# PROBIOTICS IN HUMAN NUTRITION

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# What are probiotics?

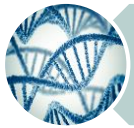
"**Live** microorganisms which when administered in **adequate amount** confer a **health benefits on the host**"


Źródła: [2, 11]

# What they should be like?


Generally Recognized As Safe (GRAS)/ Qualified Presumption of Safety (QPS)

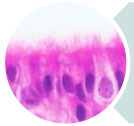
Isolated from safe environment



Genetically stable


Nonpathogenic


Resistant o bile acids and low pH



Adhesive to epithelial cells

Pathogens antagonists

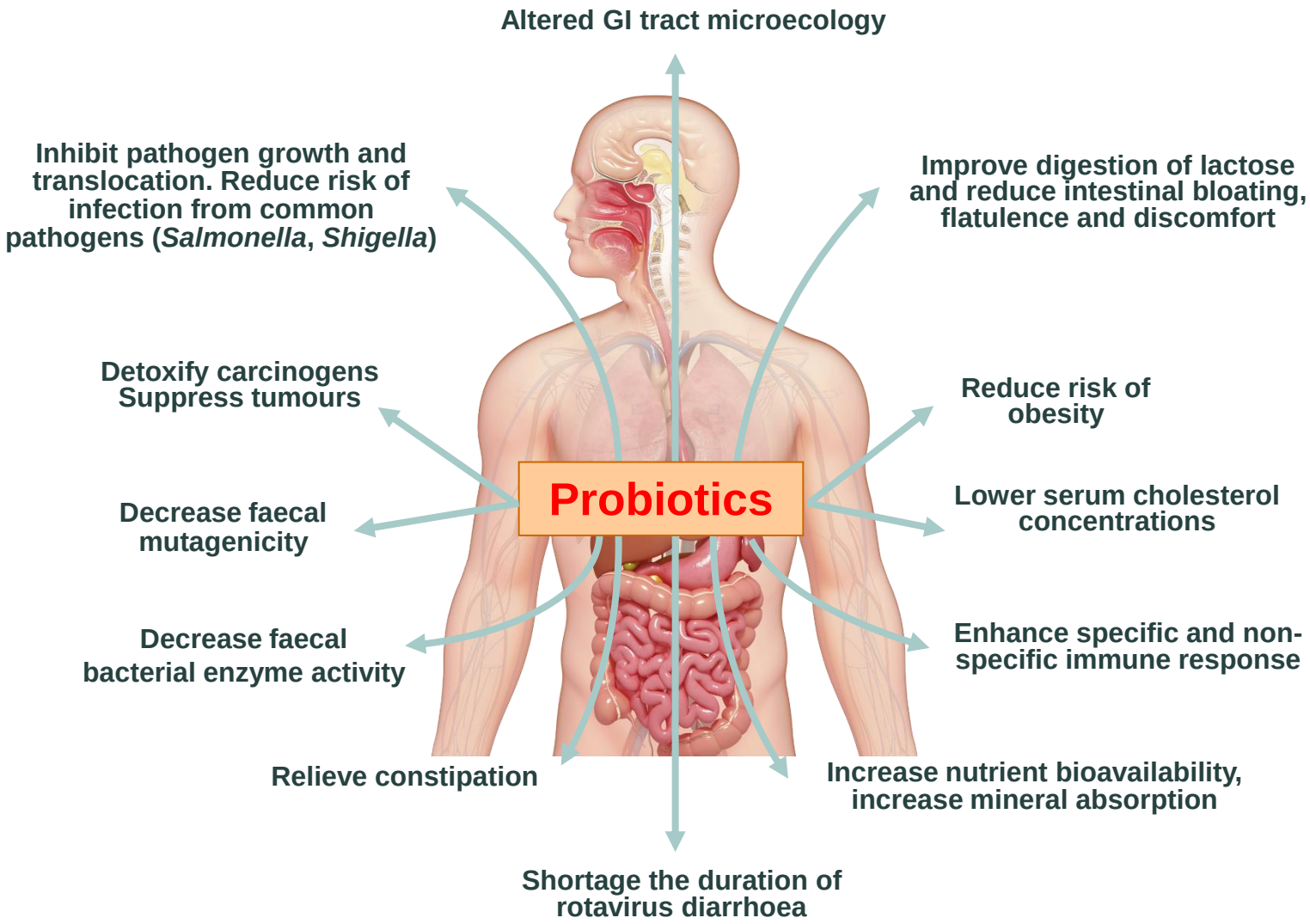
Źródła: [1, 7]

# What probiotics can do?

- **Antimicrobial effect**
  - Synthesizing antmicrobial products
  - Competitive exclusion
- **Enhacement of mucosla barrier integrity**
  - Mucin production regulation
  - Proper tight junction proteins expresion
- **Immune modulation**
  - Activation of lymphocytes
  - Production of antibodies
  - Stimulation of cells involved in innate and adaptive immunity
- **Detoxification properties**
  - Absorption
  - Metabolism

Źródła: [3, 4, 6]

# Impact of probiotics on human health




Źródła: [4]

# Route to become a probiotic microorganism

Isolation from selected environment → Bile and acids tolerance → Adherence to epithelial cells → Antagonistic activity → Genome description → Toxicology → Designation of target population → In vitro testing → In vivo testing


Źródła: [5, 8, 9]

# Probiotics used in human nutrition

| *Lactobacillus* species | *Bifidobacterium* species | Other Lactic Acid Bacteria | Other Microorganisms |
|---|---|---|---|
| *L. acidophilus* [a],* | *B. adolescentis* [a] | *Enterococcus faecium* [a] | *Bacillus clausii* [a],* |
| *L. amylovorus* [b],* | *B. animalis* [a],* | *Lactococcus lactis* [b],* | *Escherichia coli* Nissle 1917 [a] |
| *L. casei* [a],[b],* | *B. bifidum* [a] | *Streptococcus thermophilus* [a],* | *Saccharomyces cerevisiae* (*boulardi*) [a],* |
| *L. gasseri* [a],* | *B. breve* [b] | | |
| *L. helveticus* [a],* | *B. infantis* [a] | | |
| *L. johnsonii* [b],* | *B. longum* [a],* | | |
| *L. pentosus* [b],* | | | |
| *L. plantarum* [b],* | | | |
| *L. reuteri* [a],* | | | |
| *L. rhamnosus* [a],[b],* | | | |

[a] Mostly as pharmaceutical products; [b] mostly as food additives; * QPS (Qualified Presumption of Safety) microorganisms.

Źródła: [4]

# Examples of commercial probiotic products

| Strain | Commercial products | Sources |
|---|---|---|
| *Saccharomyces cerevisiae boulardii* | Florastor | Biocodex (Creswell, OR) |
| *Bifidobacterium infantis* 35,264 | Align | Procter and Gamble (Mason, OH) |
| *Lactobacillus casei* strain Shirota<br>*Bifidobacterium breve* strain Yakult | Yakult | Yakult (Tokyo, Japan) |
| *Lactobacillus casei* D<br>*Bifidobacterium anir* | | e)<br>NY) |
| *Lactobacillus johnsonii* LJ-1<br>(same as NCC533 and formerly *Lactobacillus acidophilus* La-1) | LC1 | Nestle (Lausanne, Switzerland) |
| *Lactobacillus reuteri* ATCC 55,730<br>("*L. reuteri Protectis*") | BioGaia Probiotic chewable tablets or drops | Biogaia (Stockholm, Sweden) |
| *Lactobacillus rhamnosus* GG ("LGG") | Culturelle; Dannon | Danimals Valio Dairy (Helsinki, Finland)<br>The Dannon Company (Tarrytown, NY) |

**The 2015 global probiotic market size by revenue exceeded 35 billion USD**

Źródła: [10]

# Probiotic food products


Dairy products such as yoghurt and kefir, cottage cheese or ripened cheese fermented with probiotic strains.
About 2-5x10$^{10}$ cells/100 gram portion.


Ice cream or frozen dessert. Probiotic bacteria concentration of about 10$^{7}$ cells/g.


Chocolates or cakes with lyophilised probiotic bacteria at concentration of about 10$^{7}$ cells/g.


Soft drinks with probiotic bacteria (CocoBiotic – fermented with *Lactobacillus acidophilus; Lactobacillus delbreuckii; Saccharomyces cerevisiae boulardii*): 4 billion cfu)

# Probiotic products


In lyophilised form – usually $10^{10}$ cells/g. Shelf life about 1 year. Sold as drugs or dietary supplements. Sometimes encapsulated.


Infant formula (powdered milk) with lyophilised probiotic bacteria at concentration of about $10^{7}$ cells/g.


Probiotic BioGaia chewing gum with *Lactobacillus reuteri* Prodentis. Balancing the oral flora and reducing the level of harmful bacteria associated with oral problems.

A screw cap for use on PET bottles which releases probiotic bacteria into the beverage.

LifeTop Straw which releases probiotic bacteria into drink upon piercing with the straw.


Probiotic sticks  contain a blend of *Lactobacillus acidophilus* Rossell-52 and *Bifidobacterium longum* Rossell-175 in a micro-encapsulated fruit flavoured powder form.

There are more beings in the world than just us, humans…

# "Synbiotic preparation for monogastric animals health prophylaxis and prevention of bacterial diseases and mycotoxin-related intoxications, as well as to improve animal nourishment and animal breeding eficiency" (PBS3/A8/32/2015)

Research funded by The National Center for Research and Development

The National Centre for Research and Development

Colaboration:

- Department of Swine Diseases of National Veterinary Research Institute placed in Pulawy
- Department of Biotechnology and Food Microbiology, Poznan University of Life Sciences
- Department of Pathology and Veterinary, Warsaw University of Life Science – SGGW
- Department of Animal Nutrition and Feed Science, University of Warmia and Mazury in Olsztyn
- JHJ Sp. z o. o. company

Uniwersytet Przyrodniczy w Poznaniu
Poznań University of Life Sciences

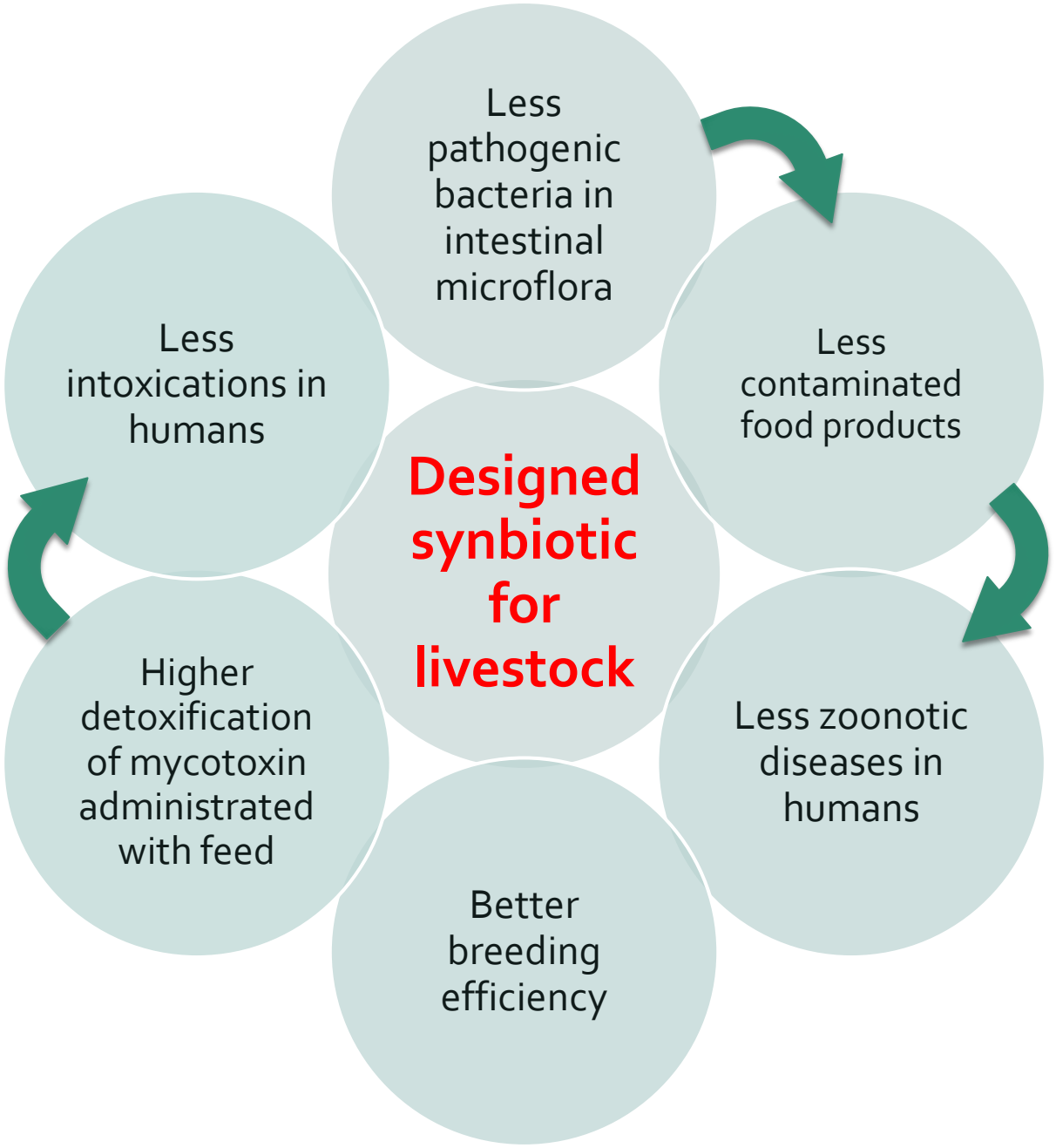
Szkoła Główna Gospodarstwa Wiejskiego w Warszawie

PIWet

Uniwersytet Warmińsko-Mazurski w Olsztynie

JHJ
Sukces przez innowacje

# If we succeed…



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