

Probiotics

Facts

- The human colon contains a high concentration of bacteria
 - 10^{12} / gram dry weight of colonic contents
- A large numbers of bifidobacteria and lactobacilli exist in the intestine of infants, healthy human adults, and animals
- Use Lb preparation improves diarrhea

Probiotics

- Live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance
- The live bacteria (mainly lactic acid bacteria) used to ferment dairy products

Prebiotic

- A nondigestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or the activity of one or a limited number of bacteria in the colon, and thus improves host health
 - Nondigestible oligosaccharides: raffinose, soybean oligosaccharides, fructooligosaccharides, galactooligosaccharides, galactosyl lactose
- Disaccharides and other alternatives

Synbiotic

- The combination, in the same food product, of a pro- and a prebiotic

Proposed Benefits of Probiotics

- Increased resistance to infectious diseases, particularly of the intestine
- Decreased duration of diarrhea
- Reduction in blood pressure
- Reduction in serum cholesterol conc.
- Reduction in allergy
- Stimulation of phagocytosis by peripheral blood leucocytes
- Modulation of cytokine gene expression
- Regression of tumors
- Reduction in carcinogen or co-carcinogen production

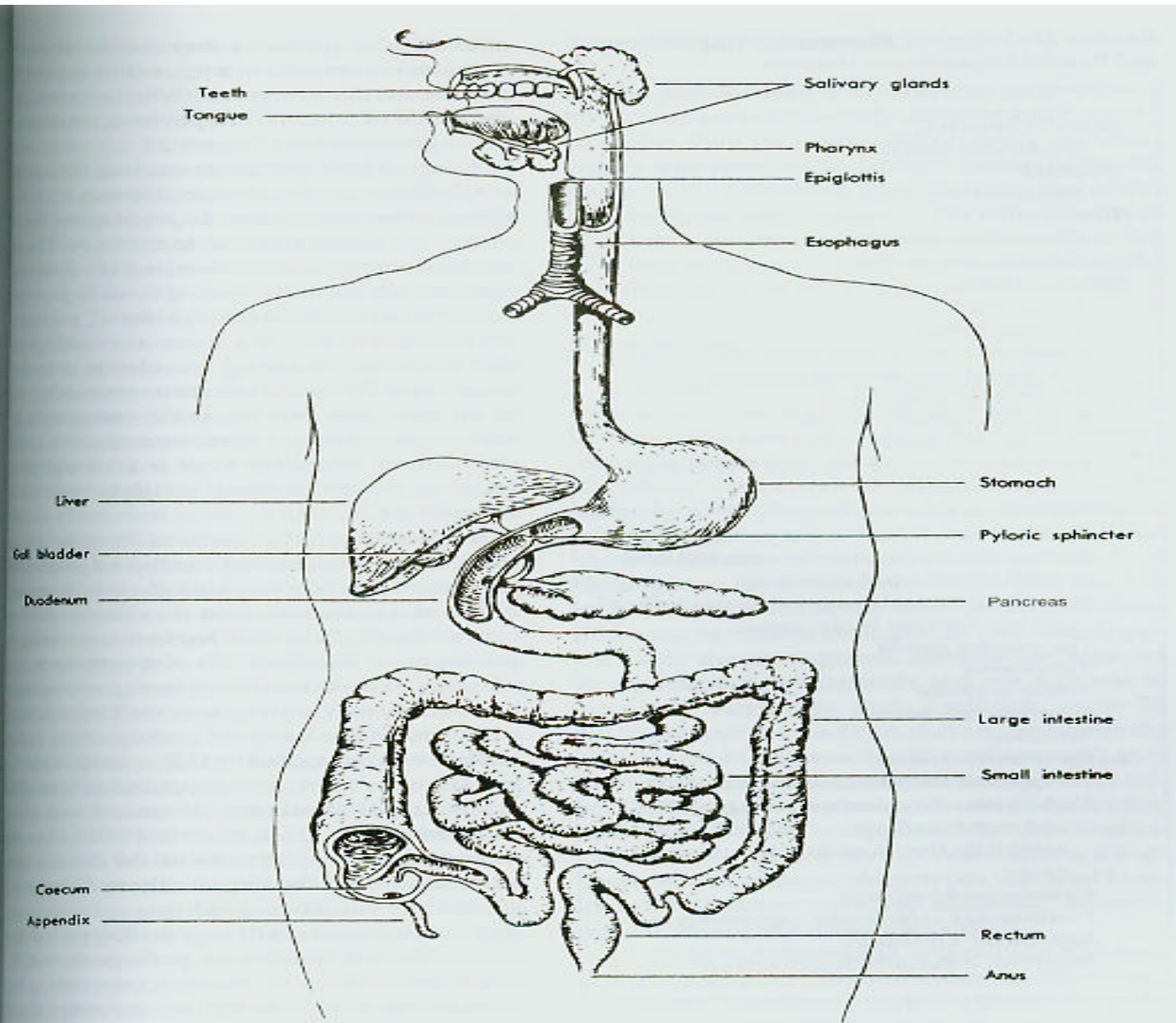


Figure 22-2 Diagram of the human digestive system. Courtesy of John W. Kimball, © 1965, Andover, Massachusetts.

Probiotics vs the real intestinal microflora

- Colonization?
 - Bacterium itself
 - Effect of GI environment (ingredients, pH, bile, salt, etc.)
- Colonization resistance?
 - Existing microbes exert interfering factors
- Microflora modification?

Prerequisite for probiotic research and development

- Fundamental knowledge of intestinal bacteria
- Their interactions with each other and with their hosts

Bifidobacterium

- 24 species recognized
- 9 species essentially from human: *B. bifidum*, *B. longum*, *B. infantis*, *B. brevis*, *B. adolescentis*, *B. angulatum*, *B. catenulatum*, *B. psuedocatenulatum*, and *B. dentium*

Change from weaning to adulthood

- Influence of age
 - Environmental change leads to decrease of the microflora or microflora changing causes aging?
- Diet
- Pathogenicity

Adhesion to Human Gut Mucosa

- Human-derived strains of lactic acid bacteria are preferred as probiotics; however, some dairy strains show moderate to good adhesion properties to human cell lines, at least in vitro
 - *Lactobacillus acidophilus* NCDF 1748, *Lactobacillus acidophilus* LB, *Lactobacillus* GG (ATCC 53103), *Lactobacillus reuteri*, *Lactobacillus rhamnosus* (LA750), and *Lactobacillus acidophilus* BG2FO4 have been shown to be adherent in Caco-2 cells or in other systems

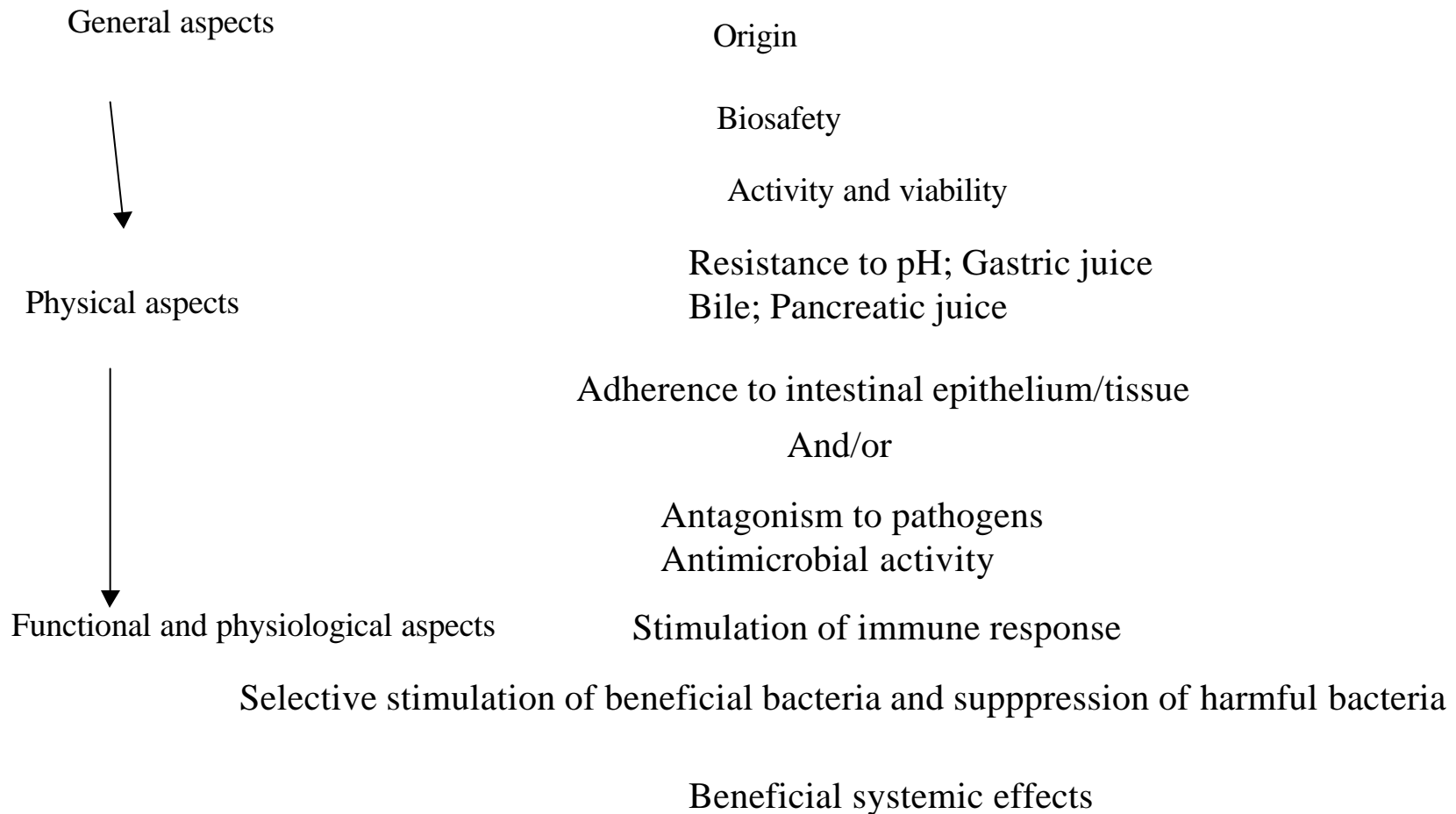
Technical advantages of Probiotic LAB

- Probiotic lactic acid bacteria easily accessible to the food industry
- Handy growth and pleasant aroma and flavor profiles for probiotic functional foods
- The stability of probiotic strains in continuous industrial culturing and functional foods

How to pick “good” strain?

- Safety
- Functional aspects
 - Survival
 - Adherence
 - Colonization
 - antimicrobial production
 - immune stimulation
 - antigenotoxic activity

Selection criteria for probiotic bacteria



Isolation of probiotic *Enterococcus faecium* strains

(Saavedra *et al.*, 2003, Int. J. Food Microbiol.
88:241-245)

- Assimilation of cholesterol
- Producing enterocin
- Natural flora of fermented foods, contribute to flavor

Isolation of probiotic *Enterococcus faecium* strains

- Bile tolerance
- Bile salt hydrolase, cholesterol reduction
- Antimicrobial activity

Concerns

- Virulence determinants?
- Gene transfer?
- Animal to human?

Research direction

- Intestinal microflora and host relationships,
- The scientific rigour of trials involving animals or humans
- Accurate identification of intestinal bacteria, safety, and maintenance of bacterial viability under industrial conditions
- Development of methods for the derivation of genetically modified intestinal bacteria, their application in studies of microbial ecology, and in the generation of beneficial host-microbe relationships
- Potential for modulation of the intestinal microflora using fermentable substrates as dietary additives
- *Novel Selection Criteria:* immunological assessment