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Perspectives

PERSPECTIVES

Ain't No Sunshine When They're Gone: Rendering the Gut Microbiota "Homeless" by Cecectomy Reveals Their True Thermogenic Potential

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A Perspective on "Gut Microbiota Represent a Major Thermogenic Biomass"

It is now widely accepted that perfect symbiosis between the human body and the vast bacterial colonies must exist for the mutual benefit of both. For example, the bacteria present on the skin and mucosa can fight infections and aid in the wound healing process,[1] while the commensal microorganisms provide the host with essential nutrients by metabolizing indigestible compounds.[2] In turn, the host provides their microscopic allies with a favorable environment that fosters growth and prosperity and consequently promotes the homeostasis of the host.[3] This symbiosis is a fragile and delicate relationship, shaped by evolution of coexistence.[4] Humans are born virtually sterile, although this remains a topic of a heated debate, and our interaction with the microbiota from early life to adulthood helps shape our immune, cardiovascular, GI, and nervous systems, and all types of behavior—physiological, psychological, and social. Environmental and dietary changes that impact the abundance and fitness of our microscopic symbionts can result in dysbiosis that has shaped the new frontiers in medical research.[5,6] Considering that human genetic mass constitutes only 4% of the total hologenome, manipulation of bacterial species for the benefit of the human host in health and disease is long overdue.

This is no less true in the case of intestinal microbiota, which, according to the NIH Human Microbiome Project, contributes to approximately 1% of an adult human's body mass, and to over 10 million genes of the total human hologenome. While many studies have demonstrated the ability of the gut bacteria to instruct the feeding and metabolic behavior of the host, Grobe et al.[7] introduce a new concept that the large mass of gut bacteria may also contribute to the total daily energy turnover of the host. Taking into consideration the diversity of gut microbiota that may exist in lean and obese states of the host, Grobe and colleagues go on to postulate and then elegantly show in a mouse model that the gut microbiota may contribute to approximately 8% of daily energy flux, disproportionally to its 1% contribution to the total biomass of the host.[7] This means that even the relatively minor reductions in anaerobic energy flux by the gut bacteria could greatly contribute to and perhaps even account for the excess calorific values leading to human obesity. This logical but groundbreaking concept identifies the gut microbiota as a thermogenic "organ" with a potential to become a new therapeutic target in energy management disorders resulting from a wide range of conditions from famine to obesity.

Aside from highlighting the novel thermogenic role for gut microbiota in regulation of host energy balance,[7] this fascinating study underscores the current technical shortcomings when attempting to measure it. Gut bacteria exist in anoxic environment thus rendering the existing in vivo respirometry methods ineffective. Grobe and colleagues attempt to overcome this by employing two separate methods of calorimetry in combination with surgical and pharmacological interventions to assess the contribution of the gut microbiota to the total energy flux of the

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host.[7] In this context, it is worth noting that a more precise and direct in vivo measurements of anaerobic metabolic function and thermogenesis in conscious intact animal models need to be developed to push this research forward. Only then will we be able to move toward development of potential therapies that will leverage manipulation of gut microbiota for conditions characterized by energy imbalance. Despite this, the logical conclusions by Grobe et al.[7] are based on sound quantitative methodology and usher new thinking on the gut microbiota as a target for disorders caused by imbalances in energy distribution between the host and its microbiota.

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Conflict of interest statement

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