Babies, Bacteria and Breast Milk: Genome Sequence Reveals Evolutionary Alliance

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(PhysOrg.com) -- As every parent discovers, human babies are bubbling, burping processing plants that take in milk, extract compounds useful for rapid growth and development, and unceremoniously excrete the byproducts. Those babies' guts are full of helpful bacteria, and a new study shows how humans and bacteria evolved together.

Scientists have known for some time that a certain subspecies of bacteria quickly colonize the gastrointestinal tracts of breast-fed infants, playing an important role not only in the digestive process but also in keeping out harmful microorganisms. Interestingly, these beneficial bacteria, known as Bifidobacterium longum supsp. infantis, feed on specific sugars in human milk that are nutritionally of no use to the baby.

In hopes of better understanding the molecular mechanisms and networks that make possible this functional alliance between the baby, the bacteria and the mother's milk, a team of researchers, led by scientists at the University of California, Davis, recently published a sequencing of the genome — an analysis all of the genes and related DNA — of B. longum subsp. infantis.

Through sequencing the genome, the researchers identified gene clusters that appear to equip these bacteria to make use of the sugars in human breast milk.

They also identified another cluster of genes that control production of enzymes that enable the bacteria to capture milk-borne urea — an

important source of nitrogen — from the baby's bowel. This recycling of the urea to salvage nitrogen is significant because the protein concentration in human breast milk is often too low to supply all of the nitrogen needed for the rapid growth of a newborn baby.

"In short, the genome sequencing revealed that the relationship between B. longum infantis, its infant host and human breast milk is a fascinating example of co-evolution," said David Mills, a UC Davis microbiologist and lead author on the study, which was published in the Dec. 2 issue of the *Proceedings of the National Academy of Sciences*.

"It is obvious that human milk has been evolutionarily refined through the millennia to retain highly beneficial properties," he said. "The result is a fluid that is so valuable to the infant that it more than justifies the energy costs to the mother to produce it."

Collaborating with Mills were researchers from UC Davis; the U.S. Department of Energy's Joint Genome Institute in Walnut Creek, Calif.; and the U.S. Department of Agriculture's National Center for Agricultural Utilization Research in Peoria, Ill.

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