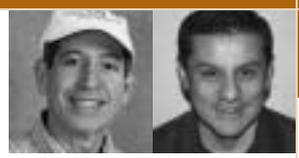
Engineering

Exercise, Diet, and Disease: Relationships Between Cellular Metabolism and Physiological Responses



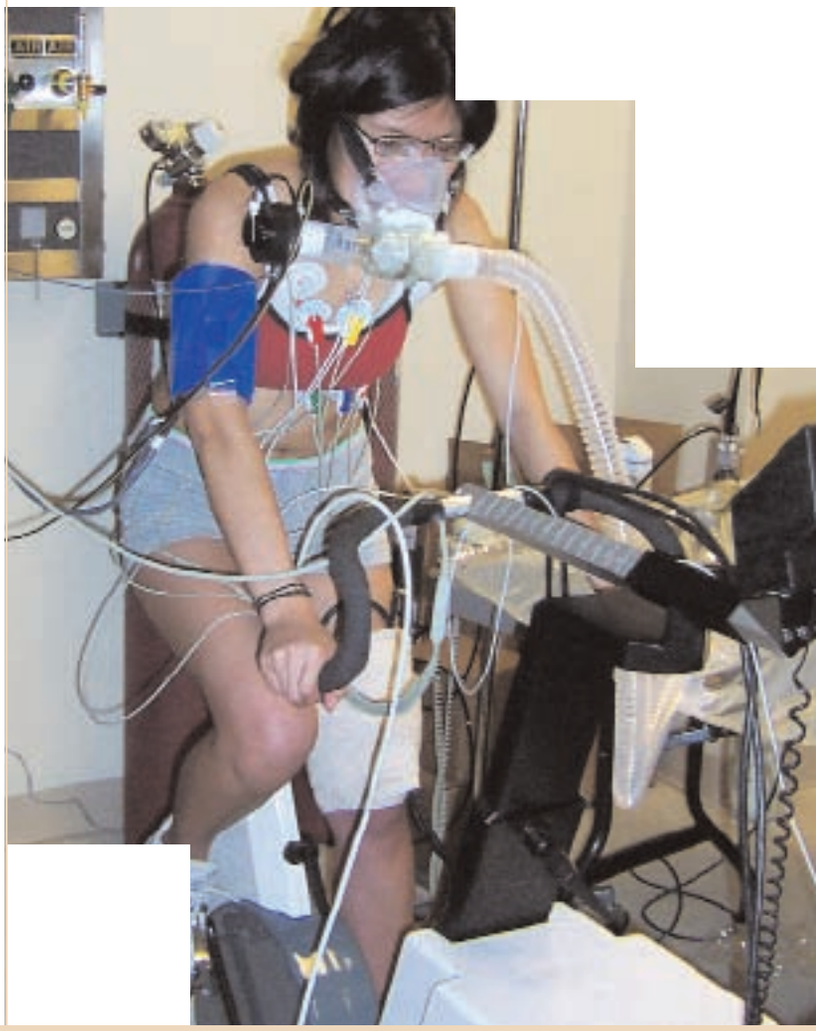
GERALD M. SAIDEL + MARCO E. CABRERA

The goal of the Center for Modeling Integrated Metabolic Systems (MIMS) is to apply computational methods for quantitative analysis of metabolic mechanisms of the heart, skeletal muscle, brain, liver and adipose tissue, as well as their integrated effects in the human body. The ultimate purpose and mission of the MIMS Center is to identify molecular targets or control points in metabolic pathways for therapeutic interventions. Using mathematical modeling and computer simulation to analyze cellular metabolism *in vivo,* research teams of the MIMS Center examine metabolic changes associated with exercise, diet, and disease. The MIMS Center is distinctive because of its multi-level, multi-scale approach to *in vivo* metabolic system dynamics. With this approach, MIMS research teams develop and apply quantitative tools to analyze complex biological mechanisms related to obesity, aging, diabetes, liver diseases, and neuro-degenerative processes.

The MIMS center achieves its goals with distinctive collaborative teams that provide tight relationships between theoretical and experimental studies. Validated MIMS models not only simulate biochemical and physiological responses, but also predict responses for which insufficient experimental data exist. Computational dynamic models allow quantitative evaluation of metabolic pathways and regulatory mechanisms under normal or abnormal conditions and in disease states. Another goal of the MIMS Center is to develop a new generation of researchers who can deal with complex systems modeling with emphasis on metabolism. The MIMS Center offers research training at the undergraduate, graduate, and postdoctoral levels associated with biomedical engineering, mathematics, biomedical sciences, and related fields.

The MIMS Center's director, **Gerald M. Saidel, Ph.D.,** professor of biomedical engineering, and associate director, **Marco E. Cabrera, Ph.D.,** associate professor of pediatrics and biomedical engineering, work with nine Center teams. These teams of four to seven participants involve 10 other key faculty collaborators and more than 20 research associates, graduate students, and staff. They come from many fields including biomedical engineering, pediatrics, physiology and biophysics, anatomy, biochemistry, molecular medicine, mathematics, and chemical engineering. These participants are associated with Case and Cleveland State University. Key investigators have research laboratories also at the University Hospitals Case Medical Center and Cleveland Clinic.

The MIMS Center is one of seven national Systems Biology Centers supported by the National Institute of General Medical Sciences, an arm of the National Institutes of Health, established to develop new methods for studying complex biological systems. "Our ability to analyze complex biological mechanisms is of critical importance because they are at the root of many serious health problems," notes Dr. Saidel.



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