

Engineering Approaches to Energy Balance and Obesity: Opportunities for Novel Collaborations and Research

Report of a Joint National Science Foundation and National Institutes of Health Workshop

Abby G. Ershow, Sc.D.,¹ Alfonso Ortega, Ph.D.,² J. Timothy Baldwin, Ph.D.,¹ James O. Hill, Ph.D.³

Abstract

Energy balance disorders account for a large public health burden. The obesity epidemic in particular is one of the most rapidly evolving public health problems of our day. At present, two-thirds of American adults and one-sixth of American children and adolescents are considered either overweight or obese. Public health concern about obesity is high because of the increased risk and increased mortality of cardiovascular disease, Type 2 diabetes, many forms of cancer, gallbladder disease, and osteoarthritis. These risks increase with the severity of the obesity. Excess adipose tissue, representing fat storage, ultimately derives from an imbalance between energy intake and energy expenditure. Conversely, undesirable and inadvertent loss of body weight and muscle mass, as seen in aging and cachectic states of chronic diseases such as heart failure and cancer, have serious clinical and functional consequences without satisfactory clinical or behavioral solutions. Innovative engineering technologies could help to address unresolved problems in energy balance, intake, and expenditure. Novel sensors, devices, imaging technologies, nanotechnologies, biomaterials, technologies to detect biochemical markers of energy balance, mathematical modeling, systems biology, and other approaches could be developed, evaluated, and leveraged through multidisciplinary collaborations. Engineers, physical scientists, and mathematicians can work with scientists from other relevant disciplines who possess expertise in obesity and nutrition. Furthermore, the possibility of re-engineering the “built environment” to encourage higher levels of physical activity has been suggested as another promising and important approach to which engineers can contribute (see <http://www.obesityresearch.nih.gov>). Ultimately, systematic application of the “Engineering Approach” can help in developing the needed technologies and tools to facilitate research and eventually support therapeutic advances and behavioral change. This article summarizes important public health concerns related to disordered energy balance and describes research priorities identified at a recent National Science Foundation-National Institutes of Health workshop. Research funding opportunities are described as posted on the NIH Guide to Grants and Contracts (see <http://www.nih.gov/grants/guide>).

J Diabetes Sci Technol 2007; 1:95-105

Author Affiliations: ¹Division of Cardiovascular Diseases, National Heart, Lung, and Blood Institute, National Institutes of Health, US Department of Health and Human Services, Bethesda, Maryland, ²Department of Mechanical Engineering, Villanova University, Villanova, Pennsylvania, ³Division of Human Nutrition and Department of Pediatrics, University of Colorado – Denver Health Sciences Center, Denver, Colorado

Corresponding Author: Abby G. Ershow, Sc.D., Division of Cardiovascular Diseases, National Heart, Lung, and Blood Institute, Two Rockledge Center, MSC 7956, 6701 Rockledge Drive, Bethesda, MD 20892 (Express 20817), ErshowA@mail.nih.gov