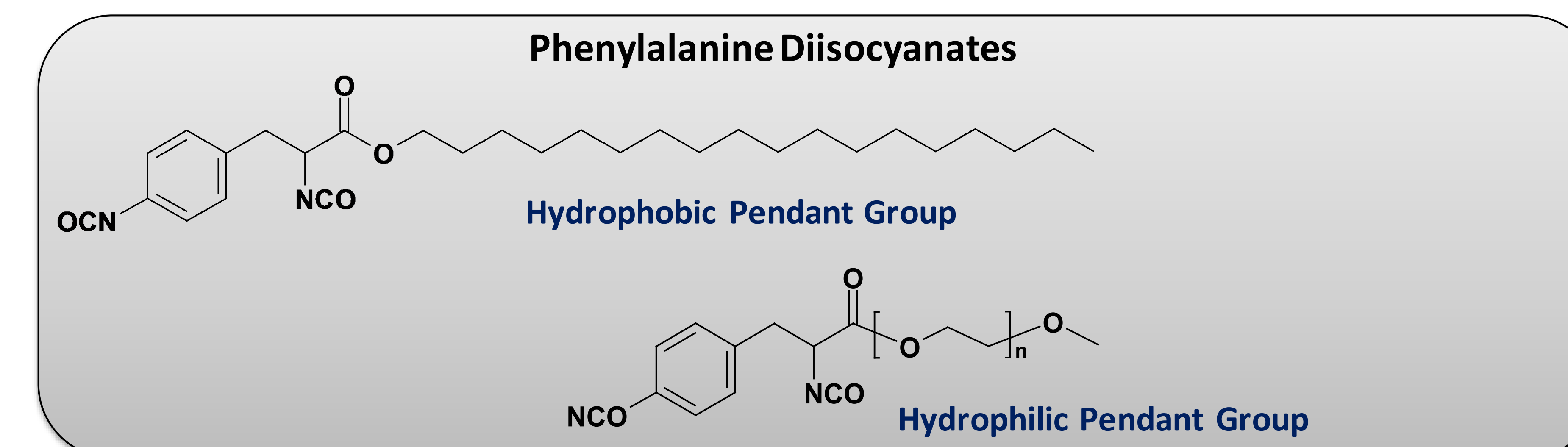
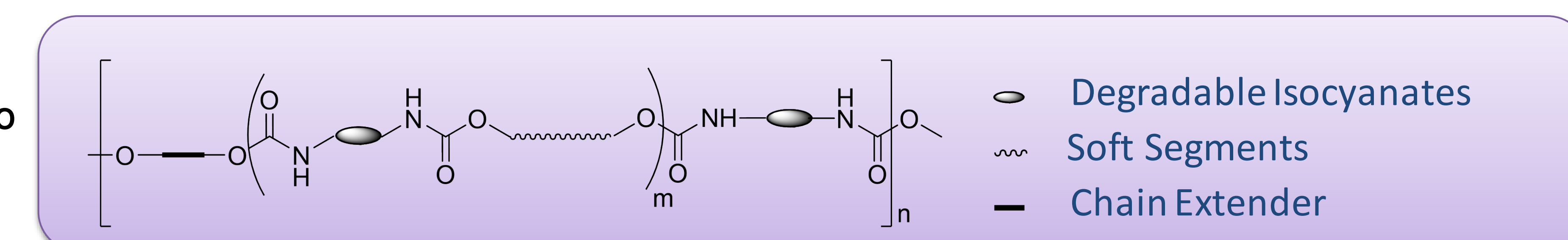
Functionalized Absorbable Phenylalanine based isocyanates



Key Features

- ❖ Ability to prepare absorbable polyurethanes with pendant hydrophobic and hydrophilic groups and chains which enables us to modify the surface properties of the finished articles prepared from these polyurethanes
- ❖ Ability to incorporate anti-microbial compounds such as Triclosan as the pendant group in the polyurethane backbone which enables us to impart anti-microbial properties to the finished articles prepared from these polyurethanes.
- ❖ Ability to control the hydrolytic degradation profile of the polyurethane. For example, polyurethane prepared from glycolic acid functionalized phenylalanine based isocyanate will hydrolyze much faster than lactic acid or caprolactone functionalized phenylalanine based isocyanates.

Absorbable Polyurethanes: Representative Examples



Advantages

- Controlled degradation profiles
- Tunable physical and mechanical properties
- Derived from safe and biocompatible molecules
- Degradation products safe and biocompatible

SUMMARY

- For the first time, our company has developed *Phenylalanine based isocyanates* with controlled hydrolytic degradation profiles.
- These isocyanates are expected to be safe as they are derived from safe and biocompatible monomers such as glycolide, lactide, and caprolactone.
- Polyurethanes derived from these Phenylalanine based isocyanates with chain extender diols and amines will not only be absorbable but will have hydrolytically unstable urethane and urea hard segment.
- These polyurethanes are expected to have toughness and mechanical properties of that of commercially available medical grade polyurethanes and absorbability of that of commercial bioerodible polymers.
- These polyurethanes are expected to degrade into safe and biocompatible degradation products and have controlled degradation profiles.