Physiological and molecular consequences of divergent selection for basal metabolic rate (BMR) in laboratory mice

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A key assumption of BMR variation is its functional link with major eco-physiogical traits. To test this assumption, we studied the responses of long-term divergent selection on BMR in laboratory mice. On the organismal level, selection resulted in substantial between-line differences, with high BMR (H-BMR) mice having a higher energy consumption rate, digestive efficiency and spontaneous locomotor activity. H-BMR mice also produce more and better quality milk, which results in higher postnatal growth rates. They, however, have a shorter lifespan than that of the low BMR (L-BMR) mouse line. On the organ/tissue and cellular level, H-BMR mice have larger metabolically active internal organs (small intestines, liver, kidneys and heart), but smaller immunocompetent organs (thymus). H-BMR mice are also characterized by smaller erythrocytes, but have higher total white cell and anti-KLH antibody counts. In contrast, their cell membranes have a low proportion of fatty acids. The results of our selection experiment show that BMR variation reflects a profound and multi-faceted diversification of major structural and functional traits.