HOW ANTIBIOTICS AND CAESAREANS ARE CONTRIBUTING TO OUR MODERN PLAGUES

At the beginning of 2014 a book described as “a critically important call to arms about the harmful effects of some of our most revered modern medical practices” was published. “*Missing Microbes*” is a compelling account of the discovery of antibiotics, which ushered in a golden age of medicine, and how our subsequent overuse of these seeming wonder drugs has contributed to the loss of microbial diversity on and within our bodies which is now exacting a terrible price on our health. (1)

Author Dr Martin Blaser has spent more than 30 years studying the role of bacteria in human disease. In his book he explains how disturbing the natural balance of what he calls the human microbiome is affecting common conditions such as obesity and diabetes, long thought of as primarily nutrition and lifestyle related problems. He points the finger at two major medical practices – the overuse of antibiotics and the rising rates of caesarean sections – which are behind what he calls our modern plagues: obesity, childhood diabetes, asthma, hay fever, food allergies, oesophageal reflux and cancer, celiac disease, Crohn’s disease, ulcerative colitis, autism and eczema.

The studies undertaken by Dr Blaser and others have shown how antibiotic use during early childhood poses a huge risk to long-term health. He points out that American children receive on average 17 courses of antibiotics before they are 20 years old. At the same time, caesarean sections are depriving babies of important contact with their mother’s microbiomes which is resulting in life-long challenges to babies’ health.

In the first seven chapters of his book, Dr Blaser introduces the reader to the fascinating world of microbes, particularly those that are found in humans. He describes how the human body is an ecosystem which is composed of an estimated 30 trillion human cells, as well as being host to more than 100 trillion bacterial and fungal cells, the friendly microbes that have co-evolved with our species. This means that 70–90% of all cells in the human body are nonhuman. Collectively these bacteria weigh about 1.5 kilos and represent about 10,000 distinct species. They reside on every inch of the skin, in the mouth, nose and ears, in the oesophagus, stomach and especially in the gut. Women also have a rich assortment of bacteria in the vagina.

The microbes that make up each person’s unique microbiome are generally acquired early in life. By the age of three, the populations of microbes in children resemble those of adults. Together, they play a critical role in immunity as well as the ability to combat disease. It is each person’s microbiome that keeps them healthy. But now parts of it are disappearing.

Without these ancient bacteria we would not survive for very long because they carry out many metabolic and protective functions. In other words, they work for us in a myriad of mysterious and amazing ways that modern science has only just begun to understand. The development of the human microbiome begins at the moment of

birth, and continues to develop in the first few years of life by acquiring ever more microbes from the people around the growing infant.

The impact of caesarean sections

Chapter 8 of this fascinating story of the role of microbes is entitled “Mother and Child” and it is this chapter that reveals the huge impact that being born by a caesarean section has on the baby.

Throughout the animal kingdom, mothers transfer microbes to their young while giving birth. For millennia, mammalian babies have acquired founding populations of microbes by passing through their mother’s vagina. Dr Blaser explains how this important “microbial handoff” is a critical aspect of infant health in humans. “Today it is in peril,” he says.

Dr Blaser describes how microbes play a hidden role in the course of every pregnancy. As the baby grows, the mother’s breasts and uterus begin to enlarge. Simultaneously, and invisibly, the microbes in the mother’s intestinal tract begin to stir. During the first trimester, certain species of bacteria become over-represented while others become less common. By the third trimester, just before the baby is born, even greater shifts occur. These changes, involving scores of species, are not random. Experiments have revealed that many physiological and pathological features of pregnancy are controlled, at least in part, by the mother’s resident microbes which evolved to help her and themselves. When food is in short supply during pregnancy, as has often occurred in human history, the mother’s microbes will shift their net metabolism so that more calories flow from food to her body.

Dr Blaser believes that these shifts in microbial composition may be partially responsible for the extra pounds that women gain during pregnancy as well as for the increased sugar or glucose levels that commonly occur during pregnancy. “It makes sense; mothers store more energy to optimize the success of their newborns” he writes. One consequence of this process is that some women develop gestational diabetes. They can’t deal with the extra weight without stressing their systems. Most of the time, the problem is mild and resolves within weeks following the birth of the baby.

As microbes in the mother’s intestinal tract are storing up energy, another population of microbes – those in her vagina – begin to shift as well. They, too, are preparing for the baby’s birth.

Women of reproductive age carry bacteria, primarily lactobacilli, which make the vagina more acidic. This environment provides a hardy defence against dangerous bacteria that are sensitive to acid. During pregnancy these lactobacilli flourish and predominate, crowding out other resident species and potential invaders, all the while gearing up for the main event – birth. Dr Blaser suspects that microbes also have a role to play in exactly when a mother goes into labour.

When the mother’s waters break a rush of fluid pours into her vagina, sweeping up bacteria as it flows out of her body onto her thighs. The fluid that is now dominated by lactobacilli rapidly colonises the mother’s skin. As labour progresses the germ-

free baby gets ready to emerge, and as s/he comes down the vagina every surface of the baby's skin comes into contact with the lactobacilli and various other microbes.

Once the baby is born, it instinctively reaches for the mother's nipple and begins to suck. The birth process introduces lactobacilli to the first milk that goes into the baby. This interaction could not be more perfect. Lactobacilli and other lactic acid-producing bacteria break down lactose, the major sugar in milk, to make energy. The first form of breast milk, colostrum, also contains protective antibodies.

"The choreography of actions involving vagina, baby, mouth, nipple, and milk ensures that the founding bacteria in the newborn's intestinal tract include species that can digest milk for the baby. These species are also armed with their own antibiotics that inhibit competing and possibly more dangerous bacteria from colonising the newborn's gut. The lactobacilli, which bloom in the mother's vagina at the end of pregnancy, become the earliest organisms to dominate the infant's formerly sterile gastrointestinal tract: they are the foundations of the microbial populations that succeed them. The baby now has everything it needs to begin independent life," Dr Blaser writes.

When the baby is born by caesarean section there is no "microbial handoff" from mother to child. The baby is not colonised by its mother's lactobacilli, and those first microbial residents which provide signals that critically interact with cells in the rapidly developing baby's body are therefore very different.

Several decades ago *Scientific American* published a study that revealed that babies born by caesarean section were far more susceptible to respiratory infections and breathing difficulties during childhood, but why this was so remain-ed a mystery until quite recently. A number of studies published over the past few years have now revealed that not only are caesarean-born babies at increased risk of childhood eczema and asthma, they are also more vulnerable to allergies and are more likely to have diarrhoea during their first year of life. (2) Their chances of being allergic to cow's milk are twice as high as babies born normally.

In his chapter on "Solutions" Dr Blaser states that health providers are slowly starting to wake up to the need for change, and predicts that doctors will become more cautious about advocating for caesarean sections as the evidence continues to emerge about the life-long consequences of obesity, asthma, allergies, juvenile diabetes and even autism that can be attributed to being born by an elective caesarean section.

"Our ancient resident microbes are there for a reason; that's how we evolved. Everything that changes them has a potential cost to us. We have changed them plenty. The costs are already here, but we are only just beginning to recognize them. They will escalate," Dr Blaser warns. The rising rates of caesarean section and the overuse of antibiotics, especially in children, are two key practices at the core of modern health care. Both need to be urgently curtailed as their unintended consequences are endangering our children.

"*Missing Microbes*" is a book that every obstetrician, paediatrician and GP should read. As the world rapidly heads towards what Dr Blaser calls an antibiotic winter, this book is a much needed wake-up call.

References

1. Martin J Blaser. "*Missing Microbes*." Published by Henry Hold & Co. 2014.
2. http://www.henryford.com/body.cfm?id=46335&action=detail&ref=1829