Making Sense of Our Metabolisms

Human nutrition research entered a new era in June 2000 when the full sequence of the human genome was published. Now, for the first time, nutrition scientists can determine why some people can eat all they want and never become obese, whereas others seem to gain weight just looking at food. Also, nutrition scientists can identify how individuals adjust to widely varying intakes of nutrients and remain healthy.

To address these issues, nutritionists need to conduct comprehensive studies of the effect of certain diet treatments on metabolism, physiological function, and health as well as the genetic response to those treatments. The six ARS Human Nutrition Research Centers provide a unique setting for investigators to explore some mystifying nutrition questions.

In her Food and Agricultural Policy Statement, USDA Secretary Ann M. Veneman identified the need to establish “outcome-based performance measures” for evaluating the impact of federal food assistance programs. This means that we need sensitive, precise markers of when dietary needs are met and when they are not. Such markers are not available for most nutrients. And today nutrition scientists have a whole new set of markers to test—markers of gene expression.

We’ve known for more than 150 years that organisms respond to dietary changes by changing their metabolism. Metabolic adjustments are presumably made by “sensors” responding to dietary changes in vitamin A, calcium, or selenium. These sensors have not yet been identified, so nutritionists measure aspects of metabolism that may have changed as a result of the action of the sensors. It is very difficult to detect the many metabolic adjustments that occur in the body after it’s been disturbed by a change. It is likely that sensors are products of the human genome. In other words, certain genes are turned on or off either to produce or stop producing a protein that signals a whole cascade of metabolic events.

The story on page 4 of this issue describes zinc studies at the ARS Western Human Nutrition Research Center at Davis, California. Researchers there have identified mechanisms—proteins called zinc transporters—that control the uptake and release of zinc from cells. The scientists think that these proteins are sensors to changes in dietary zinc.

We have known for decades that individuals vary in the way they absorb and use essential nutrients. The human genome provides a tool for understanding these perplexing differences. The fact that no two people are alike stems from variations of this way they absorb and use essential nutrients. The human genome provides a tool for understanding these perplexing differences. The fact that no two people are alike stems from variations of the human genome that will allow full analysis of existing and future data. In this way, ARS human nutrition research will help define new, sensitive markers of nutritional health and of the variability in nutrient requirements and function. All of this work will strengthen the basis for food and nutrition policies and recommendations in the United States.

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