



INSTITUTE OF EXPERIMENTAL MEDICINE

FACULTY OF MEDICINE

PAVOL JOZEF ŠAFÁRIK UNIVERSITY IN KOŠICE



Alojz Bomba



Co-funded by the
Erasmus+ Programme
of the European Union



THE MAIN OBJECTIVE OF THE CONCEPT OF THE INSTITUTE'S ACTIVITIES

- Building the research institute of the highest international level focusing on research in the prevention and treatment of chronic diseases
- Application of interdisciplinary approach and teamwork
- Engagement of the Institute into international consortia of research projects in the European Union Framework Programme for Research and Innovation Horizon 2020



RESEARCH TEAM



GROUP LEADER:

Alojz BOMBA, DVM, DSc

- 6 senior scientists
- 5 junior scientist
- 3 PhD students
- 3 technicians

LONG-TERM RESEARCH PROGRAM

The role of gut microbiota in pathogenesis of chronic diseases and possibilities of targeted modulation and transplantation of gut microbiota in chronic disease prevention and treatment



INFRASTRUCTURE



Molecular biology Lab



Microbiology Lab



Cell culture Lab



Biochemistry Lab



Mass Spectrometry Lab



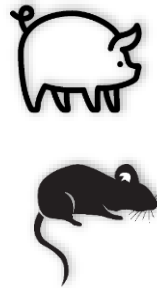
Immunology Lab

EXPERIMENTAL MODELS

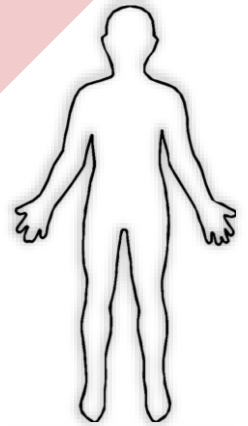
In vitro studies



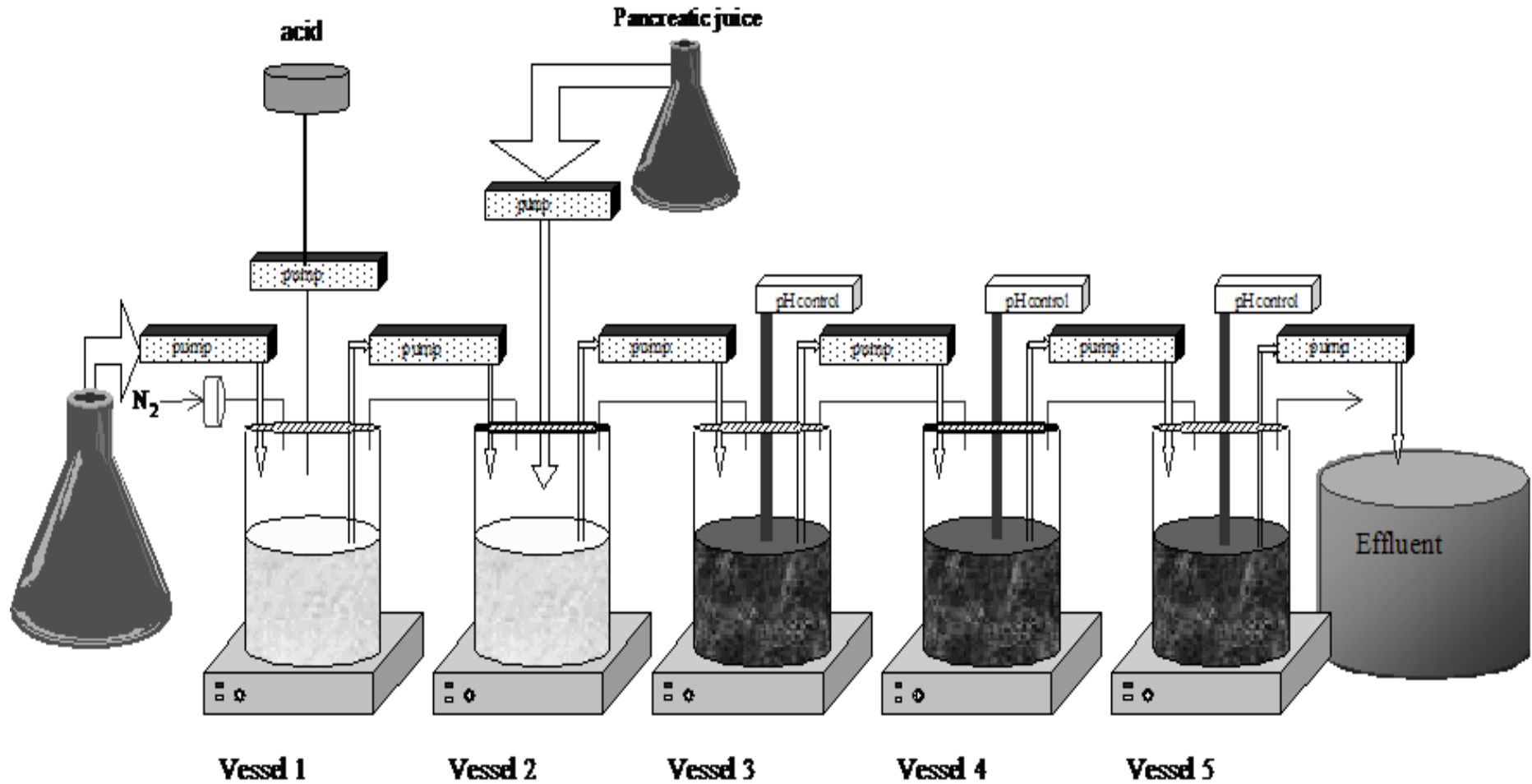
Preclinical studies



Clinical studies

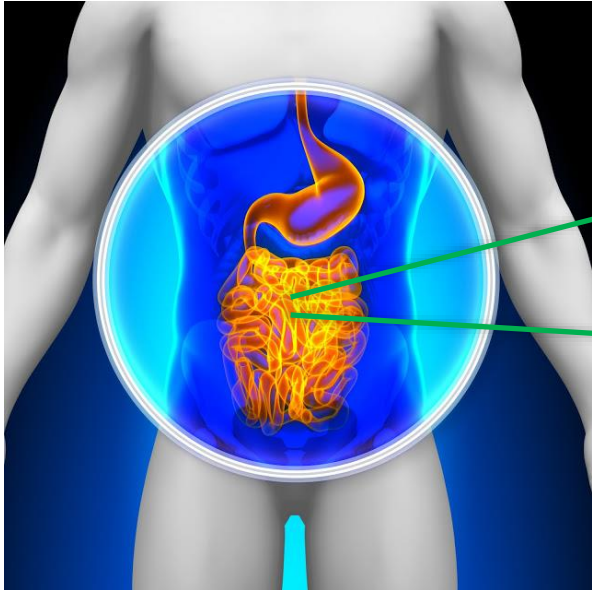


SHIME[®] SIMULATOR OF THE HUMAN INTESTINAL MICROBIAL ECOLOGY

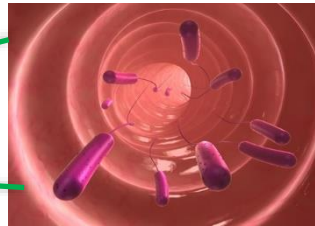




RESEARCH



Gut microbiota



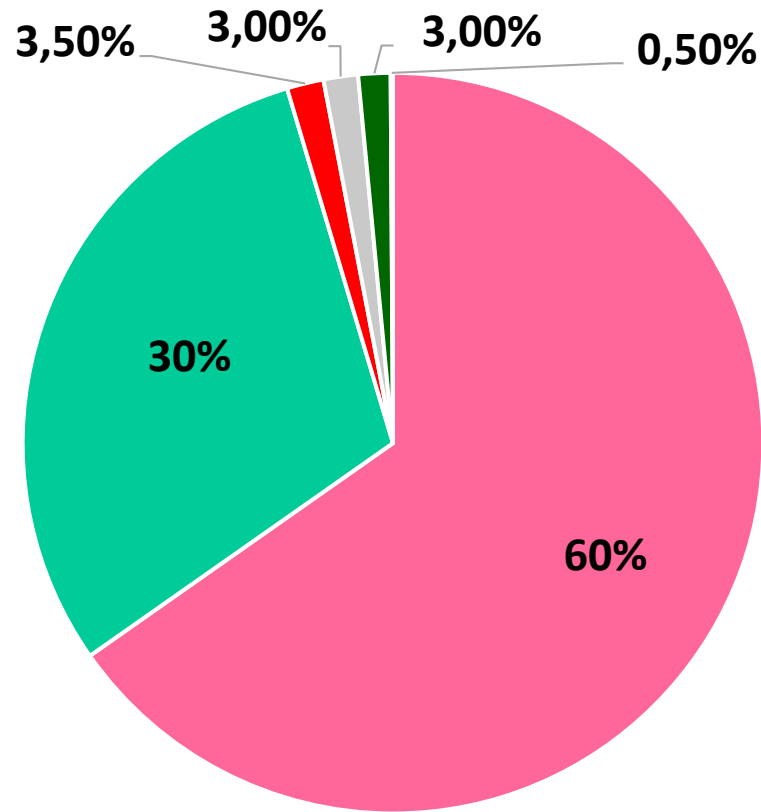
Key questions:



- **What is the role of gut microbiome in health and pathogenesis of chronic diseases?**
- **What are possibilities for prevention and treatment of chronic diseases using targeted modulation and transplantation of gut microbiota?**



THE COMPOSITION OF GUT MICROBIOTA



■ Firmicutes

■ Bacteroidetes

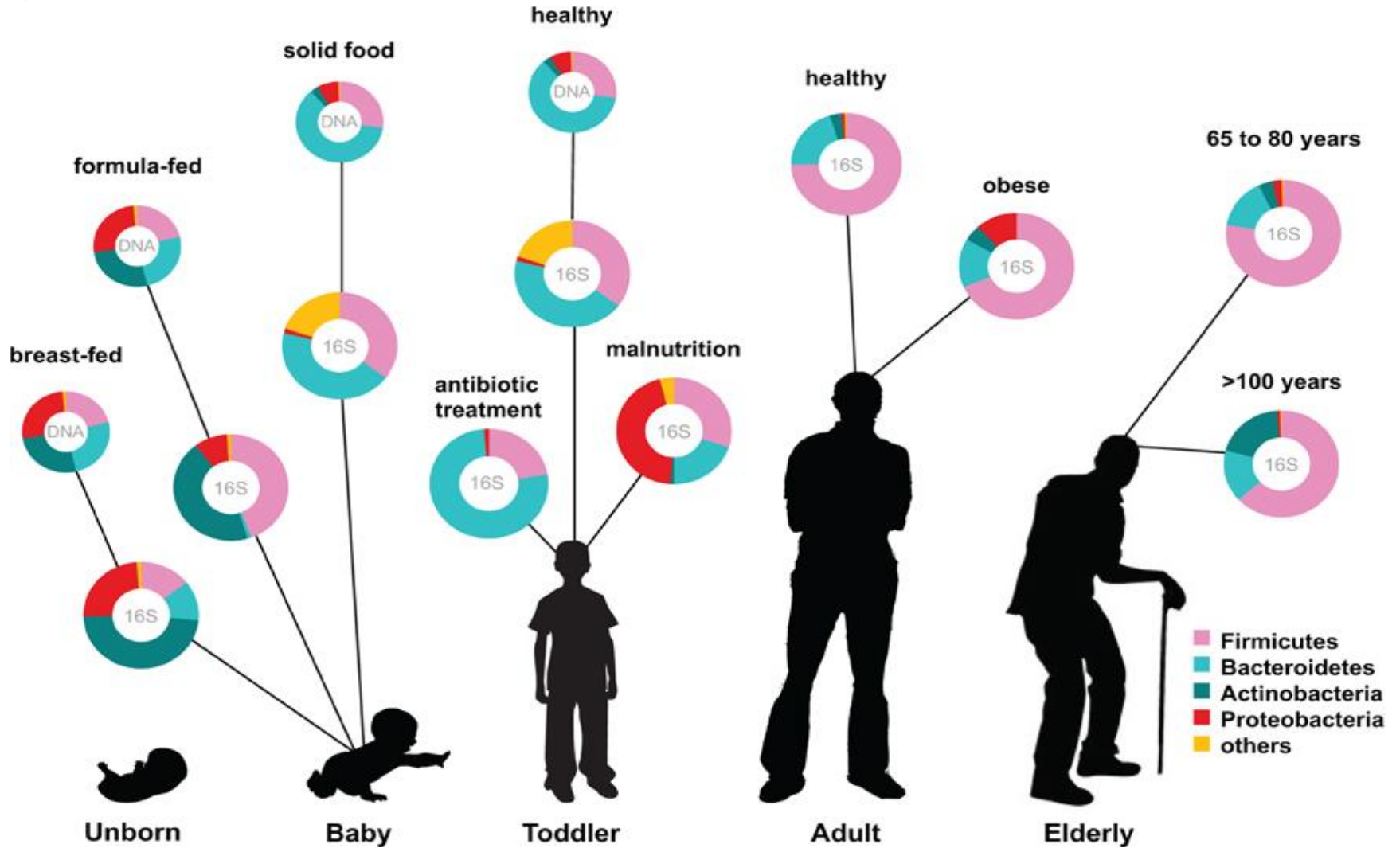
■ Proteobacteria

■ Verrucomicrobia

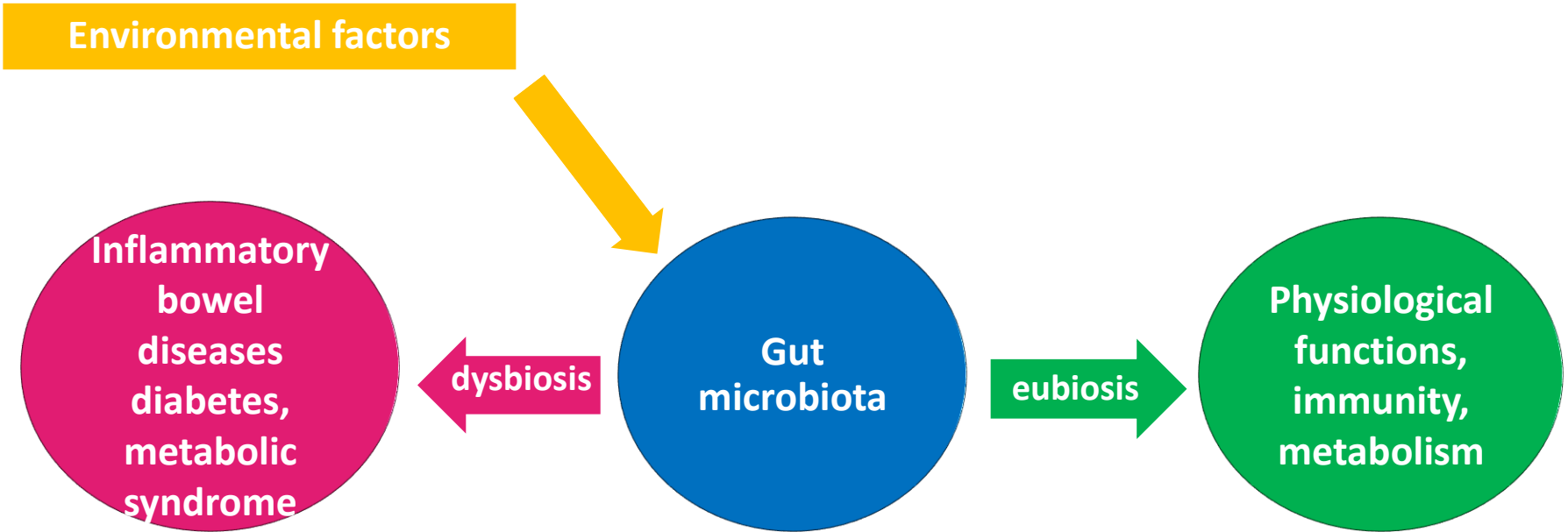
■ Actinobacteria

■ Ostatné

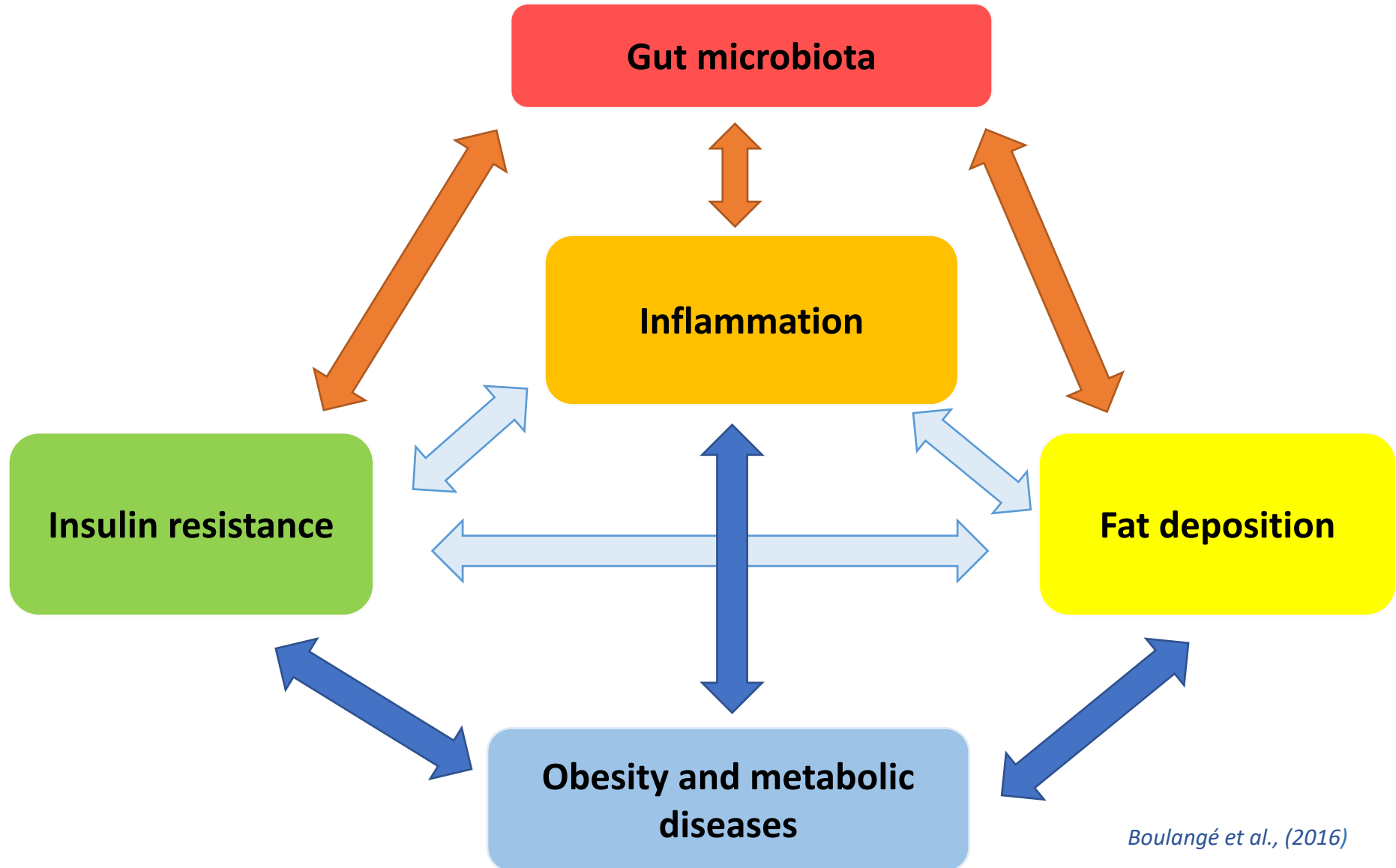
THE COMPOSITION OF GUT MICROBIOTA DEPENDING ON AGE



GUT MICROBIOTA IN HEALTH AND DISEASE



GUT MICROBIOTA, INFLAMMATION AND METABOLISM



GUT MICROBIOTA IN HEALTH AND DISEASE

- Better understanding of the bacterial communities inhabiting human gut and properties of healthy microbiota
- The role of dysbiosis in various disease states
- New therapeutics in the treatment of diseases using microbiota



DEFINITION OF PROBIOTICS

Live microorganisms which when administered in adequate amounts confer a health benefit on the host

(FAO and WHO 2001)

Lactobacilli (*Lactobacillus casei*, *L.acidophilus*, *L.lactis*, *L.plantarum*)



Bifidobacteria (*Bifidobacterium bifidum*)

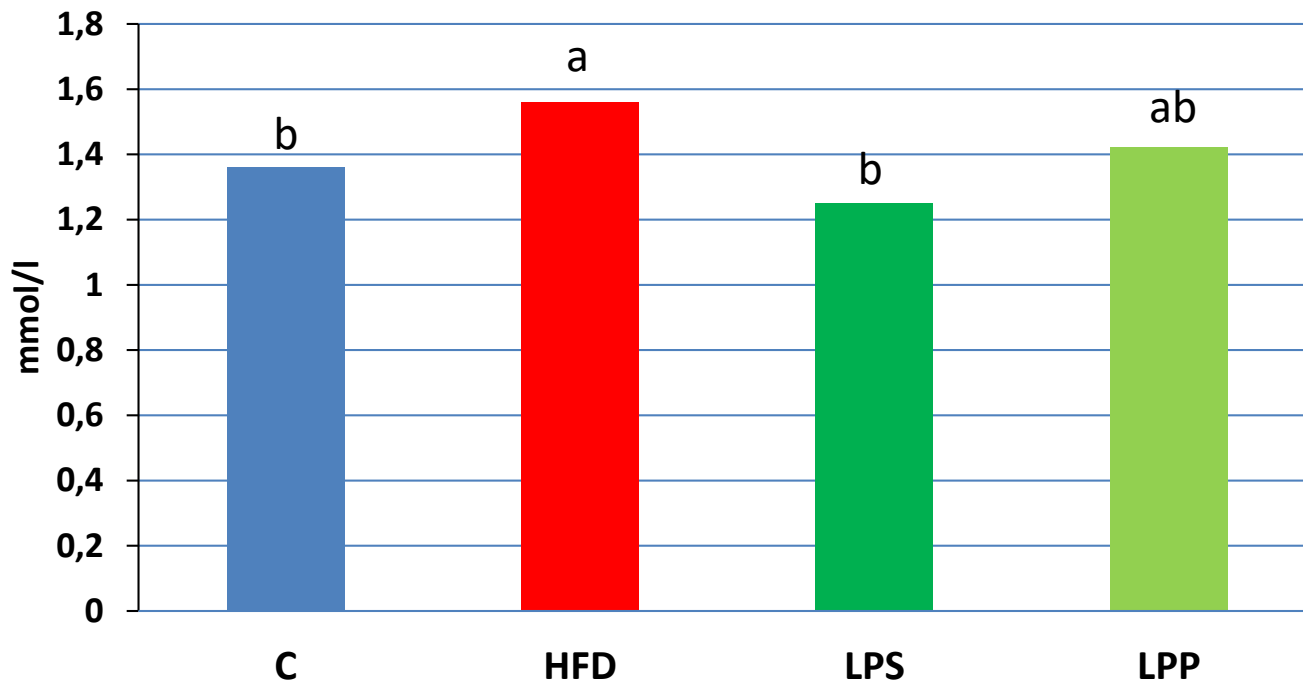


BIOMEDICAL EFFECTS OF PROBIOTICS



MODULATION OF LIPID METABOLISM BY PROBIOTICS IN HIGH-FAT DIET FED RATS

**Total serum cholesterol concentration in rats
fed by high fat diet**



C: Control group;

HFD: high fat diet;

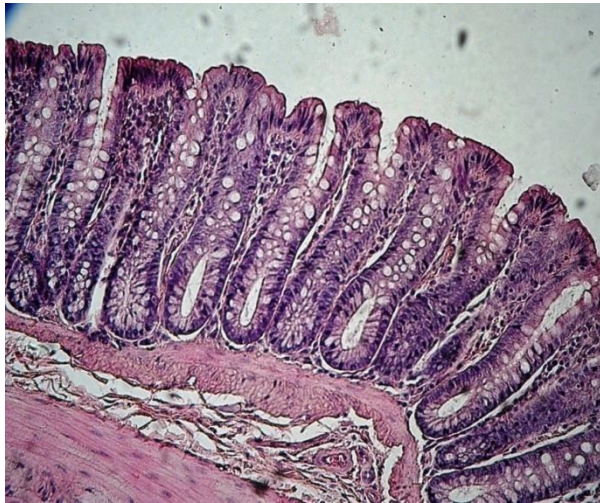
LPS: HFD + *L. plantarum* LS/07

LPP: HFD + *L. plantarum* LP96

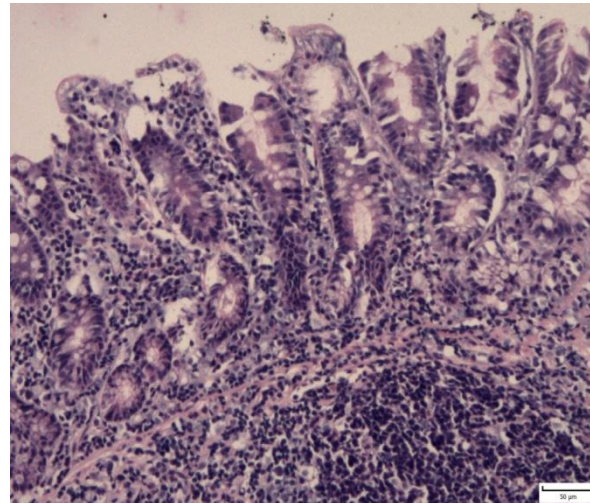
The values with different superscript letters
differ significantly ($p < 0.05$)

MODULATION OF GUT MICROBIOTA IN PREVENTION OF ACUTE COLITIS USING PROBIOTICS

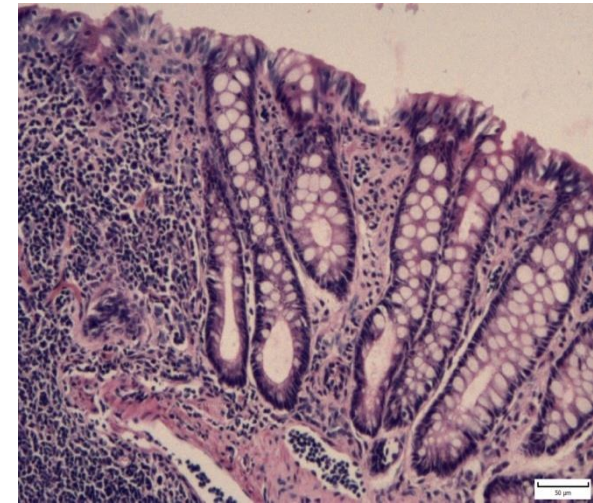
Effect of *L. plantarum* application on gut morphology of rats in chemically induced acute colitis (DSS)



Control group



DSS group (colitis)

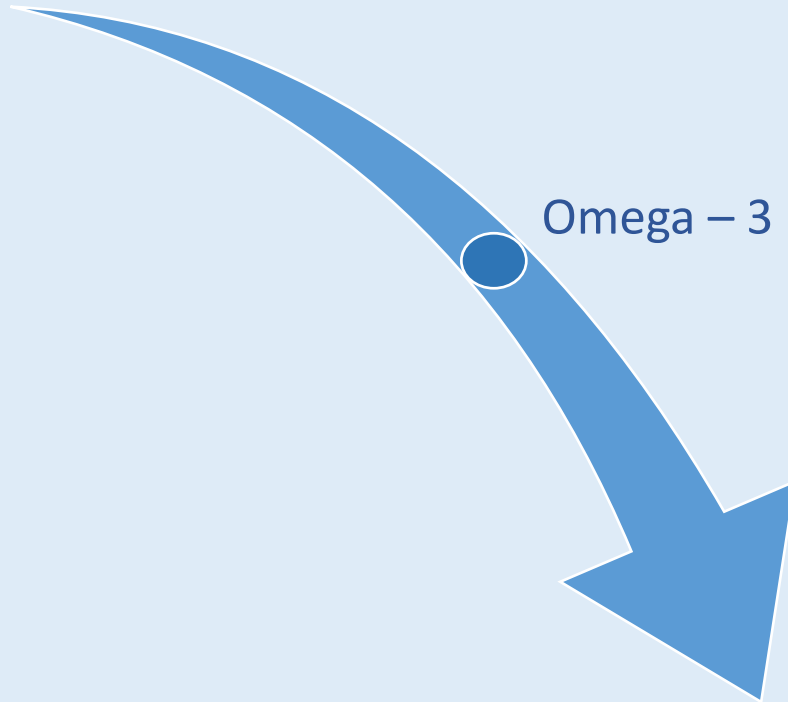


L. plantarum group



POTENTIATED PROBIOTICS

Probiotics

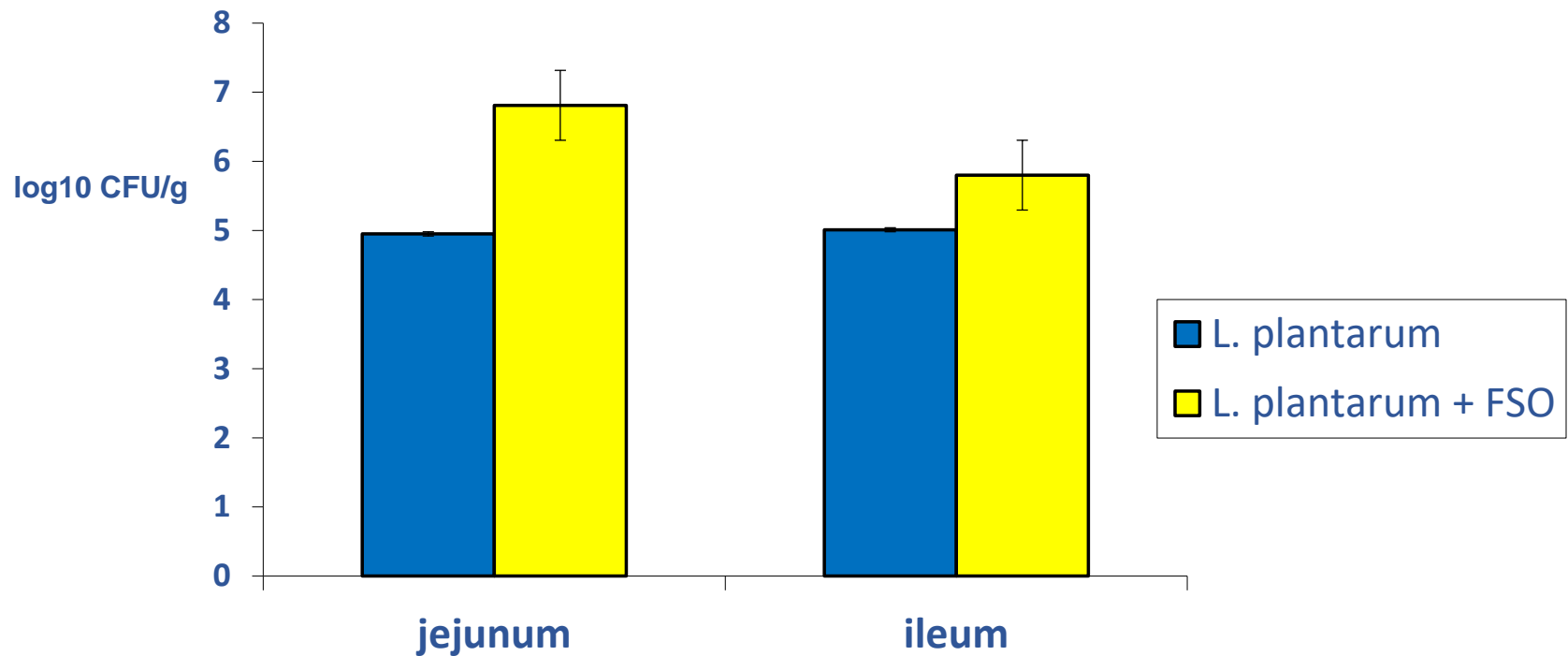


Omega – 3 polyunsaturated fatty acids

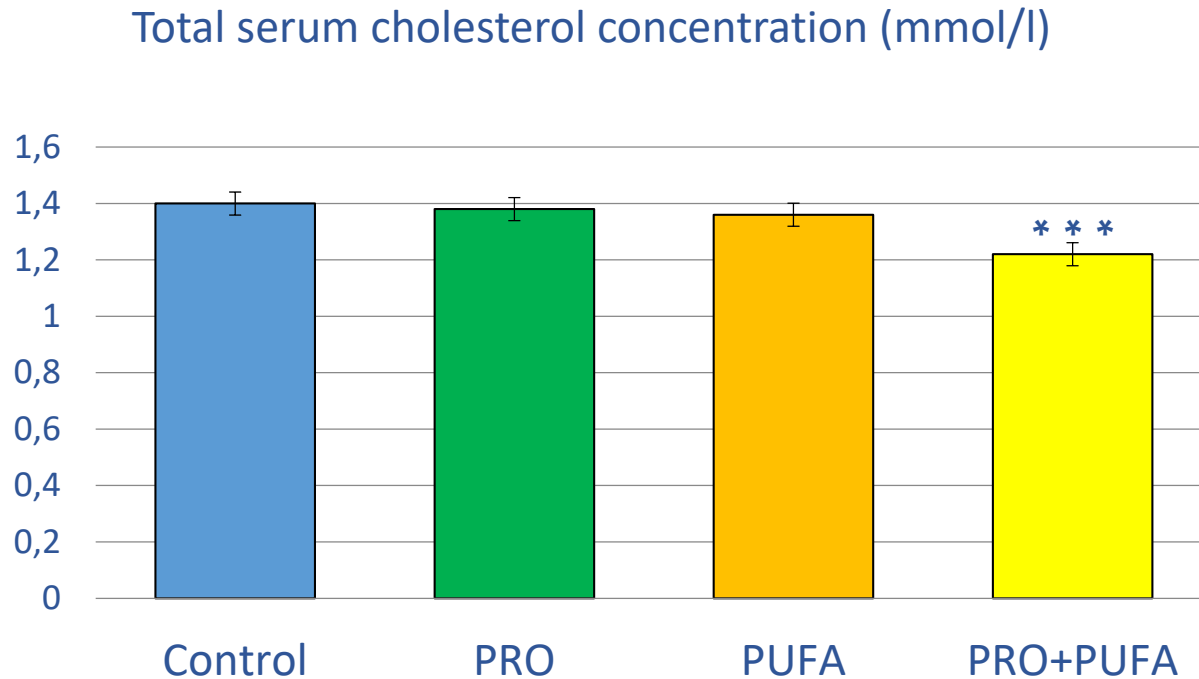
Potentiated probiotics

THE EFFECT OF N-3 POLYUNSATURATED FATTY ACIDS ON THE INHIBITORY EFFECT OF *LACTOBACILLUS PLANTARUM* ON THE ADHERENCE OF *E. COLI* O8:K88AB:H9 IN THE GUT OF GNOTOBIOTIC PIGLETS SUPPLEMENTED WITH FLAX-SEED OIL

The counts of *Lactobacillus plantarum* adhering to the intestinal mucosa of 9-day-old gnotobiotic pigs after administration of flax-seed oil



THE EFFECT OF LACTOBACILLUS PLANTARUM AND N-3 POLYUNSATURATED FATTY ACIDS (PUFA) ON TOTAL CHOLESTEROL SERUM CONCENTRATION IN RATS



Control group

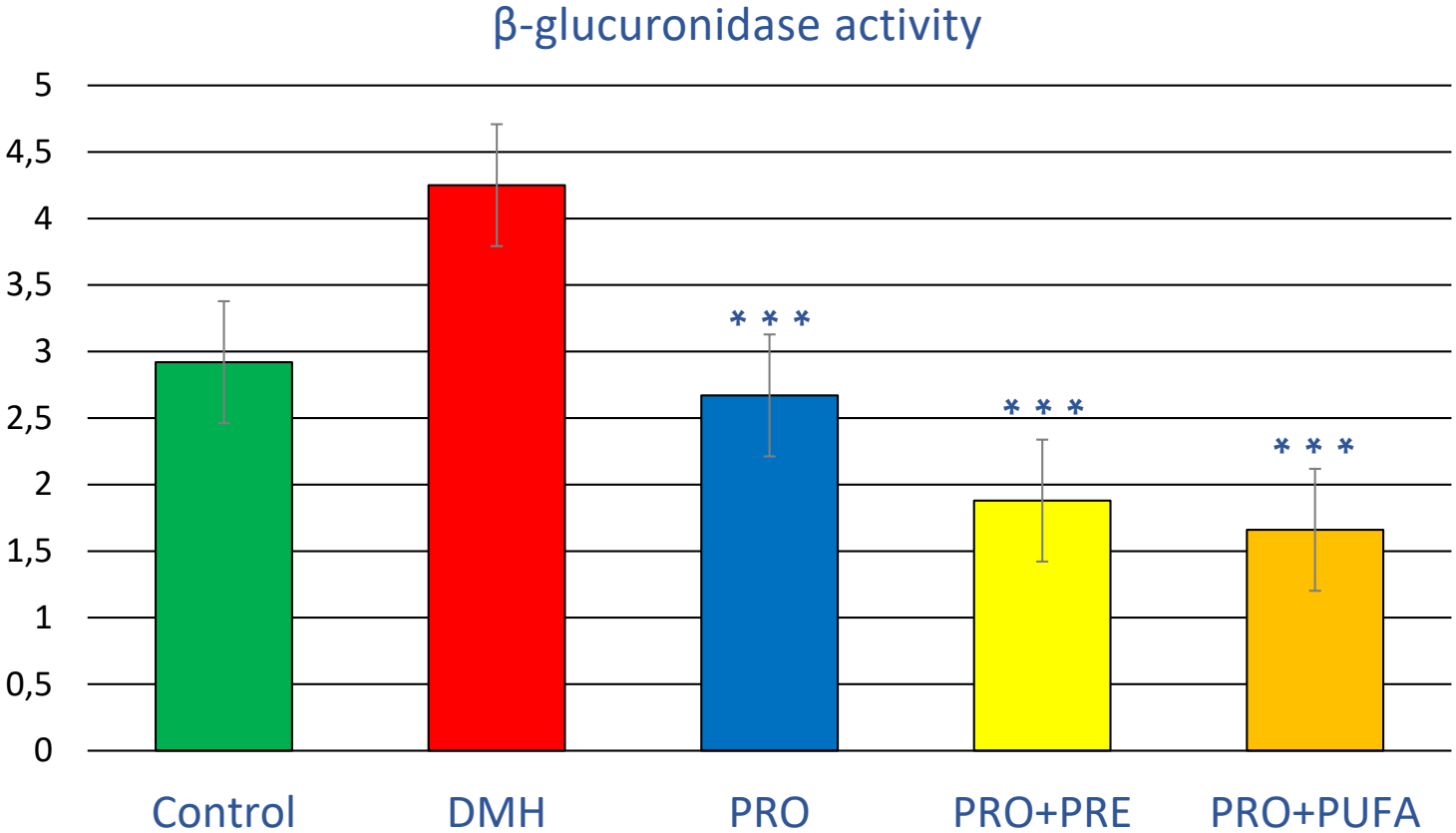
PRO: Lactobacillus plantarum

PUFA: linseed oil (Lini oleum virginale)

PRO+PUFA: Lactobacillus plantarum + linseed oil (Lini oleum virginale)

*** ($p < 0,001$)

THE EFFECT OF *LACTOBACILLUS PLANTARUM* (PRO) AND N-3 POLYUNSATURATED FATTY ACIDS (PUFA) ON ACTIVITY OF BACTERIAL ENZYMES IN 1,2-DIMETHYLHYDRAZINE EXPOSED RATS

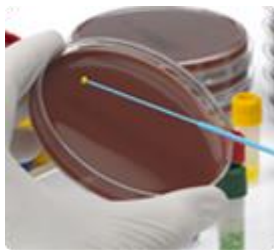


sign. different from DMH *** ($p < 0,001$)

Strojny et al., 2011

AUTOPROBIOTICS

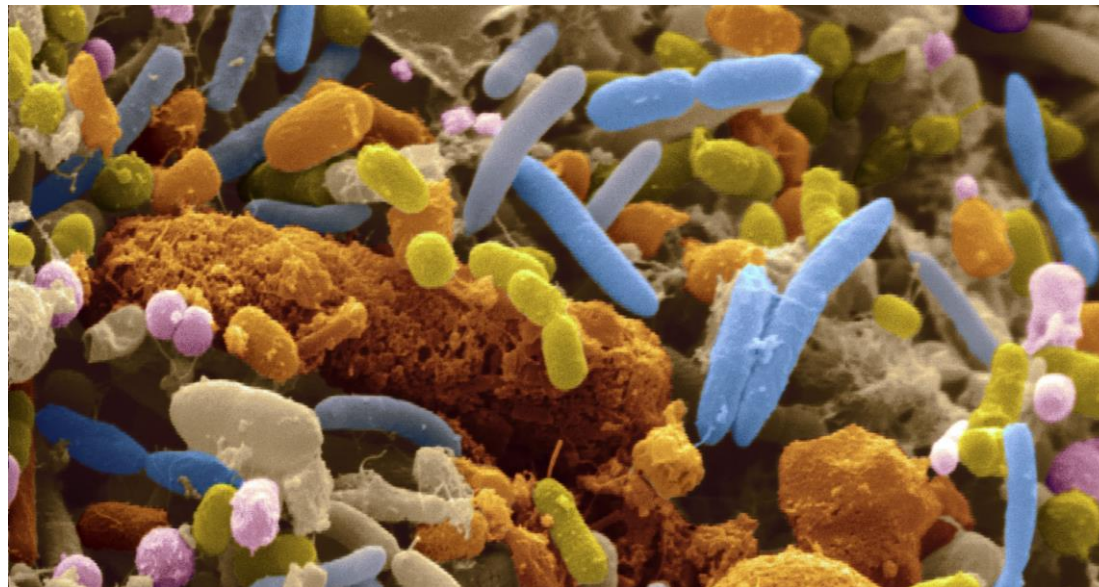
Autoprotibiotic technology is based on the indigenous bacteria used for restoring the normal microbiota in the case of a dysbiotic condition



ADMINISTRATION OF DEFINED MICROBIOTA

Stool substitute transplant therapy

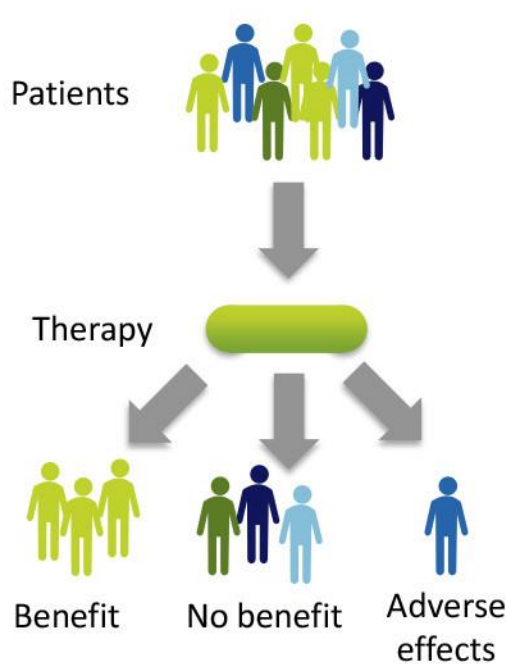
It was demonstrated that a stool substitute mixture comprising a multi-species community of bacteria is capable of curing antibiotic-resistant *C. difficile* colitis



FECAL MICROBIOTA TRANSPLANTATION

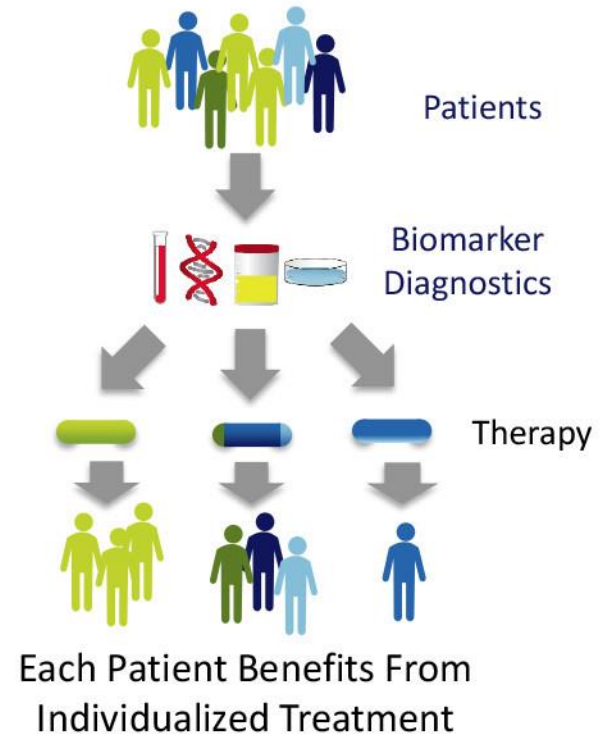
Without Personalized Medicine:

Some Benefit, Some Do Not



With Personalized Medicine:

Each Patient Receives the Right Medicine For Them



TARGETED MODULATION OF GUT MICROBIOTA IN DISEASE PREVENTION AND TREATMENT

- Original solution of gut microbiota modulation which could possibly meet criteria of the personalized medicine approach
- Our solution eliminates the risks connected with the fecal microbiota transplantation from donor and it allows the targeted modulation according to specific needs of the patient



PERSPECTIVES

- The completion of a top international level research institute
- New, original and effective solution of targeted gut microbiota modulation in chronic disease prevention and treatment
- Participation in international consortia of research projects in European Union Framework Programme for Research and Innovation

Thank you for your attention