The power of mommy's bacteria

A research study on the transmission of maternal microbiome provides the basis to better understand its impact on children’s health. The research - featured on the cover of “Cell Host and Microbe” - is coordinated by a team of Cibio researchers of the University of Trento with Santa Chiara Hospital in Trento.

Trento, 11th July 2018 – Every human being carries a double set of personal information: a genetic heritage, which is passed on to us from our parents, and a unique microbiota, a set of bacteria, viruses and fungi that inhabit our body. Maternal bacteria and other microorganisms are passed on directly to the child during the first instants of life, in the different stages of natural delivery, and subsequently with breastfeeding and skin-to-skin contact. These bacteria seem more persistent than others in the infant. These findings are revealed in an article that has just appeared in “Cell Host and Microbe”. The news made it to the cover of the scientific journal, where a mother is portrayed holding a large umbrella to protect her child from unwanted microorganisms, symbolizing the mother-child transmission.

The study, funded by Fondazione Caritro and coordinated by a research team of the Centre for Integrative biology (Cibio) of the University of Trento with Santa Chiara Hospital in Trento (which has been reconfirmed as a “Baby Friendly Hospital” under the WHS-UNICEF initiative), demonstrates the transmission of various microorganisms from mother to child in the first days and months of life. The researchers mapped the transmission of microbiome by using, among others, new computational solutions, and have shown how bacteria from the mother are more likely to colonize newborns compared with bacteria from other sources like the surrounding environment. “Our study provides the foundations for a better understanding of the microbiome acquisition process, its impact on the child’s health and the role of natural childbirth, breastfeeding and skin-to-skin contact” explained Nicola Segata, research study coordinator and head of the Laboratory of Computational Metagenomics at Cibio.

The study involved 25 mother/child couples recruited and sampled by the departments of Obstetrics and Neonatology of Santa Chiara Hospital in Trento starting in 2014. Segata recalled how the study was carried out: “At the hospital, we collected microbiome samples from different body sites (skin, tongue, faeces and vagina) of the mothers before they gave birth, and of the newborns (faeces and tongue). Then we examined the samples to identify and map microorganisms, and their transmissions from mother to child, by using metagenomics and bioinformatics”.

What have we found out? “First of all, we have established that all the microbiomes we have sampled from the different body sites of mothers have a direct influence on the development of the infant’s microbiome. Infants acquire microorganisms from other sources too, but we have found out that maternal microorganisms are more persistent in the newborn compared to microorganisms acquired in other ways, from
other sources. This opens very interesting scenarios because the preference for maternal microorganisms in infants may suggest that there is a co-evolutionary mechanism that has remained largely unexplored so far”. Another intriguing aspect is that some of the bacteria that are passed on from mother to child belong to unknown bacterial species: “It is crucial to characterise these unknown bacteria through targeted experiments to understand their specific role in the child’s health”, added first author Pamela Ferretti, previously at Cibio and now at the European Molecular Biology Laboratory (EMBL).

The study opens new perspectives, continued Segata. “Now that we have learned which microorganisms pass from mother to infant and how they do it, we want to better understand their impact on the child’s health. For example, how the transmission of maternal microbiome is affected by factors like C-section delivery, no skin contact between mother and child in the first instants of life, and feeding with infant formula. In the future it may be possible to provide children with the microorganisms that they have not received from their mothers for one of the above reasons. This may help improve the health and wellbeing of children”.

The article, entitled “Mother-to-infant microbial transmission from different body sites shapes the developing infant gut microbiome”, involved international collaboration from 45 people from 10 universities and health centres. Cibio participated with Pamela Ferretti, currently predoctoral fellow at EMBL and first author of the study, professor Nicola Segata, project’s head and coordinator, and six other members of the Laboratory of Computational Metagenomics. The paper was co-authored by 16 members of the Provincial Healthcare Services who have coordinated and performed the sampling at Santa Chiara Hospital in Trento. The same members of Cibio have also co-authored a study which was published in the same journal confirming the results achieved by a complementary analysis carried out in the laboratories of Harvard and of the Broad Institute in Boston.

The paper is available here: https://doi.org/10.1016/j.chom.2018.06.005