

From Micro to Macro //

Molecular biologists at MGH study the intricate machinery of the cell, from the tightly coiled DNA in its nucleus to the labyrinthine, bumpy endoplasmic reticulum where proteins are made and folded, to the sugars, lipids and other waste products the cell excretes. The ultimate goal: to deepen understanding of how these complex components work to maintain or disrupt human health. With this knowledge, therapies can be developed to treat diseases at the cellular level.

Regulating Protein Production

Gary Ruvkun and colleagues discovered small strands of RNA called microRNAs that are responsible for turning genes on and off, ultimately regulating which proteins are produced. In the cytoplasm, microRNAs act upon ribosomes to regulate protein production. Ruvkun is using RNAi screening techniques to reveal the genes involved in a pathway that regulates aging and life span.

Chromosome Protectors

Jack Szostak contributed to the discovery that the tips of chromosomes—telomeres—in the cells of organisms ranging from yeast to humans are repaired by an enzyme called telomerase, which protects the chromosome ends much as the plastic sleeves on shoelace tips keep them from fraying. Shortened telomeres have been linked to both cancer and aging. Researchers studying telomerase hope to find ways to detect and treat cancer and perhaps even influence aging.

The Cell's Metabolites

Cardiologist Robert Gerszten and his team study the lipids, fatty acids, sugars and other molecules that are by-products of cell metabolism. Cholesterol is one metabolite that is already widely used in medicine, but others—including metabolites generated by diabetes and exercise—are being studied for clues about the cell processes that produce them.

The Genome's Packaging

Chief of molecular biology Bob Kingston and his group are examining how the genome is packaged, and how that packaging works to "silence" genes when they're not needed. Researchers hope eventually to manipulate that packaging to enable therapeutics to treat developmental defects, cancer and diabetes.

