Basic research in signal transduction: applications to biotechnology.

David W. Litchfield, Ph.D.

The reversible phosphorylation of proteins is a major mechanism that controls many fundamental cellular processes. Emphasizing the widespread involvement of protein phosphorylation in biological regulation is the fact that the human genome encodes more than 500 protein kinases that catalyze the phosphorylation of specific proteins within cells. Furthermore, several protein kinases have been implicated in human diseases such as cancer, heart disease, neurodegeneration and immune disorders. Consequently, the protein kinase family of enzymes has attracted attention both for basic research directed towards an elucidation of specific biological events and for applied research as potential therapeutic targets. An important proof of concept in the field is the demonstration that Gleevec, a protein kinase inhibitor that selectively targets the Bcr-Abl gene product, can be used effectively for the treatment of chronic myelogenous leukemia. In an effort to replicate the success of Gleevec, detailed investigation of protein kinases and their contributions to human disease has intensified in basic and applied studies. While high throughput analysis and the screening of proprietary compound libraries has traditionally been the domain of the large pharmaceutical companies, there are numerous opportunities for basic research to make contributions to biotechnology. These contributions range from the development of reagents (i.e. antibodies, assay kits etc.) that can be commercialized to facilitate basic and clinical research to the implementation of innovative model systems and/or complex assays that are necessary for validation of therapeutic targets. Technological advances in fields such as genomics, proteomics and bioinformatics have also accelerated the pace of discovery and provided additional opportunities for new ventures in biotechnology.