

## **Principles and Tools used in the design and implementation of Biomedical Ontologies**

The lack of medical data categorization and the difficulties associated with the integration and validation of medical data records have been two prevailing problems resulting from the continual surge in the amount and formatting complexity of medical data records. The lack of well-defined categorization of medical data has been a direct result from the deprivation of standardized definitions and classification of medical terminologies. On the other hand, data integration has been a major problem due to the diversity of medical data formats and the immense variety of data storage media and interfaces.

We will address the above two problems and show how recent developments in medical ontologies can provide efficient solutions to both problems. We review available medical ontologies and discuss their benefits, use, and limitations. In addition to reviewing major ontology tools, we provide information regarding available resources to design and implement ontology libraries in the field of medical informatics. We also show how to integrate new medical datasets into existing medical ontologies. Our discussion will be driven by the use of ontology tools to find independent parameters related to major human diseases and the efficacy of treatment. We show how ontology tools can be used to provide advanced analysis of immune responses to infections and vaccinations, and to provide a cohesive approach to describe the coordinated and integrated immune system.