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The Functional Microbiome: How Antibiotics Affect Gut Ecology and Systemic Health

This issue is part 2 in a series about the gut microbiome. This month, Dr. Bland is pleased to interview Dr. Martin Blaser, who is the author of *Missing Microbes: How the overuse of Antibiotics is Fueling Our Modern Plagues*. Dr. Blaser's book is a fascinating history of the co-evolution of humans and bacteria. At the same time, it is also a cautionary tale of the ways in which modern living may be putting microbial balance at risk. Dr. Bland considers this topic to be of key importance in his ongoing discussion of the gastrointestinal-associated immune system and its influence on systemic health.

Clinician/Researcher of the Month

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Dr. Martin Blaser has studied the role of bacteria in human disease for more than 30 years. At NYU, he is the director of the Human Microbiome Program and is the Muriel and George Singer Professor of Translational Medicine. As both a physician and a microbiologist, Dr. Blaser has an extensive publication record. He is interested in understanding the relationships between persistently colonizing bacteria and health, and much of his research has focused on human pathogens, including *Campylobacter* and *Helicobacter pylori*. Over the last decade Dr. Blaser has been actively studying the relationship between the microbiome and conditions such as asthma, obesity, diabetes, and allergies. This work has led to his hypothesis that the overuse of antibiotics, Caesarian sections, and antiseptics has permanently changed our microbiome and has caused an increase in modern diseases, which is the topic of Dr. Blaser's 2014 book, *Missing Microbes: How the Overuse of Antibiotics is Fueling Our Modern Plagues*.

As they begin their discussion, Dr. Blaser explains that he wrote *Missing Microbes* to acquaint the general reader—not just scientists—with the relevant history of microbiology. The book features a string of interesting stories, many of which come from Dr. Blaser's personal experiences with his patients. The book includes not only important facts related to the human microbiome, but it also branches into important related topics, such as the longtime sub-therapeutic use of antibiotics in animal feed to enhance weight gain.

Every person carries a unique "zoo" of microbes. These personal ecosystems used to be very diverse, but evidence is accumulating that this diversity is decreasing—that microbes are being lost at what Dr.

Blaser describes as an alarming rate. This is a central topic of both his book and his discussion with Dr. Bland. He uses the story of *Helicobacter pylori* as an example to illustrate some of his points. Further, he describes his thoughts about *why* microbes are disappearing.

Can anything be done? This question is, of course, part of the conversation. Dr. Blaser provides his suggestions for steps that can be taken while further study is conducted. He is actively working on several areas of research in his own lab. One study that he has recently published was a comparative analysis of different types of antibiotics (specifically, beta lactams versus macrolides) to determine if certain classes of antibiotics are more "friendly" to the microbiome than others. Dr. Blaser suggests that a new class of narrow spectrum antibiotics—those targeted to specific uses—is an area of research that should be pursued.

At the close of their discussion, Dr. Bland asks Dr. Blaser about the reception his book has received. Dr. Blaser is very encouraged by the interest in the microbiome he has witnessed among both professionals and the lay public. He feels that people are very interested not only in their own health, but in the health of their children and grandchildren. The microbiome appears to be a topic that is resonating with people throughout the world. REF #1-4

Issue Summary

Following this month's interview, Dr. Bland expands upon some of the concepts he discussed with Dr. Blaser. In particular, he focuses on the role the birth process and dietary exposures during the first year of life have on the colonization of the microbiome. He cites and comments on the work of Dr. Wendy Walker, who heads the Mucosal Immunology Laboratory at Massachusetts General Hospital and Harvard Medical School. From there he discusses an article published in *Science* magazine in 2013 that he feels illustrates how influential the microbiome can be on systemic health. The title of the study is "Gut Microbiomes of Malawian Twin Pairs Discordant for Kwashiorkor." In this paper researchers describe a situation in which twins are raised in the same environment and consume the same diet and yet have very different gut microbiota. They were examining twin pairs in which one twin—the twin with low diversity in the gut—developed kwashiorkor, a condition historically associated with protein malnutrition. Dr. Bland feels this study suggests that there is a strong correlation between the microbiota of an infant and their developmental patterns into childhood. Dr. Bland goes on to discuss a number of additional articles, including the research of Dr. Wendy Garrett of the Harvard School of Public Health, who has been investigating the role of the microbiota on cancer susceptibility. REF #5-12

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