

Assessing the ‘sterile womb’ and ‘in utero colonization’ hypotheses

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Video Abstract

Keywords: Sterile womb, In utero colonization, Microbiome, Placenta, Contamination, Axenic animals

Posted Date: November 20th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-112864/v1>

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Abstract

Research is increasingly showing the impact of the microbiome – the diverse microbial communities living within the gut – on human health. But, *when* and *how* is the microbiome established? Two opposing hypotheses have been put forward. For over a century, the prevailing thought has been that the human fetal environment is sterile and that microbes are acquired during and after birth. If this view is correct, the microbiome of infants born via C-section should differ from those born vaginally. Recent studies using molecular techniques, however, suggest that bacterial communities may be present in the placenta, amniotic fluid, and the baby's first stool. They posit that the acquisition of the gut microbiome, therefore, begins *in utero*. If this is the case, delivery method should have less of an effect on early microbiome assembly. So, does this new research represent a paradigm shift? Do we need to rethink the way the microbiome is established, and adjust our views on clinical practices accordingly? Not so fast, warns a recent review of the literature published in the journal *Microbiome*. A team of Canadian and American researchers set out to critically assess the literature that tested both hypotheses, which dates back more than 100 years. Placental and fetal characteristics such as anatomical, physical, and immunological barriers were considered, as well as research methods and the interpretations of the scientific findings. The researchers concluded that recent studies do not support colonization in utero as the methods used were insufficient to accurately characterize low-density bacterial populations and are susceptible to contamination. Additionally, they point out, the fact that germ-free animals can be derived from a wide variety of mammalian species through C-sections provides strong experimental evidence for the absence of microbes in the fetal environment. This assessment led the researchers to the conclusion that the original assumption of a 'sterile womb' is still valid and that there is currently little evidence that would warrant challenging this paradigm. The authors therefore argue clinical decisions regarding delivery method should remain unchanged and funding priorities should be steered away from studies attempting to further characterize hypothetical *in utero* bacterial communities. Instead, future research should focus on furthering our understanding of how lifestyle and environmental factors impact microbiome assembly early in life and how this relates to human health.