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VIVO: Simplifying Research Discovery in the Life Sciences

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Introduction

In a 21st century environment where users expect up-to-date information delivered by means of a single point of access, academic institutions, particularly those involved with life sciences, medical, or health science research, are increasingly engaged with interdiscipli-

nary research communication technology and dissemination in an effort to remain competitive. As a 2007 National Science Foundation (NSF) Impact of Proposal and Award Management Mechanisms (IPAMM) report states, the Foundation has “actively fostered a shift [towards an interdisciplinary culture] both through the use of solicitations requiring interdisciplinary teams of researchers and by simplifying the mechanism for submitting collaborative projects to any NSF program through FastLane.”

Certainly, NSF is not alone in expressing preference for interdisciplinary collaboration; other funding agencies, as well as University reports and task forces, have similarly articulated commitment to strengthen collaborative work. At Cornell University, the creation of the 2001 New Life Sciences Initiative (NSLI), the most far-reaching initiative in Cornell’s history, is a major effort to boost multi-disciplinary collaboration. One system initially designed to respond to NSLI’s collaborative mission is the Virtual Life Science Library, or VIVO. VIVO is a library-developed system dedicated to providing on-line users, both internal and external to the university, with an overview of life science research and scholarship at Cornell.

An ontology and semantic Web application, VIVO has introduced a new approach for individuals interested in medical and life sciences research to discover grant information, facilities and services, publications, research areas, and more, in one virtual space. This article will provide an overview of VIVO’s development as a library initiative and discuss its structure, sources of content and next steps that ensure the information in the system remains accurate, current, and accessible.

Background

VIVO’s impetus stemmed from NSLI’s mission “to strengthen existing premier departments and programs as well as promote new and collaborative initiatives.”

Specific NSLI disciplines include a range of fields such as, but not limited to, ecology and evolutionary biology, nutrition, biomedical sciences, plant sciences, plant sciences, biomedical engineering and computational biology. During preliminary NSLI meetings, university faculty and academic staff articulated that they had difficulty identifying intra-institutional research collaborators, facilities, and resources. Since faculty engaged in multi-disciplinary collaboration in life sciences and biomedicine receive major sources of funding from foundations and agencies keen to award research endeavors spanning multiple disciplines, this lack of information was a major impediment.

Mann Library representatives who attended these meetings realized such concerns constituted a void in access to information, and that the library, as a bastion of information stewardship and dissemination, was perhaps the best candidate to examine this need in greater detail. Librarians, as well as many developers in library information technology departments, are trained to evaluate both resources and information management practices by considering vast informational landscapes, including how to best classify, represent, and deliver the myriad

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of outputs such as books, articles, Websites, and audio-visual material, that comprise a field of study. In addition, many academic libraries have embraced technology that can expedite discovery of substantial quantities of information. To further explore the institutional complexities as expressed by the faculty, the Cornell University Library formed the Life Sciences Working Group. This group, whose expertise range from agriculture and veterinary science to chemistry, identified a number of key areas for impact and examination, including the need to present a unified view of the Life Sciences at Cornell via a single point of entry, where research and scholarship are emphasized. As the group considered approaches to connect life sciences research activities, events, and scholarly output from a diverse academic community, it became clear that an index providing links to Websites and resources would not reveal the kind of associations faculty sought. Thus, instead of preserving a linear hierarchy where research is affixed to person via their college, department or campus, members of the Life Sciences Working Group were determined to find a new way to cross-reference research and activities spanning multiple departments, centers, institutes and campuses to connect scholarship to its most basic element: the researcher.

Other academic institutions also active in scientific research have similarly created new research-focused discovery models. Similar Web-based efforts from institutions committed to fostering inter-disciplinary collaboration are taking place across the United States and abroad. HealthLinks at the University of Washington, and Bio-X at Stanford University, are two such systems that highlight research and communication in an effort to link individuals to their areas of research in an online environment that encourages scholastic connection. In addition, University of Florida’s Marston Library has implemented the VIVO technology to develop their own comprehensive research tool. Gator Scholar. One non-U.S.-based system, Find an Expert, from Australia’s University of Melbourne, is a University-wide system that “turn[s] administrative data inside out” to provide the public with a user-friendly interface to discover experts on a particular topic. Creation of these, as well as many other research discovery models not mentioned here, seems to clearly demonstrate the need for inter-disciplinary scientific research retrieval.

System

VIVO was created by Mann Library developers using an ontology blueprint from the Advanced Knowledge Technologies (AKT) project, an early Semantic Web project designed to discover and promote connections among computer science research activities across multiple universities in the United Kingdom. Ontology is, historically-speaking, a philosophical concept, but has more recently been adopted by information science as a process to express relationships within a domain; in this instance, the domain is Cornell, and the relationships are people and their research activities. The ontology reflects people in academia, and the affiliations they are likely to have, such as his or her relationship to a department, a graduate field, a research grant, a publication, or an event. As relationships overlap and intersect through common associations, a network of connections builds that can be entered at any point (typically by discovery through a search engine) and navigated to provide users a much greater sense of context than typical top-down, administratively-organized Websites. An ontology structure is particularly useful not only because of the collaborative emphasis within life sciences and medical research, but also because it can accurately represent Cornell’s field-oriented structure for graduate studies, which cuts across traditional department and college boundaries. VIVO’s ontology is “home-grown” in part because of the specificity of information desired by faculty. In addition, very few commercial systems could, at the time, effectively showcase an array of material that was constantly changing, highly inter-linked, and that permitted direct entry of new content by individuals (faculty) with little incentive to adopt anything beyond a simple interface.

Content is initially entered into VIVO both through manual curation and automated or semi-automated processes, but developers are promoting direct self-update as an important additional means of updating narrative information in the terminology of the moment. Input, as well as discovery, is bi-directional; thus, the link between faculty and field of study could be made by either declaring a field of study relationship to the person, or by declaring a field of study and then adding the person. Conducting a VIVO search will yield a display that clusters entities into broad categories, such as people, events, and organizations.

Sources of Content and Library Outreach

VIVO’s content is culled by two primary means: automated data ingests from units that can provide standardized, machine readable data in a consistent format, and non-automated processes such as manual entry. VIVO’s mission is to represent the breadth and depth of scholarship at Cornell and not to replace or replicate department or other university Websites which are designed for more thorough narratives, branding, multimedia, and document hosting. To this end, librarians identified and prioritized specific classes to populate first, such as people, research facilities, academic units, and graduate fields because cross-referenced content in these areas could quickly bolster the impact VIVO would have on the life sciences community. Populating each parent class with individual entries was a combination of manual and automated effort. Student editors, as well as librarians, surveyed publicly available Web and print resources from departments, laboratories, centers, and administrative units for information about institutional contributions to scholarship. This was complemented by certain content currently provided to VIVO though automated means by cooperation with several on-campus units including the Office of Human Resources (OHR); the Office of Sponsored Projects (OSP); the System for Tracking Administrative Records for Students (STARS); and internal college reporting systems. Some journal citations have also been harvested from commercial and non-commercial vendors. Data from these sources offer integral updates to the faculty and academic staff’s overall summary in the VIVO system, providing such information as faculty and academic staff members’ official department appointment and title (OHR), and grants reported and administered (OSP). In addition, colleges that have employed their own annual reporting mechanisms can elect to provide non-sensitive faculty information, such as research areas, professional activities, and publications. Publications have required a three-part effort to gather and display in VIVO: journal citation information has been brought
in from external commercial and open-source database vendors such as Biosis and PubMed, through manual curation of information found on faculty member’s department Websites and online C.V.’s, as well as through internal reporting systems. The initial content input for the life sciences and subsequent disciplines required a great deal of human entry. The efforts of both manual curator and automated processes have resulted in a system that reflects the electronic information currently available for faculty and staff, but manual entry alone is not a viable option for moving forward. VIVO’s goal is to transition to a platform where nearly all of its content is harvested and delivered through automated or semi-automated processes. The sustainability of VIVO’s content has remained at the forefront of the technological and administrative development of the system, particularly with regards to the profiles of individual researchers.

Librarians and developers on the VIVO project have focused much of their effort on outreach with faculty, staff, and administrative and academic units to unearth standardized information from any available sources, as well as to engage the university community in content development and management. The library recognizes its strong role as an impartial nucleus between multiple campus interests; it does not, however, have the expertise and resources to continually develop accurate class associations for the university’s diverse community. Nor does it have the type of consistent foundation that a system like Find an Expert (University of Melbourne) has; Australia maintains several government-defined classification schemes, including Research Fields, Courses and Disciplines (RFCD) that offers a strong semantic framework on which to build. Engaging the university community, particularly administrative units and research centers and institutes, in content management has been met with some success; for example, a high-tech facility recently requested and received editor training in an effort to manage their own content. The VIVO system, in as much as it seeks to enrich the collaborative culture on campus, must also foster partnerships for itself to ensure that the system remains a powerful, accurate and highly utilized component of Cornell’s overall online presence.

Conclusion and Next Steps
As interdisciplinary collaboration is imbedded into more university cultures, both in the life and medical sciences and beyond, adopting online systems that can provide new discovery models will likely increase. A case in point is VIVO; when VIVO was released to the Virtual Life Sciences Library in 2005, other Cornell colleges, departments, and administrative units realized the potential offered by VIVO. These entities, too, wanted a system that could provide a bird’s eye view of their resources, research, events, and facilities. In 2006, with cooperation and funding from Cornell’s administration, the library agreed to expand what was initially a discovery tool to emphasize life sciences to a system that could showcase the research of over 1,200 faculty and academic staff who span Cornell’s geographically distant campuses in New York State and abroad. In the latest phase of development, self-editing capabilities for the system have been developed and are currently under testing. This functionality will allow faculty and academic staff at Cornell to securely login using the university authorization system, and modify their current VIVO profile. This latest iteration, VIVO Research and Scholarship, will be released campus-wide in fall 2008. The library will continue to play its role as the technical arbitrator and outreach liaison between VIVO and the university community, as well as seeking new ways to strengthen access to content across not only disciplinary boundaries within Cornell, but across institutions as well.

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