

Keynote Forum: ‘The New Information Age in Life Sciences and Clinics: From Static Data Warehouses to Decision Support based on Dynamic Semantically Integrated Data and Knowledge Networks’

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Abstract

Traditional data integration has focused on relational data warehouses as solutions for storage and mining. Such an approach requires thorough upfront schema considerations and puts a rigid, static, inflexible structure in place which in many cases is already outdated when becoming operational. With the advent of translational research and science spanning multiple information domains, a dynamic, flexible and extensible solution is necessary to cope with the demand for knowledge management and data sharing across disciplines. As data from countless disperse sources (new instruments, files, images, database and web content) are generated in ever-changing formats, new approaches are required.

This talk will demonstrate how the transition to a semantic data integration, where data are in context with other data, changes the playing field. Semantic technology provides the toolset required for the new information age in life sciences and clinics. Semantics harmonize synonyms and nomenclature, and allows for relationship mining, inference and reasoning in a systems approach. Dynamic, flexible resource description framework (RDF) triples stores, SPARQL endpoints and "linked open data" initiatives are the key in research demanding global collaboration. Graph representations of merged data correlation networks and mechanistic reference networks allow identifying classifiers in biomarker discovery and focusing on relevant dimension-reduced subnets. Knowledge from powerful systems biology-based models fosters understanding of complex biological processes (e.g., diseases & disease states, pre-disposition to certain biological responses, patient stratification for trials and treatment, predictive risk assessment for tumor growth, organ rejection, and severity of drug side effects).

Examples of "imprecise connections" across multiple sources provide proof of the semantic capabilities for predictive informatics:

1. Combining and reasoning across experimental and published data to create target profiles identifying effective compounds and warning of toxic indication.
2. Actionable inferences about disease states and treatments using combined clinical, genomic and molecular phenotypic data to assert patient-centric personalized medicine.

The new information age in Life Sciences and Clinics has become reality.

Biography

Dr. Erich Gombocz has over 30 years of experience in Life Science research, laboratory automation and data management in scientific and distributed systems environments. He also has more than 30 years programming experience in instrumentation control, user interface, database design, scientific analysis, and on-line laboratory automation as well as being the developer of innovative software algorithms and architecture. His years as Section Head at the Department for Biochemical Analysis at the Federal Institute of Food Analysis & Research, Vienna, Austria, were pivotal for the early development of computational analysis and automation procedures in a complex distributed environment. In 1978, under his direction, the Institute pioneered the first nationwide Laboratory Information Management System for the Ministry of Health and Environmental Protection, connecting federal institutes and laboratories within an integrated data network. During the Chernobyl crisis in 1986, Austria's early warning system delivered real-time information critical to international decision-making. Erich's post-doctoral research at the National Institute of Health (NIH) (1985 & 1988) focused on techniques and computer models for separations, which led him to build an automated real-time instrument and to found venture-backed Lab Intelligence in 1989. Lab Intelligence's system, the HPGE, with over 20 patents, achieved worldwide distribution. In 1999, he joined NucleoTech, a bio-image informatics company, as Chief Science Officer and developed two new scientific product lines, including a software suite for the Life Sciences and a real-time gene analyzer. From 2000-2003, as Chief Science Officer of Biosentients, Erich contributed substantially to the design and implementation of the company's informatics technology, including its systems architecture, data structure and analytical modules. Focusing on semantic data integration and knowledge management in life sciences, he founded IO Informatics in 2003 together with Bob Stanley to apply systems biology approaches to challenges in the area of pharmaceutical and clinical decision-making. Dr. Gombocz has published over 60 scientific publications and holds currently more than 40 biotechnology- and software-related US and international patents. He is an international expert in separation science and bioinformatics, a member of several professional organizations, and serves on the editorial board of a number of scientific journals.



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