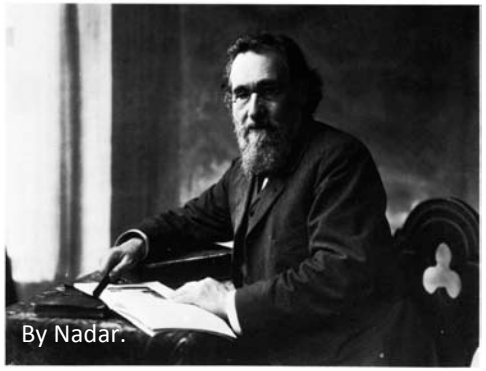
Probiotics

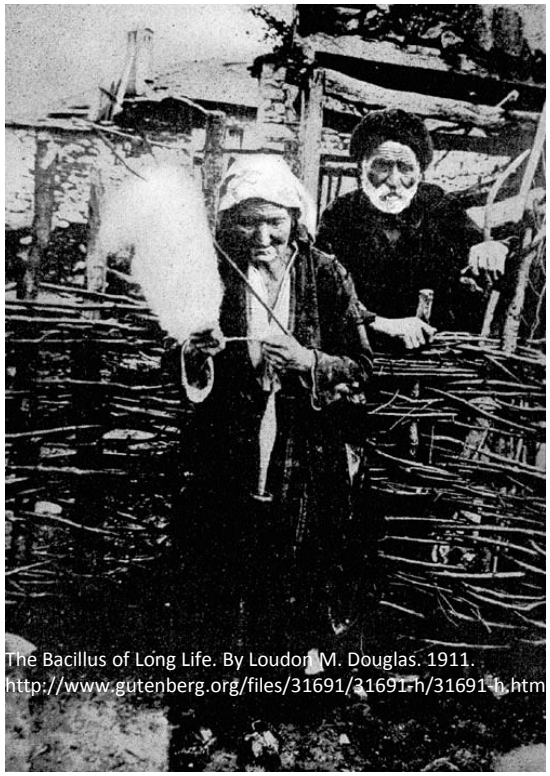
"live microorganisms which when administered in adequate amounts confer a health benefit on the host" (WHO/FAO)

History of Safe Use

Humans have ten times more bacterial cells in their gastrointestinal tract than human cells in their body. A beneficial relationship with the gut microflora is essential for good health.


By Nadar.


www.ua.all.biz/en/g818771/

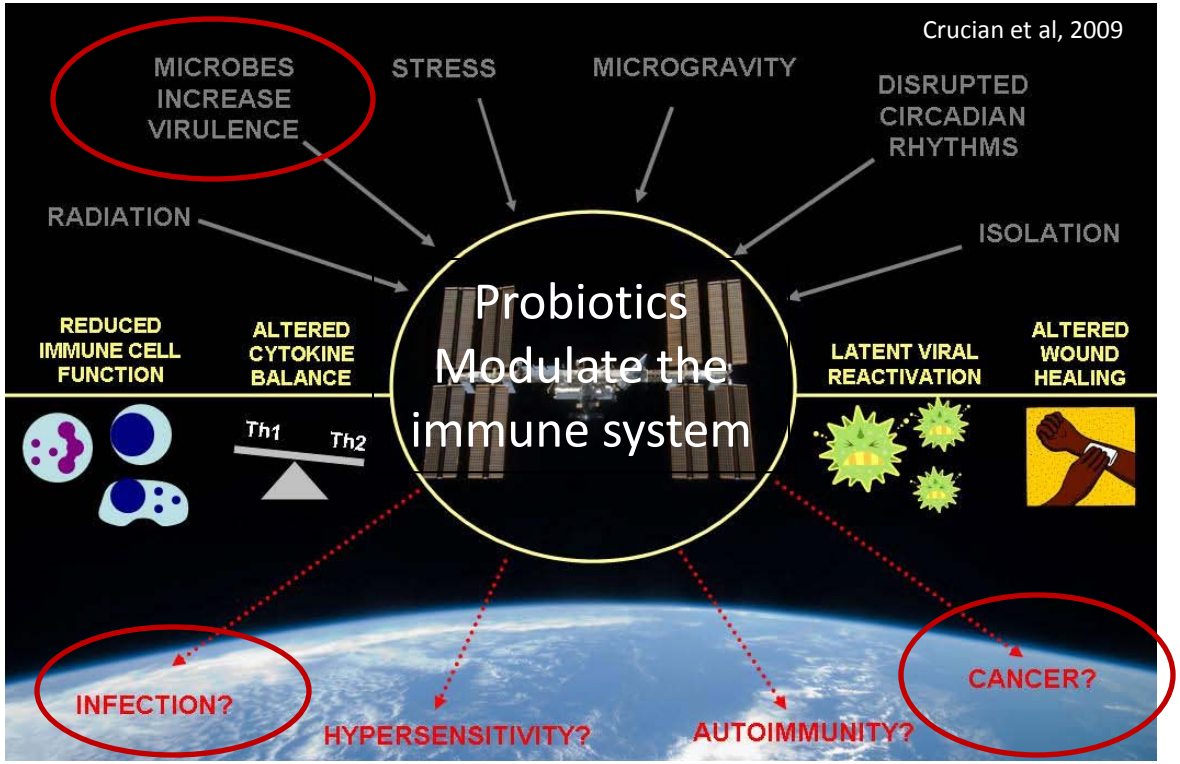

The Bacillus of Long Life. By Loudon M. Douglas. 1911. http://www.gutenberg.org/files/31691/31691-h/31691-h.htm

Probiotics	GRAS list number
Bacillus coagulans	GRN 378 (Pending)
Bifidobacterium animalis subsp. *lactis* strain Bf-6	GRN 377
Bifidobacterium lactis Bb-12	GRN 49
Bifidobacterium longum strain BB536	GRN 268
Lactobacillus acidophilus NCFM	GRN No. 357
Lactobacillus reuteri DSM 17938	GRN 254
Lactobacillus rhamnosus HN001 (DR20)	GRN 281
Lactobacillus rhamnosus GG	GRN 231

Immune dysregulation in spaceflight and probiotic benefits

Antagonize pathogens

Protect against infection



Prevent and treat antibiotic associated diarrhea

Reduction in cancer biomarkers in colon

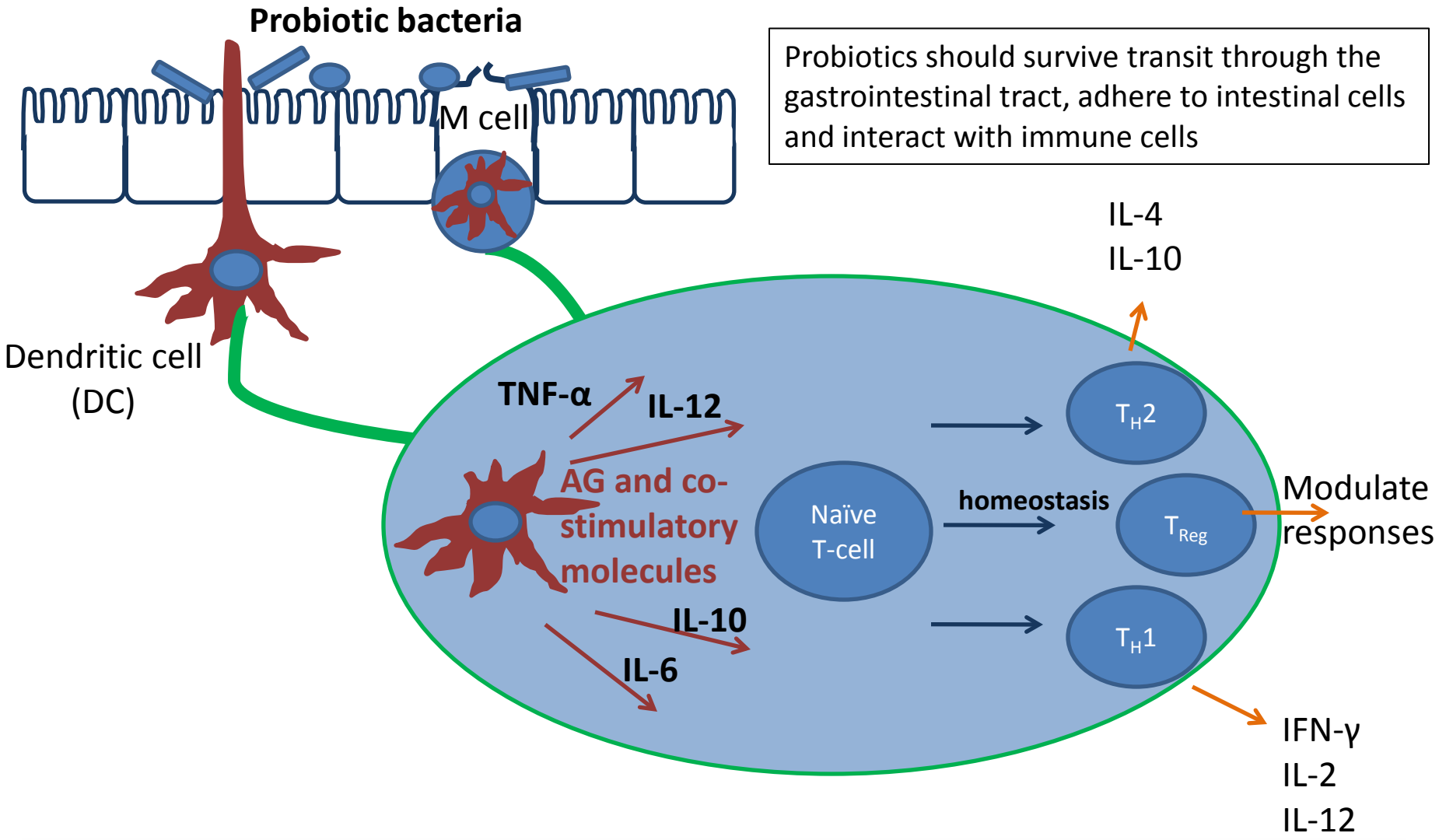
Increase specific IFN-γ responses and natural killer cell activity

Reduce cold and flu-like symptoms

Alleviate gastrointestinal issues

Prevention of urinary tract infection

Mode of Action



Probiotics should survive transit through the gastrointestinal tract, adhere to intestinal cells and interact with immune cells

Probiotics in Spaceflight

- Unknowns
  - Alterations in microbial activity
  - Probiotic tolerance in relation to immune changes in spaceflight

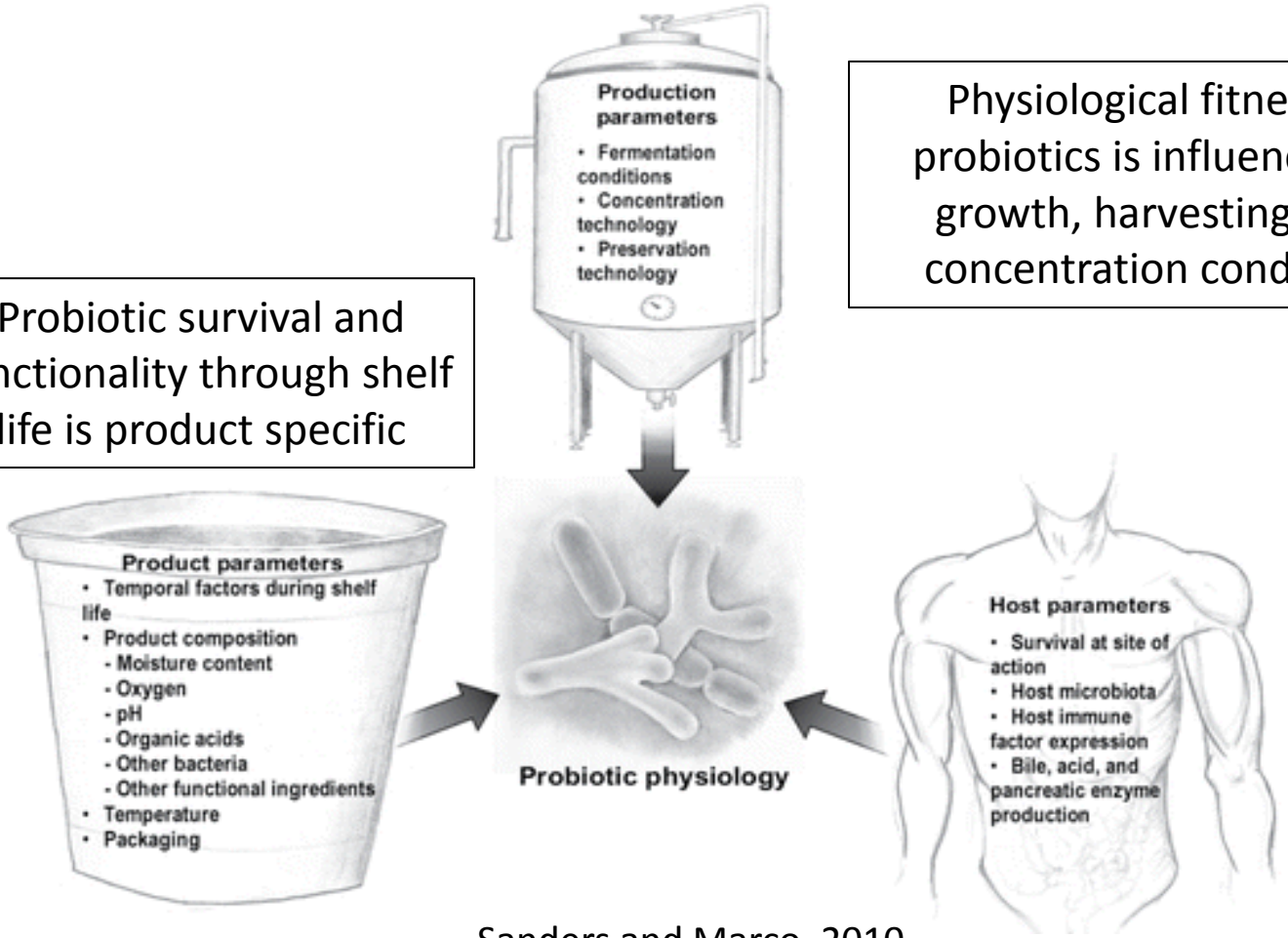
- Preliminary Studies
  - Determine changes in growth, stress response, or metabolic activity in an analog growth environment
  - Evaluate probiotic effect on human immune function in an analog environment or spaceflight
  - Identify probiotic candidates for spaceflight


Synthecon, Inc.

Shelf Life and Food Matrix

Physiological fitness of probiotics is influenced by growth, harvesting, and concentration conditions

Probiotic survival and functionality through shelf life is product specific



Sanders and Marco, 2010

Food matrix may impact survival and physiological activity of probiotics in the gastrointestinal tract

Introduction into Space Food System

- Introduction of probiotics will exceed current flight approved microbial limits.
- Food must have a five year shelf life at ambient temperature.
- A method to introduce probiotics into this system must be determined.

Factor	***Limits***
Total aerobic count	20,000 CFU/g for any single sample (or if any two samples from a lot exceed 10,000 CFU/g)
Coliform	100 CFU/g for any single sample (or if any two samples from a lot exceed 10 CFU/g)
Coagulase positive *Staphylococci*	100 CFU/g for any single sample (or if any two samples from a lot exceed 10 CFU/g)
Salmonella	0 CFU/g for any single sample
Yeasts and molds	1000 CFU/g for any single sample (or if any two samples from a lot exceed 100 CFU/g or if any two samples from a lot exceed 10 CFU/g *Aspergillis flavus*)