

TN01000044/4 – V2

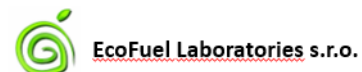
PREZENTACE VÝSLEDKŮ NA KONFERENCI FORMOU ODBORNÉHO SDĚLENÍ (VÝSTUP TYPU O)

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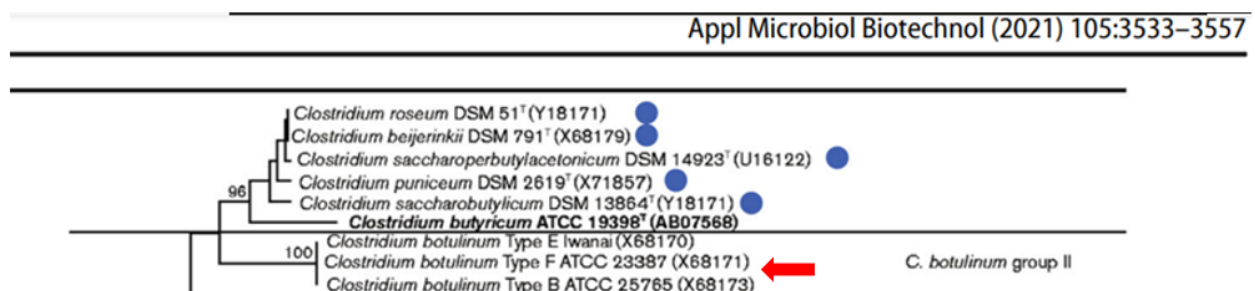
Projekt BIOCIRKL (TN02000044) je řešen s finanční podporou TA ČR.

Characterization of probiotic bacterium *Clostridium butyricum*

Basařová D., Kaštánek P., **Patáková P.**

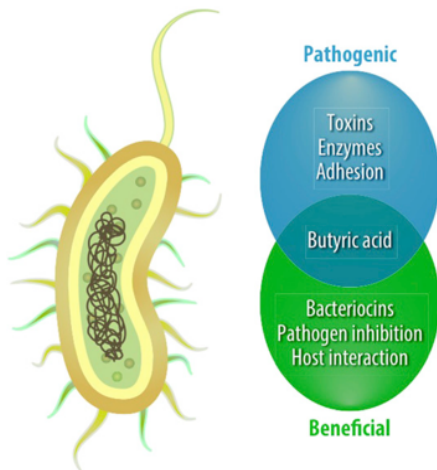


Taxonomic classification of Clostridium butyricum



Type strain – *C. butyricum* ATCC 19398 – 3.9 Mb chromosome, 770 kb megaplasmid, 8kb plasmid, 6 kb plasmid
Non-toxinogenic, butyricin producing

C. butyricum as a species with Janus face



Strains with different abilities

Pathogenic

Botulotoxin type E producing

Causing necrotizing enterocolitis

Probiotic

NO toxins formation

Ability to utilize polysaccharides

More sensitive to oxygen

Butyricin formation

Cassir et al., 2016 -
<https://www.sciencedirect.com/science/article/pii/S1198743X15009143>

Probiotics properties of *Clostridium butyricum* MIYAIRI 588

- Probiotics for large intestine
- Reduction of negative effects of antibiotics
(especially in *C. difficile* infection)
- Stabilization of gut microbiota
- Anti-cancer and anti-inflammatory effects

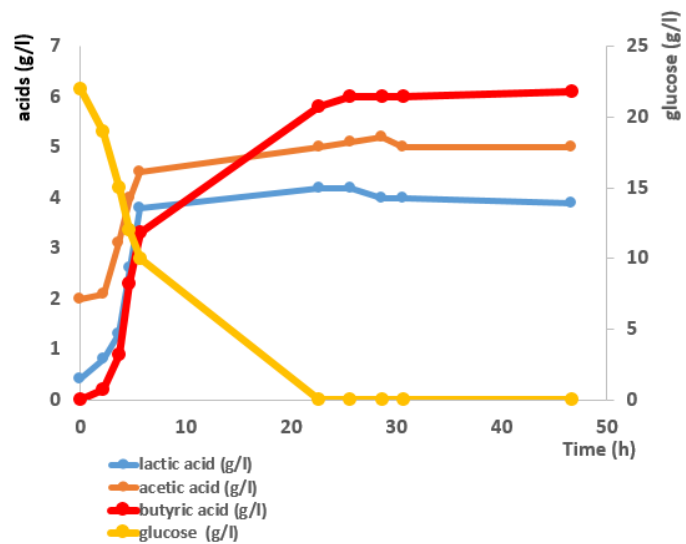
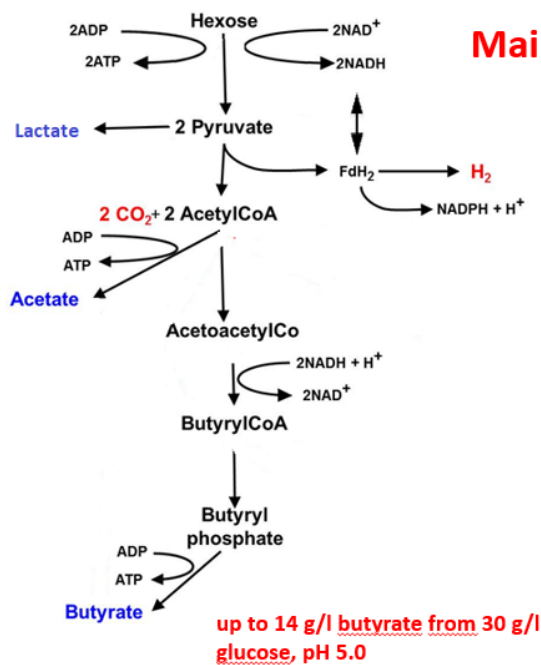
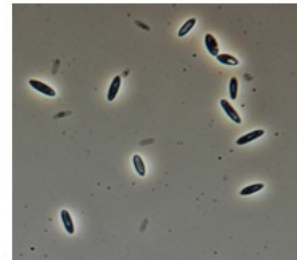
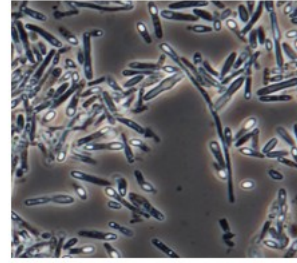
The strain approved by EFSA as novel food ingredient in
food supplements and feed supplements for piglets or
chicken



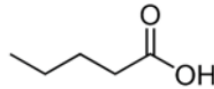
Usual route of administration - **spores** (advantageous in terms of passage through the GI tract), germination in the colon

Main features of the strain

- 0.5-1.7 x 2.4-7.6 μm rods
- Independent cells, pairs, short chains
- Young cells motile
- Gram positive
- Endospore formation
- Strictly anaerobic
- Ideal growth conditions: pH 6.5-7.0; 30-37°C
- Occurrence in nature : soil, water sediments, faeces



Butyric acid in a colon



Direct actions

- Energy for the colonocytes
- Inflammation and oxidative status
- Synthesis of mucus
- Production of cytokines
- Control of pathogens
- Intestinal motility
- Absorption of nutrients
- Regulation of apoptosis
- Proliferation, differentiation and cell maturation
- Control of the intestinal barrier effect

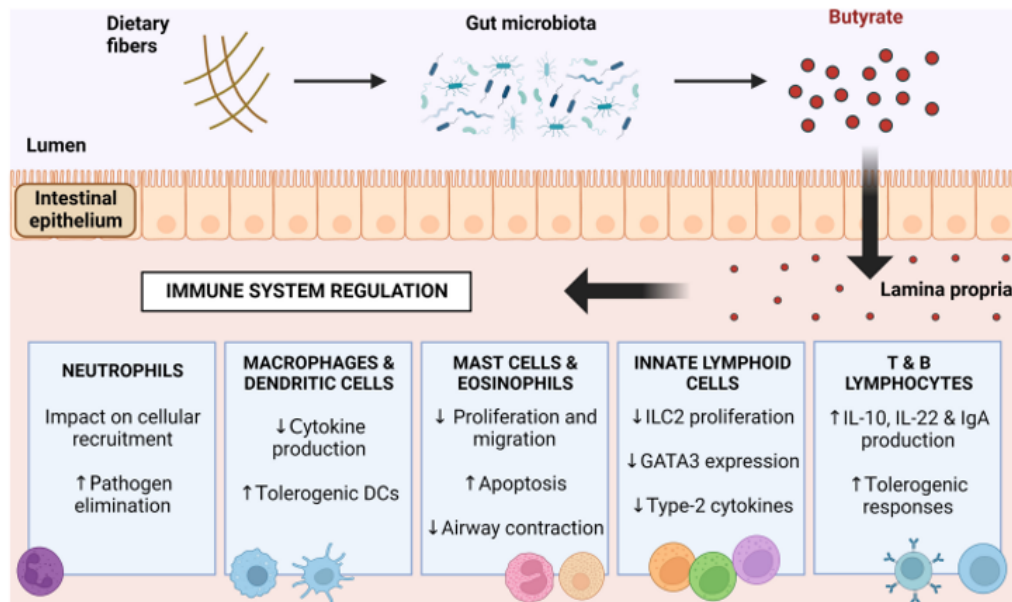


Alleviation of pathologies

- Constipation
- Diarrhea
- Traveler's diarrhea
- Diarrhea associated with antibiotics
- Irritable bowel syndrome (IBS)
- Intestinal bowel disease
- Ulcerative colitis (UC)
- Crohn's disease (CD)
- Colon cancer

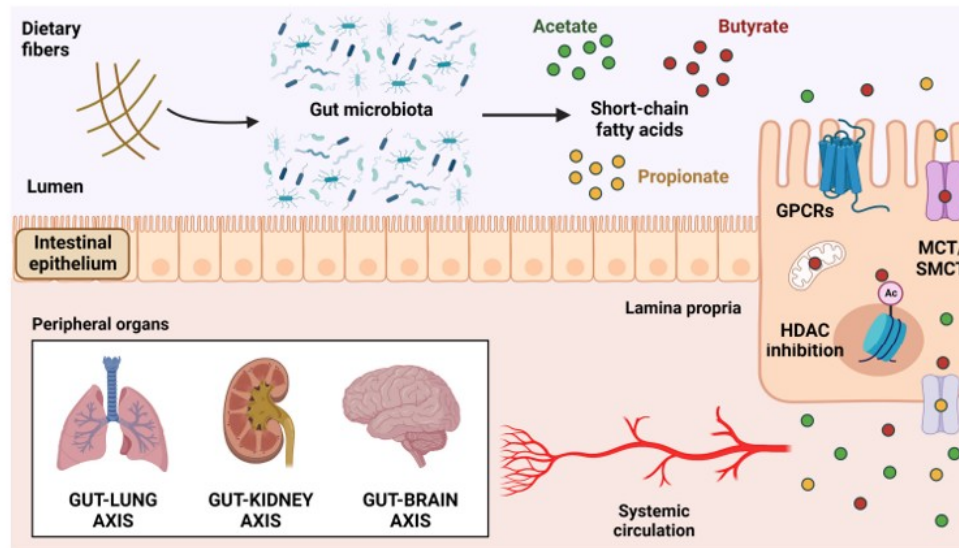
Miguel et al., 2018 - <https://www.sciaeon.org/articles/Role-of-Butyric-Acid-in-Food-and-Intestinal-Health.pdf>

Immunomodulation driven by butyrate



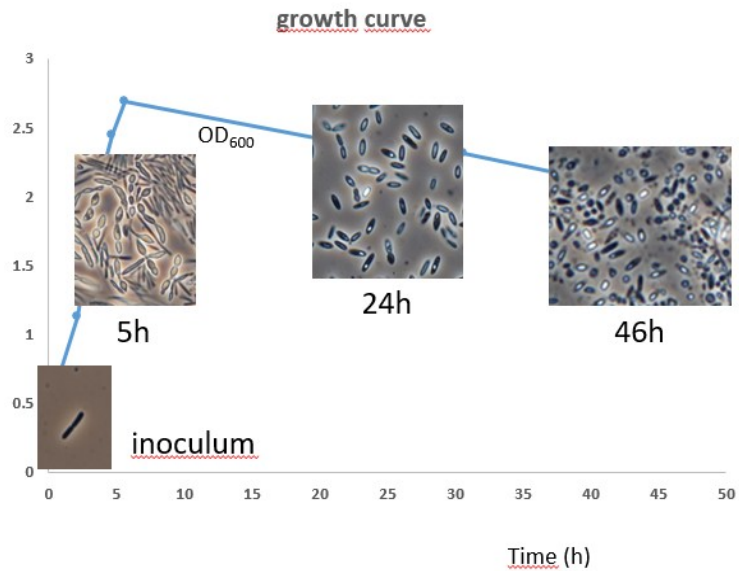
Correa et al., 2022 - <https://www.frontiersin.org/articles/10.3389/fnut.2022.1011732/full>

Mechanisms of action of short-chain fatty acids on different levels in a colon



Correa et al., 2022 - <https://www.frontiersin.org/articles/10.3389/fnut.2022.1011732/full>

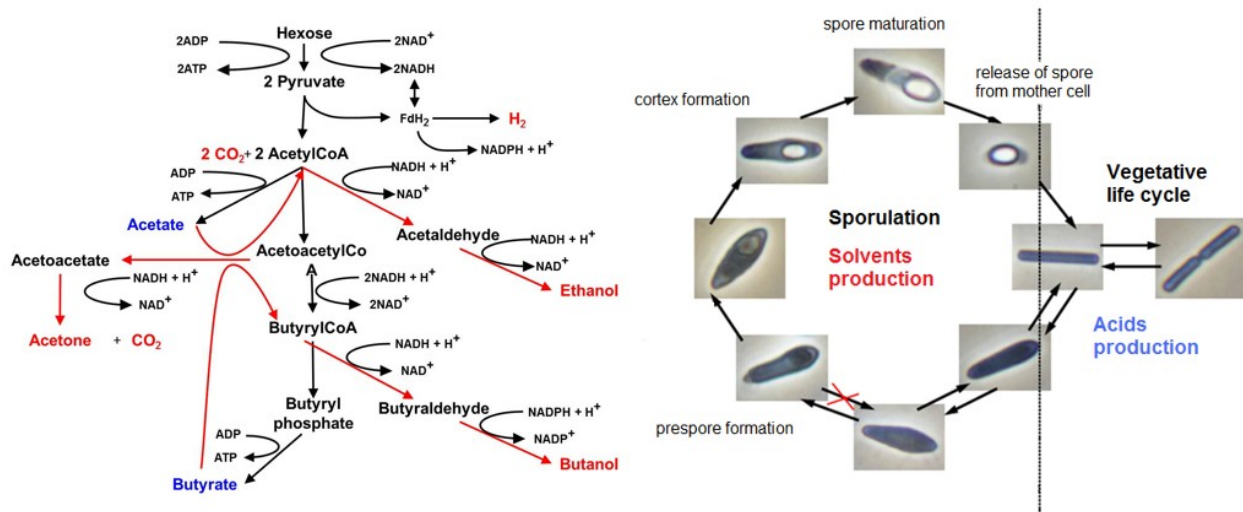
Sporulation



Conditions for sporulation:

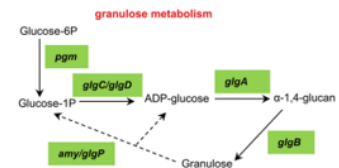
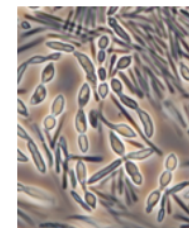
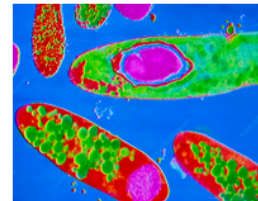
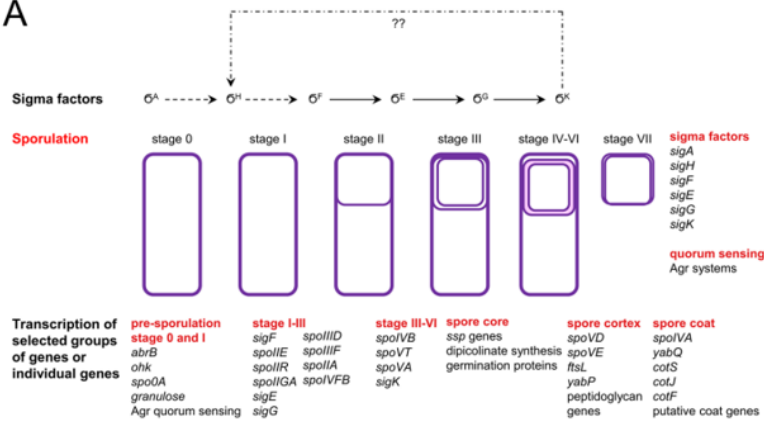
- **pH regulation**
- **Cell density** (quorum sensing signal – Agr type QS ?)
- Sufficient glucose concentration?

Comparison with *Clostridium beijerinckii*

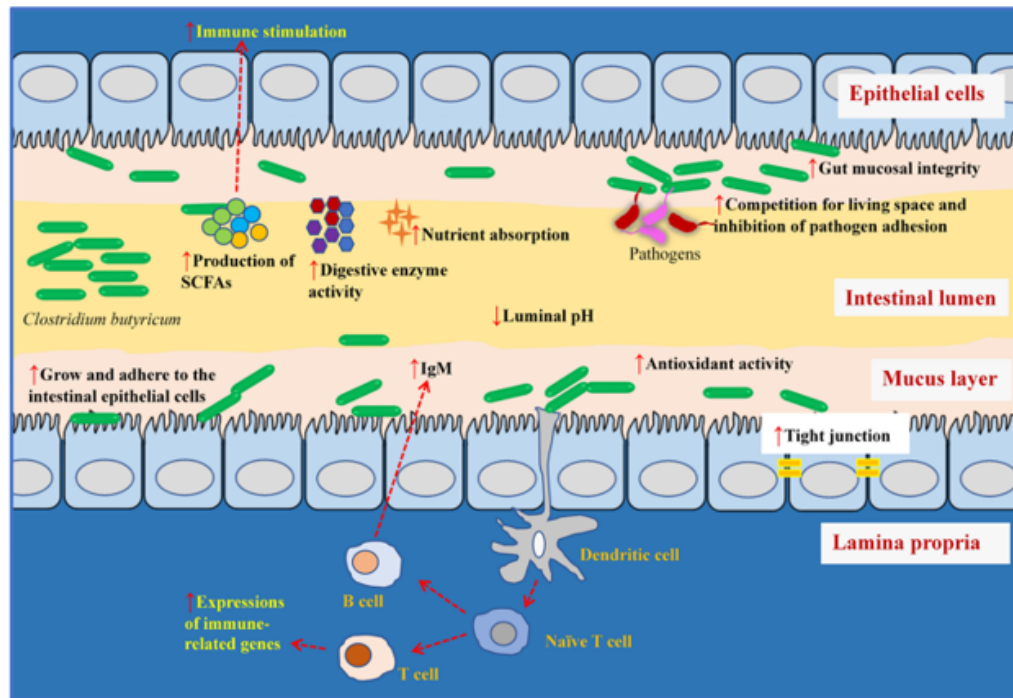


Comparison with *Clostridium beijerinckii*- II

A

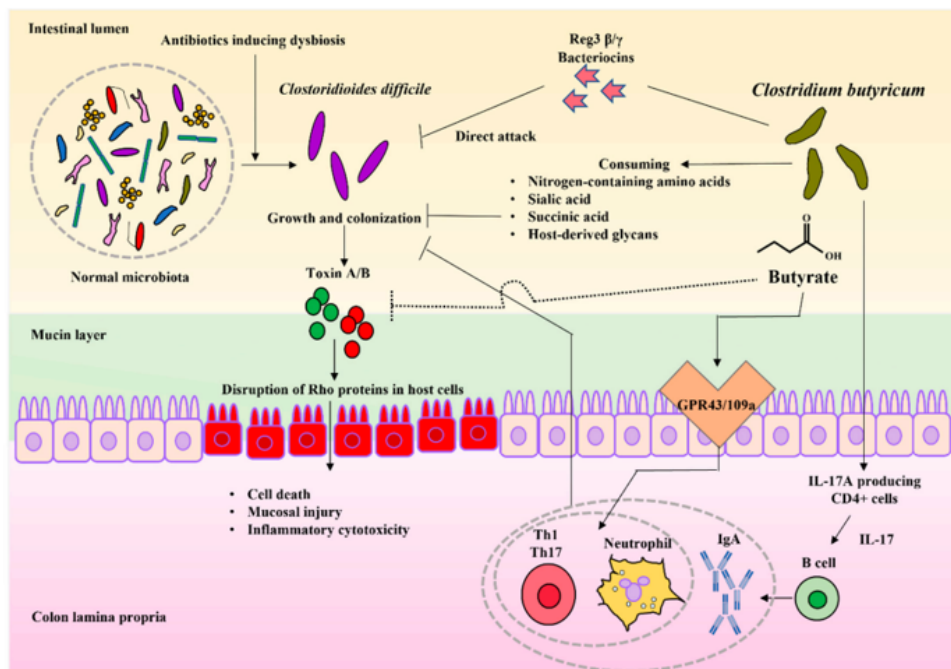


C. butyricum whole cells effects in a colon



Tran et al., 2020- <https://onlinelibrary.wiley.com/doi/full/10.1111/raq.12459>

Protection against *Clostridioides difficile* infection



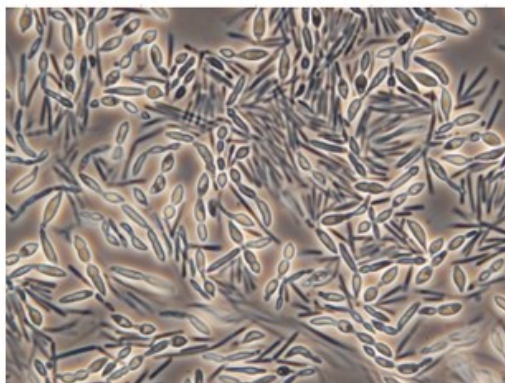
Ariosh et al., 2022 - <https://www.mdpi.com/2227-9059/10/2/483>

What to study in future?

- Stimulation of spore germination by bile acids, L-alanine (L-lactate), CO_2 , H_2
 - Effect of different pH on spectrum of metabolites and sporulation
 - Transformation of bile acids
 - Production of butyricin
 - Signals for sporulation
-
- Utilization of different substrates (development of cheap culture medium)
 - Antimicrobial and other beneficial effects

Thank you very much for your attention

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Many thanks for the financial support!



BIOCIRKL
Národní centrum kompetence
„Biorafinace a cirkulární ekonomika pro udržitelnost“

