

VO: Vaccine Ontology

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Abstract

The collaborative, community-based Vaccine Ontology (VO) was developed to promote vaccine data standardization, integration, and computer-assisted reasoning. Currently VO covers a variety of aspects of the vaccine domain, with an emphasis on classification of vaccines and vaccine components, and on host immune response to vaccines. VO can be used for a number of applications, e.g., ontology-based vaccine literature mining through collaboration with the National Center for Integrative Biomedical Informatics (NCIBI).

Introduction

Vaccination is the most important invention to prevent various diseases and improve public health. With extensive vaccine research and clinical usages, it has become challenging to standardize vaccine annotation, integrate information about varied vaccine types, and support computer-assisted reasoning. To address this challenge, we developed the community-based Vaccine Ontology (VO; www.violinet.org/vaccineontology).

Results of VO development

As of June 8, 2009, VO contains 1802 classes, 192 object properties, and 13 datatype properties. Among these terms, 934 classes and 19 properties are assigned VO-specific IDs. In addition, VO includes 38 classes from the Basic Formal Ontology (BFO; www.ifomis.org/bfo) as upper-level framework, 24 terms from Relation Ontology (RO), 37 classes from Ontology for Biomedical Investigation (OBI), and many terms from other ontologies. VO development follows the OBO Foundry principles (obofoundry.org/crit.shtml).

VO has defined ‘vaccine’ as a ‘processed material’ that is prepared and used to protect against a

pathogen organism or a disease (e.g., cancer). For example, the vaccine Fluvirin has the following hierarchical structure by definition: vaccine -> viral vaccine -> Influenza virus vaccine -> Fluvirin. More than 300 licensed vaccines and vaccine candidates in research or clinical trials have been described in VO. Vaccine components, vaccination protocols, and host responses to vaccination are also major focuses of current VO development.

VO can be used for a number of applications. For example, VO dramatically improves PubMed vaccine literature searching and is being applied to the development of an ontology-based vaccine literature mining system through collaboration with NCIBI. Vaccine-specific immune networks are being investigated using ontology-specific literature mining and advanced statistical methods. .

Discussion

VO will include all licensed vaccines in different countries and regions, as well as all possible vaccines in clinical trials and in research for major diseases. Planned future development of the VO will add further details such as clinical trials of vaccine, vaccine surveillance, and safety reports. VO will allow advanced integration and intelligent analysis of large amounts of worldwide vaccine data.

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