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Applications of the Vaccine Ontology (VO) in vaccine data integration and computer-assisted automated reasoning

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Abstract

A biomedical ontology is a set of terms and relations that represent entities and relations between these entities in a specific biomedical domain. Biomedical ontologies support biomedical data exchange, integration, and advanced data analysis. Developed using the Web Ontology Language (OWL), the Vaccine Ontology (VO) is a community-based biomedical ontology in the domain of vaccine and vaccination. Currently VO includes over 3,000 vaccine-associated terms. VO represents all licensed human vaccines in the USA and Canada, all licensed veterinary vaccines in the USA, and over 1,000 vaccines under clinical trials and research. VO also includes those microbial genes and proteins that have been used for vaccine development. The relations between these genes and proteins and various vaccines are logically defined. VO integrates vaccine data stored in the comprehensive VIOLIN vaccine database and analysis system. VIOLIN also uses VO to integrate different types of VIOLIN data curation, storage, and analysis. Through the linkage between VO and existing ontologies, vaccine data can seamlessly be analyzed. For example, the gene and protein data stored in VO are linked to NCBI taxonomy, NCBI RefSeq and Gene databases, and MeSH/PubMed systems. These linkages allow advanced analysis of vaccine-associated genes and proteins. Currently VO and RDF-based Linked Open Vaccine Data (LOVD) system is under development. LOVD and SPARQL-based Semantic Web technology will allow the integration and query of various vaccine data from different resources. Case studies will be introduced to demonstrate the power of the VO in advanced data integration and analysis.

Biography

Dr. Yongqun “Oliver” He is an associate professor in the University of Michigan Medical School. Dr. He is experienced in both vaccinology and computer sciences. His primary interests are host-vaccine interaction mechanism analysis, vaccine development, computational vaccinology, and bioinformatics. His group has developed many vaccine informatics programs including the VIOLIN vaccine database and analysis system and Vaxign vaccine design program. Dr. He initiated and leads the development of the community-based Vaccine Ontology (VO). Dr. He has published over 50 peer-reviewed papers and is an editorial board member of several journals.