The Cellular Immune System as a Gene-Prediction Resource

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One of the major obstacles to gene prediction remains the ability to demonstrate *bona fide* expression in the cell, at both the mRNA and protein levels. Here we demonstrate how the apparently unrelated field of cellular immunology can aid in gene detection and in the confirmation of otherwise hypothetical genes and proteins. The cellular immune system presents, via major histocompatibility complex (MHC) class I molecules, short peptides that are the degradation products of both foreign and self-proteins expressed in the cell. In uninfected cells, these peptides can be viewed as the remnants of translated gene products, providing leads to their source genes. A database of hundreds of individually sequenced peptides eluted from MHC molecules has been organized and is publicly available. We carried out a comprehensive search comparing these peptides to all accumulated human sequence data. These were in the form of proteins, mRNA, expressed sequence tags (ESTs), and human protein and mRNA predictions. Our findings illustrate how these peptides are informative for the identification of new genes, for hypothetical gene verification, for verifying gene expression at the protein level and for supporting splice junctions.