Nutrition and heredity are genetically linked

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A challenging goal in biology is to understand how the principal cellular functions are integrated so that cells achieve viability and optimal fitness under a wide range of nutritional conditions. Scientists from the French research centers INRA and CNRS showed by genetic approaches that, in the model bacterium Bacillus subtilis, central carbon metabolism (which generates energy from nutrients) and replication (which synthesizes DNA), two key functions in the fields of nutrition and heredity, are tightly linked.

The results appear in the May 16th issue of the online, peer-reviewed, open-access journal PLoS ONE.

The discovered link involves the activity of a small region of the central carbon metabolism (the terminal reactions of a process called glycolysis that burns sugars) and several enzymes of the replication machinery that synthesizes DNA. It is proposed that the link depends on metabolic signals generated as a function of the activity of the terminal reactions of glycolysis which are sensed, directly or indirectly, by replication enzymes. This system would then adjust the speed of DNA synthesis and the stability of the replication machinery to the nutritional richness of the environment, and thus to the cell's growth rate.

These results, along with those integrating metabolism and, for instance, transcription, apoptosis and nervous flux, suggest that the central carbon metabolism plays a global regulatory function to adjust the activity of principal cellular functions to the richness of the available nutrients. This non metabolic function may explain why several enzymes of the central carbon metabolism are essential and strongly conserved in living organisms.

In addition to its fundamental interest, the metabolism/replication link may be of medical importance as early events in carcinogenesis, which generally include an up-regulation of glycolysis (the Warburg effect) and a decrease in DNA stability and replication fidelity, may involve perturbations of the metabolism/replication link.

Source: Public Library of Science