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THERE'S METABOLISM, & THEN THERE'S METABOLISM

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When I give talks in high schools, students invariably ask about metabolism. "Why do some girls have high metabolism and can eat whatever they want, and others (with low metabolism) have to watch every calorie?"

When I talk to patients about how their body metabolizes medications, nutrients and toxins, their countenance invariably turns to quizzical. They assume that the word 'metabolize' refers to calorie burning, not disposition of the body's by-products or good and bad things that enter our bodies.

Metabolism refers to both processes and more. The prefix 'meta' denotes a change, transformation or occurrence in a series of reactions. 'Metabolism' is the sum of the physical and chemical processes in an organism (banana slugs have metabolism, too). It generates heat and energy for movement and allows us to build new tissue and replace worn out and dying cells. It is responsible for the disposition of all substances in the body, including drugs, bio-active herbs, toxins and by-products of bodily processes.

An 'anabolic' metabolic process builds up whole tissue from small components. Some examples: repairing lacerated skin, growth in childhood, the continual replacement of organ tissue as cells naturally die, making fat globules from sugar, building muscle from protein after a work-out, or growing a beer belly from alcohol.

A 'catabolic' process breaks down a large molecule or tissue into its small component parts. It contributes to the continual turnover of all our tissues. We require catabolic processes to burn food for energy and to maintain our 98.6 degree temperature. We catabolize fat, muscle, organ tissue and stored sugar (glycogen) when food is scarce, or when losing weight.

The control mechanisms for energy metabolism are different from the processes that dispose of medications. A lean person with a 'high energy metabolism' may have slow drug metabolism, and vice versa.

A host of hormones, like thyroid, cortisol, insulin, growth hormone, and sex hormones, regulate our energy metabolism. Our genetic make-up, inherited from our parents, defines the hormone patterns that affect how much we need to eat, as well as our body shape, frame size and cold and heat tolerance.

Various proteins make up the metabolic machinery that activates or disposes of vitamins, minerals (both toxic and essential ones), bioactive substances like medications and herbs, and toxins. Typically this metabolism occurs in the liver, with either complete destruction to basic elements, or disposal of partially degraded substances through the bowel or kidneys.

The liver houses the cytochrome P450 complex, one of the major systems for disposing of drugs and toxins. At least seven different P450 types degrade everything from cholesterol-lowering drugs and heart medications to antibiotics, anti-inflammatories and psychiatric medications.

Medications and naturally occurring substances turn P450 enzymes on and off, thereby influencing how rapidly drugs are metabolized. Erythromycin, nicotine and anti-seizure medications boost these enzymes to inactivate other medications (and themselves) much more rapidly. Other entities put a brake on P450 enzymes, slowing their work, so that drug levels persist at high levels. Boosting or blocking each others' clearance is how two medications may interact to create an unexpected outcome.

Grapefruit augments some medications, even to toxic levels, by inhibiting degradation by P450-3A4. St. John's Wort does the opposite, stimulating P450-3A4 activity, possibly inactivating so much medication that it doesn't work.

For some final confusion, consider that a starving anorexia nervosa patient often has high cholesterol levels. We presume this to be due to the body going into preservation mode. It doesn't waste energy on relatively unimportant metabolic processes, like clearing cholesterol.

How can you determine your metabolism? We can easily measure basal (resting) energy requirement in a pulmonary lab to get an idea of someone's energy metabolism. It takes really sophisticated techniques to estimate total (resting and activity) energy expenditure.

We really don't yet have tests for P450 activity. After taking a few medications and experiencing side-effects at very low doses, one can only guess that the clearance mechanisms are minimal in that individual. (The caveat to this approach is that humans are human, and suggestible ones who read the package insert get side effects, regardless of reality or their metabolism.