

Barry Smith, PhD >>

# LET US *define* OUR TERMS

INFECTIOUS DISEASES RESEARCHERS STRIVE TO "SPEAK THE SAME LANGUAGE"

BY ELLEN GOLDBAUM

To tackle an increasing global infectious disease burden and rising rates of drug-resistant infections, University at Buffalo medical researchers are working with philosophers to develop the first-ever infectious disease ontology.

Ontology is a field that examines how things are classified and the relationships between them. When researchers in biology and medicine use ontology classifications, they are able to "speak the same language."

By allowing geneticists, scientists and clinicians to easily share and compare many different types of data about pathogens, patients and disease processes, the ontology being developed by UB philosophers and their colleagues will expedite the development of new methods of diagnosis and treatment.

"Currently, the infectious disease data being collected by hospitals and research centers lack a common framework to enable integration and comparison of results," explains Barry Smith, PhD, SUNY Distinguished Professor, Julian Park Professor of Philosophy at UB and a pioneer of biomedical ontology. "The Infectious Disease Ontology, which is being developed by ontology experts at UB and startup firms in Buffalo, together with immunologists and infectious disease researchers throughout the world, will provide that common framework."

According to Smith, the need for an infectious disease ontology has become more imperative as the incidence of infectious diseases has increased, treatment has become more difficult and researchers have responded by generating more data in the search for better ways to diagnose and treat them.

With the support of a \$1.25 million research grant from the National Institute of Allergies and Infectious Diseases (NIAID), and \$70,000 in pilot funding from the Burroughs-Wellcome Fund, Smith and Lindsay Cowell of the Duke University Medical Center have initiated the Infectious Disease Ontology (IDO) Consortium. They will test the IDO using data from *Staphylococcus aureus*, one of the most common and potentially deadly bacteria in the U.S. and Western Europe. Research on the IDO is also being funded by the Government of Canada as it relates to study of the H1N1 flu virus.

Such interest has spurred not just the development of UB as an international center of ontology, it also is beginning to attract to Buffalo information technology firms eager to collaborate in this vibrant and emerging field. Most recently, a satellite office of Blue Highway, a wholly owned subsidiary of medical device manufacturer Welch Allyn, has moved into UB's New York State Center of Excellence in Bioinformatics and Life Sciences to develop with UB researchers new software and hardware technologies that take advantage of biomedical ontology.

Also located in UB's Center of Excellence on the Buffalo Niagara Medical Campus is the Ontology Research Group, which Smith codirects with Werner Ceusters, MD, UB professor of psychiatry, and Louis J. Goldberg, DDS, PhD, UB dean emeritus of the School of Dental Medicine.

For the past four years, Smith has been working with the developers of bio-ontologies, including the Gene Ontology, to demonstrate how the lessons learned in philosophy and logic—for example,

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the proper use of definitions and classifications—can lead to improvements, which in turn can bring real benefits to biological and clinical research.

"The use of ontologies by clinical researchers reflects recognition of the need for common frameworks for integrating data across biological and clinical disciplines," says Smith. "It also reflects increasing efforts by the National Institutes of Health and other bodies to encourage clinical researchers to make their data more easily available to wider groups of researchers.

"The new approach to ontology, which we pioneered at UB, makes it easier to build good quality ontologies in a

consistent fashion and to reason with the associated data in a way that is designed to be easily extendible to new diseases and new pathogens," he explains.

Other diseases being studied under the IDO Consortium established by Smith and Cowell include malaria and other vector-borne diseases, tuberculosis, infective endocarditis, influenza and dengue fever. The four-year grant from NIAID, in which UB works as a subcontractor to the Duke University Medical School with \$250,000 a year in funding, will support the creation, application and testing of a *Staph aureus* ontology as part of the IDO.

At the same time, the UB ontologists are strengthening their relationships with companies like Blue Highway and others located in or working with the Center of Excellence.

"Blue Highway researchers are addressing the problems that arise when integrating heterogeneous sorts

of data—in this case, the real-time data collected through the use of new medical technologies to support early detection, diagnosis and aggregation of data for comprehensive clinical support," adds Smith.

"The collaboration between Blue Highway and UB's Ontology Research Group will allow rapid testing of ontological ideas in the context of real-world, practical applications. We believe that this will improve both the ontologies and the technologies that use them to collect and reason with diagnostic data."

CONTINUED ON PAGE 18

*Albert Goldfain, PhD*, a Blue Highway researcher and recent UB graduate who works in the UB Center of Excellence, notes that the IDO research will be among the first efforts to integrate ontology data across many different scales, an important and difficult issue for biomedical applications.

“While some research has been done on individual genes, for example, and other ontology work has been done on whole organisms, these data have all been developed in separate information silos,” he says. “The Infectious Disease Ontology will cross-cut ontologies devel-

oped by others at different scales; it will draw and map relationships at the level of individual molecules, cells, organs, organisms and populations, and ultimately provide a way to speed diagnosis and treatment.”

In addition to their research on the IDO, researchers from UB and Blue Highway will collaborate on other areas of joint research, including technologies geared for applications in alarm management and data aggregation. Additional areas of potential collaboration include communications protocols for military applications, power management, materi-

als science, battery technology, and biosensors and lab-on-a-chip technologies.

“Blue Highway has a working relationship with UB and is exploring technologies of interest in the area of health care,” says Jack Rudnick, senior vice president of legal and government affairs at Blue Highway. “Blue Highway is occupying space in UB’s downtown Center of Excellence to facilitate the relevant research and leverage the excellent working opportunities with students, researchers and staff. We look forward to realizing some of the exciting opportunities that collaboration with UB provides.” **BP**