



Proceedings of the 14th International Conference on Biomedical Ontologies (ICBO 2023)

joint with the

**Workshop on Ontologies for Infectious and Immune-
Mediated Disease Data Science (OIIDDS 2023)**

and the

**FAIR Ontology Harmonization and Trust Data
Interoperability Workshop (FOHTI 2023)**

Hybrid conference, hosted in Brasília, Brazil and online

August 28 - September 1st, 2023

edited by

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¹ <https://www.biocuration.org/>

² <https://alma.hsl.org.br/>

³ <https://ncor-brasil.org/>

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Pre-conference Workshops and Tutorials

Pre-conference workshop proposals accepted:

1. Ontologies for Infectious and Immune-mediated Disease Data Science, co-organized by Asiyah Yu Lin, Alexander Diehl, John Beverley, and Lindsay Cowell.

Monday, August 28, 2023. [Workshop page⁴](#).

2. The 7th International Cells in Experimental Life Science Workshop, CELLS 2023, co-organized by Alexander D. Diehl and Yongqun "Oliver" He.

Tuesday, August 29, 2023. [Workshop page⁵](#).

3. 12th Vaccine and Drug Ontology Studies (VDOS) 2023 Workshop, co-organized by Junguk Hur, Cui Tao, and Yongqun "Oliver" He.

Tuesday, August 29, 2023. [Workshop page⁶](#).

4. FOHTI-23 (FAIR Ontology Harmonization and Trust Data Interoperability), co-organized by Anna Maria Masci and Asiyah Yu Lin.

Tuesday, August 29, 2023. [Workshop page⁷](#).

Pre-conference tutorial proposals accepted:

1. Natural Language Processing Tutorial for Biomedical Text Mining, co-organized by Senay Kafkas, Sumyyah Toonsi, Sakhaa Alsaedi.

Monday, August 29, 2023. [Workshop page⁸](#).

2. OBO Foundry Tutorial: Introduction to workflows and best practices for ontology development, co-organized by Nicole Vasilevsky, Nico Matentzoglu and Tiago Lubiana.

Monday, August 29, 2023. [Workshop page⁹](#).

⁴ <https://delaneycdmncnulty.wixsite.com/oiids-workshop>

⁵ <https://sites.google.com/view/cells2023/home>

⁶ <https://vdos-workshop.github.io/vdos2023/>

⁷ <https://fohti.github.io/FOHTI-2023/>

⁸ <https://github.com/stoonsi/ICBO-NLP-for-Biomedical-Text-Mining-tutorial/tree/main>

⁹ <https://oboacademy.github.io/oobook/courses/icbo2023/>

3. BFO as a top-level ontology for information systems modeling, co-organized by Maurício B. Almeida and Jeanne L. Emygdio.

Tuesday, August 29, 2023. [Workshop page¹⁰](#).

4. Machine Learning with Ontologies, co-organized by Maxat Kulmanov, Robert Hoehndorf, Sarah Alghamdi, Azza Althagafi, Sumyyah Toonsi, Fernando Zhapa-Camacho.

Tuesday, August 29, 2023. [Workshop page¹¹](#).

5. Ontology-Driven Conceptual Modeling with UFO, gUFO, and OntoUML, co-organized by Giancarlo Guizzardi.

Monday, August 29, 2023. [Workshop page¹²](#).

¹⁰ <https://mba.eci.ufmg.br/tutorialicbo2023/>

¹¹ <https://github.com/bio-ontology-research-group/mowl-tutorial>

¹² <https://www.inf.unibz.it/krdp/KRDB files/KRDB-SOS-2020-slides/KRDB-SOS-2020-Guizzardi.pdf>

Software Demo

Title: Ontology Development in FHIR Resources with the Fast Evidence Interoperability Resources (FEvIR) Platform

Presenter: Caue Monaco

Tool link: <https://fevir.net>

Alma Sírio-Libanês Panel

Theme: Ontologies Application in the Brazilian Health Area

Coordinator: MD. Beatriz de Faria Leão

List of Panels:

- Panelist: MD. Fabio Cerqueira Lario (Sírio-Libanês Hospital, São Paulo)
- Panel title: The role of ontologies in electronic medical record systems

- Panelist: MD. Jussara Röttsch Macedo
- Panel title: The contribution of SNOMED-CT to the Brazilian National Health Data Network (RNDS)

- Panelist: Dr. Joice Machado (SOFYA - Plug and Play Deep Medical AIs)
- Panel title: Use of SNOMED-CT sub-ontologies in the automatic identification of allergies and adverse reactions in clinical notes

- Panelist: Robson Mattos (CGIIS/SEIDIGI Digital/Ministry of Health of Brazil)
- Panel title: OBM - The Brazilian Ontology of Medicines

Preface

With great honor, we present the ***Proceedings of the 14th International Conference on Biomedical Ontology (ICBO 2023)***, convened at the Faculty of Information Science, University of Brasilia, Brasília, DF, Brazil. This year, the Conference Hosts was both the Undergraduate course in Library Science and the Postgraduate Program in Information Science of the Faculty of Information Science at the University of Brasília. The ICBO represents a preeminent annual conference series that convenes researchers, scholars, and professionals engaged in the development and application of ontologies across biomedical domains and related fields.

This edition of the conference marked a historic moment, being the first time this significant event occurred in Latin America, within Brazil's borders. This edition took place in conjunction with the 16th Ontology Research Seminar in Brazil (ONTOBRAS 2023) as a satellite conference. This joint conference served as a premier forum, facilitating the intellectual exchange of groundbreaking ideas and profound discoveries among the ontology community.

Both ICBO and ONTOBRAS series are consolidated and independent events, which have already established themselves as reference events in the field of applied ontology research, the first at an international level dedicated to biomedical ontologies and the second as nationally (Brazilian) known internationally and dedicated to ontologies in general. These distinct yet interlinked gatherings persist as vanguards, setting the standard for ontology research, spanning theoretical constructs to practical applications across diverse domains of knowledge. This volume of proceedings focuses only on the ICBO program, as ONTOBRAS 2023 conceives its own proceedings in the IAOA Series.

Biomedical ontology plays a central role in the development of health information systems, clinical data integration, and translational research facilitation, serving as a crucial component of artificial intelligence and machine learning solutions. Ontologies are not merely intellectual tools; they are foundational elements enabling effective communication among researchers, clinicians, and information systems by providing unambiguous and high-quality artifacts of knowledge representation. They empower the discovery of patterns, the analysis of complex data, and the creation of innovative applications that directly benefit human health, while also driving

advancements in artificial intelligence and machine learning within the biomedical context.

The overarching theme that directed the ICBO 2023 program was “***The Role of Ontologies in Artificial Intelligence and Machine Learning***.” In addition to the scientific paper presentation sessions, the conference encompassed four workshops, five tutorials, a panel dedicated to the dissemination of practical experiences from Brazil, a session for presenting posters, and a software demonstration, all meticulously integrated into its program. Furthermore, the conference featured four keynote lectures of eminent significance. These four outstanding keynote presentations featured at the conference were as follows:

- Dr. Mathias Brochhausen: "Improving Ontologies to Foster AI in Biomedicine"
- Dr. Maurício B. Almeida: "A BFO-Based Authority Framework for Healthcare Corporations"
- Dr. Barry Smith: "Use of AI in Medical Research and the Role of Ontology"
- Dr. Renata Guizzardi: "Ethical Requirements for AI Systems"

We previously presented detailed information about the workshops, tutorials, software demos and discussion panels.

ICBO 2023 successfully took place in a hybrid format, accommodating over **40 in-person attendees and 63 virtual participants**. Additionally, during our joint session - workshops, tutorials, keynotes, poster/software demo session, and panel, we welcomed **52 in-person attendees from Ontobras**. This conference provided a diverse array of research endeavors and practical applications. From theoretical explorations that push the boundaries of knowledge to pragmatic implementations enhancing healthcare quality, ICBO participants exhibited a profound dedication to academic and scientific excellence.

For the main conference, 24 papers and abstracts underwent rigorous peer review by three members selected by the Program Committee Chairs. We accepted 20 of these submissions for inclusion in this volume, including 14 full papers, 2 short papers, and 4 poster abstracts. We also included in this publication abstracts of the tutorials and the software demonstration, as well as contributions from the Workshop on Ontologies for Infectious and Immune-Mediated Disease Data Science (OIIDDS 2023) and the FAIR Ontology Harmonization and Trust Data Interoperability Workshop (FOHTI 2023). We extend our sincere gratitude to the program committee members

for their discerning evaluations, which significantly contributed to the quality of this compilation.

As readers delve into the proceedings of this event, we encourage profound engagement with the presented themes, urging critical inquiry into preconceptions and established paradigms. Each paper and abstract featured herein adds to the ongoing advancement of biomedical ontology, fostering innovation and collaboration in our collective pursuit of a healthier, more enlightened future.

We would like to express our gratitude to the authors for their hard and quality work, the reviewers for their dedicated time and expertise, and the organizers for their diligence in putting on this conference.

We also would like to express our heartfelt gratitude to the distinguished keynote speakers for their exceptional and inspiring presentations, which greatly enriched the intellectual discourse at ICBO 2023. Finally, but not less importantly, we extend our heartfelt gratitude to the organizers and presenters of the tutorials and workshops for their exceptional efforts and invaluable contributions, which greatly enriched the conference experience for all attendees.

In closing, we hope that this conference's proceedings will serve as inspiration for future work, fuel innovative pursuits, and strengthen connections, propelling our collective efforts to new heights and ensuring vibrant discussions at upcoming conferences within our esteemed ontology community.

October, 2023

**Fernanda Farinelli
Amanda Damasceno de Souza
Eduardo Ribeiro Felipe**

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