Heavy Math Sheds Light on Weighty Issue

By Barry A. Cipra

For mathematical obesity expert Carson Chow, the human body looks a lot like a leaky integrator. We can gain a lot, he says, by using such a bare-bones mathematical model to look at the problem of weight control. Much of the mystery and many of the myths surrounding Americans’ expanding waistlines can be accounted for with a few simple differential equations. Unfortunately, the calculus of weight gain suggests that solving the problem may not be so simple.

Chow, a researcher in the laboratory of biological modeling at the National Institute of Diabetes and Digestive and Kidney Diseases, part of the National Institutes of Health, gave a joint invited presentation on the dynamics of obesity at this year’s side-by-side SIAM Annual Meeting and Conference on the Life Sciences, held in Pittsburgh in July. Chow led the audience through the equations of macronutrient flux, body composition, and basal metabolism, to the implications of “life on the Forbes curve” for the relation between weight and weight gain.

The basic equations start in three dimensions: Weightwise, we worry about our intake of fat, carbs, and protein. (A good way to gain weight quickly is to drink a couple large glasses of water, but that’s not the kind of weight gain anyone worries much about.) These nutrients are stored in the form of body fat $F$, glycogen $G$, and protein

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