Session 1: HISTORY, BACTERIAL DIVERSITY AND THE MICROBIOME

**Origin of the microbiome and probiotics [Sept 11, 2017]**
- Nomenclature and definitions
- Diversity of life on earth and relative distribution of biomass
- The evolution of symbiosis and mutualism
- What has the microbiome done for you lately?
- Bacterial diversity
- History of pre- and probiotics
- Growth of the probiotic industry

**The role of probiotics and antibiotics [Sept 11, 2017]**
- Probiotic “snake oil”: Research and publication bias
- Product delivery and quality control
- 20th century miracle drug: The discovery of antibiotics
- The impact of antibiotics
- The “The microbial Empire Strikes Back” & the “Antibiotic winter”

Session 2: “NO GUTS NO GLORY”

**Gut anatomy, physiology and immunology [Sept 18, 2017]**
- Evolution of the gut and mutualism
- The microanatomy of the gut: Physical and functional compartmentalization
- Enterocyte are the barrier to translocation that prevents bacteremia
- The innate recognition of microbial-associated patterns (MAPs) and the microbiome
- MAP encounter drives development of the adaptive immune system
Colonization of the GI tract [Sept 18, 2017]

What defines a healthy gastrointestinal (GIT) microbiome?
The concept of a “good” (eubiosis) versus a “bad” (dysbiosis) microbiome

Acquiring the microbiome
The microbiome-gut-brain axis
Autism and other microbiome associations

Session 3: “WAR OF THE WORLDS” AND BIOTICS IN NEONATAL DEVELOPMENT

“War of the worlds” [Sept 25, 2017]

Dynamics of the GIT microbiome: “Microbial Darwinism”
Bacteria are protected from antibiotics and lymphocytes by mutation and DNA exchange

“Birth of the Jedi lymphocyte”: Somatic gene rearrangement and mutation versus the bacterial genomic

The mucosal immune system of the GIT: Immune homeostasis and “peaceful co-existence”
Oral tolerance to dietary antigens and to “good” members of the GIT microbiome
Regulatory T cells (Tregs) patrol the GIT to maintain health

Biotics in neonatal development [Sept 25, 2017]

“Normal” infant microbiome
Colonization of the infant GI tract

Cesarean versus vaginal birth
Antibiotic use
Premature infants and use of pre- and probiotics

Session 4: INTESTINAL PATHOLOGY, THE DIRT HYPOTHESIS, FOOD ALLERGY, AND ANTIBIOTIC GROWTH PROMOTORS

Intestinal pathologies [October 2, 2017]

Immune-mediated disease and the environment
Brief overview of immune regulation
Micro/macro-biome as a context setter

The microbiome and various diseases: C. difficile colitis; IBD; celiac disease; muscular dystrophy and Helicobacter pylori ulcers
The dirt hypothesis, allergy and antibiotic growth promotors [October 2, 2017]

The “dirt” or (hygiene) hypothesis, and the increase allergy
Childhood allergies parallel other maladies in Western culture and implicate the microbiome
Antibiotic growth promotors (AGP) in food animal production
Is obesity an antibiotic and microbiome issue?
Horizontal transfer of pathogens from animals to humans
Facts, fiction and misunderstandings about AGP and therapeutic antibiotics
Preplacing antibiotics with pre- and probiotics in agriculture and aquaculture
“Eat your Yogurt” and “Do no harm”

The Instructors
J.E. Butler (the principal instructor) is an emeritus professor of immunology/microbiology and was the first mucosal immunologist recruited by the Carver College of Medicine. He has a background in zoology, immunology, biochemistry and molecular biology. He has > 40 years of experience studying the development of the immune system in neonates. He was a selected participant in the conference on probiotics held in Baltimore and sponsored by the American Society of Microbiology. He was twice named Distinguished Veterinary Immunologist. Ekhardt Ziegler is a retired pediatrics nutritionist with extensive experience with premature and conventional infants. David Elliot is the current head of gastroenterology in the Carver College of Medicine.

Course Description
Focus is on the establishment and complexity of the microbiome, its importance, ecology and the consequences of its perturbations. Lectures trace the introduction of pre-, pro- and anti-biotic therapy and their positive and negative effects on the microbiome. The evolution of self/non-self-recognition via innate and adaptive immunity is discussed with regards to their relationship to the gut microbiome, including situations in which failures in the system can result in pathologies. Other topics include the microbiome in neonatal development, the hygiene hypothesis and the use of antibiotic growth promotors.