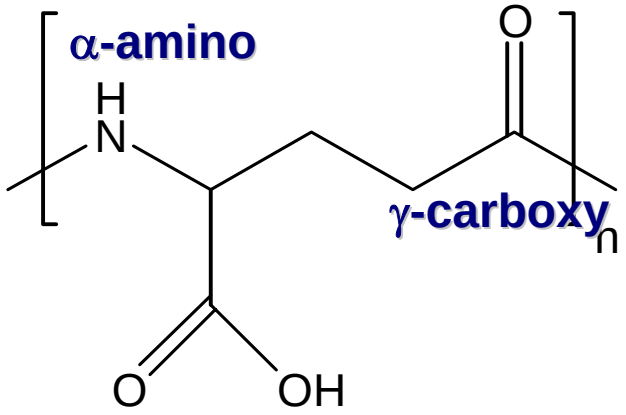
Microbial Polyamides

Bacterial poly-γ-glutamic acid

Produced by *Bacillus* (*anthracis*, *subtilis*)

- **encapsulation of cells for survival**
- **storage of nutrients**
- **known since 1921**

Fermentative product from starch
Yields up to 50 g/L,
M_n > up to 2 Million
Chain Stereochemistry is variable
Edible



Gross, R.A. In, Biopolymers from Renewable Resources, Ed. D.L. Kaplan, Springer-Verlag, Heidelberg, Germany. 195-217 (1998).

Possible applications:

- **Thickener in cosmetic formulations**
- **Vehicle for oral delivery of drugs**
- **Edible films for food preservation**

Bacterial poly-γ-glutamic acid: literature references

- Anne-Marie Cromwick, Gregory A. Birrer and Richard A. Gross, "Effects of pH and Aeration on γ-Poly(glutamic acid) Formation by Bacillus licheniformis in Controlled Batch Fermenter Cultures", *Biotechnol. Bioeng*., Vol. 50, 222-227 (1996).
- Anne-Marie Cromwick and Richard A. Gross, "Effects of Manganese (II) on Bacillus licheniformis ATCC 9945A Physiology and γ-Poly(glutamic acid) Formation, *Int. J. Biol. Macromol.*, Vol 17, No. 5, 259-267 (1995).
- Anne-Marie Cromwick and Richard A. Gross, "Investigation by NMR of Metabolic Routes to Bacterial γ-Poly(Glutamic Acid) Using 13C Labeled Citrate and Glutamate as Media Carbon sources, *Can. J. Microbiol.,* Vol 41*:* 902-909 (1995).
- Gregory A. Birrer, Anne-Marie Cromwick and Richard A. Gross, "γ-Poly(glutamic acid) Formation by Bacillus licheniformis ATCC 9945A: Physiology and Biochemical Studies, *Int. J. Biol. Macromol*., 1994, 16(5) 265-275.