

## **Lactation and milk as a model for scientific research and innovation on diet and health**

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Solving the problems of food production, food safety, nourishment and sustainability will require a much more detailed understanding of the complex interplay between human health and food. In effect agriculture must move from the simplifying reductionist principles of chemistry to the integrative principles of biology. Fortunately, many of biology's valuable principles learned under the relentless pressure of Evolutionary selection are encoded in life's genomes. As life sciences interrogate organisms in genomic detail, lactation and its remarkable product, milk provide unique insight into the evolution of animals and their food. Most organisms evolved in part to avoid being eaten. Agriculture's success has been to select and process commodities into safe, stable and delicious foods. Agriculture's challenge now is to enhance their nutritional quality and the question is how? The Rosetta stone of food and nourishment is mammalian lactation and milk. Milk as a complete and comprehensive diet is the product of 200 million years of symbiotic co-evolution between a mammalian mother and her infant. All of the tools of modern science from genomics to molecular anthropology can now be leveraged to understand this remarkable process. Molecular insights from sugars to oligosaccharides, proteins to encrypted peptides, structures from globules to micelles, intact cells from stem cells to immune cells represent just the first wave of discoveries of how complex and functional components can be in the diet. In parallel with discoveries of nutritional targets and component bioactivities are new insights into principles of sustainability. The complex competition between maternal cost and infant benefit for milk's resources are a vivid model for cost versus benefit relationships. Mothers literally recruit a unique group of bacteria to populate their baby's intestine and provide them a selective food source, complex oligosaccharides, to keep them and their baby 'happy'.