

Biological pathway abstractions

Citation for published version (APA):

Waagmeester, A. S. (2024). *Biological pathway abstractions: from two-dimensional drawings to multidimensional linked data*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20240116aw>

Document status and date:

Published: 01/01/2024

DOI:

[10.26481/dis.20240116aw](https://doi.org/10.26481/dis.20240116aw)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

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- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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The main objective of the thesis is to explore how to analyze effectively and, where possible, transform biological knowledge into a structured, machine-readable and semantically enriched data format. This is to facilitate large-scale integration of knowledge into pathway diagrams and models. We could extract relevant concepts from the literature and extend this knowledge by integrating them with other formally described knowledgebases. This thesis led to better-integrating pathway knowledge with the literature and other (linked-)data sources.

Results from this thesis proved to be relevant to the broader research community. Bibliographic studies on citations of the published work stemming from some of the chapters in this thesis show subsequent and downstream usage of the pathway data with other linked-data resources. This has been demonstrated by integrating the RDF generated by the workflow developed in work from this thesis in various projects, of which Open PHACTS is the most prominent. WikiPathways RDF consistently ranks high in ranking frameworks such as YummyData ¹.

Wikidata, a community-curated knowledge base, is described in this thesis as a potential source of knowledge for pathway curation. The wikidata workflows described in this thesis addressed structuring pathway knowledge in the public knowledge base but did so for other biomedical and chemical public data sources. Judging from the different citations to the work on wikidata described in this thesis has been inspirational to others. It shows at least some impact of this work beyond the narrative of pathway curation. As the author, I was able to set up a scientific research startup called Micelio BV; since its inception in 2014, it has been involved in various projects, not limited to pathway curation alone. Micelio BV is a company that provides services to different actors, primarily in the life sciences domain. Micelio is an economically viable company that became a partner in various initiatives and projects in

¹<http://yummydata.org/>

healthcare, biomedical research, agriculture and cultural heritage. The company is built on the reputation gained and the results from the output in this thesis.

The results in this thesis are primarily geared towards pathway curators. However, since pathways act as an abstraction of cellular processes and interactions, they can also be seen as a hub of biological knowledge in the broader sense. Making pathway knowledge machine-readable can be instrumental in making biological knowledge more impactful, making the results relevant for a wider audience.

This thesis proved the value of methods developed in the field of bioinformatics. A more comprehensive application of these methods and research results requires further investment in capacity training for biocurators. This field needs formal training in linked data and its affiliated methods to fully appreciate its potential for biocuration.