

Swiss Institute of
Bioinformatics

From bioinformatics to biodiversity informatics

Patrick Ruch

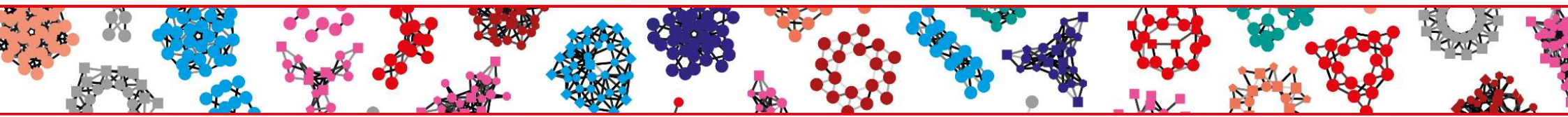
patrick.ruch@hes-so.ch

SIB & HES-SO / HEG Genève



www.sib.swiss

Overview



01

• SIB

02

• From SIBiLS to Biodiversity PMC

03

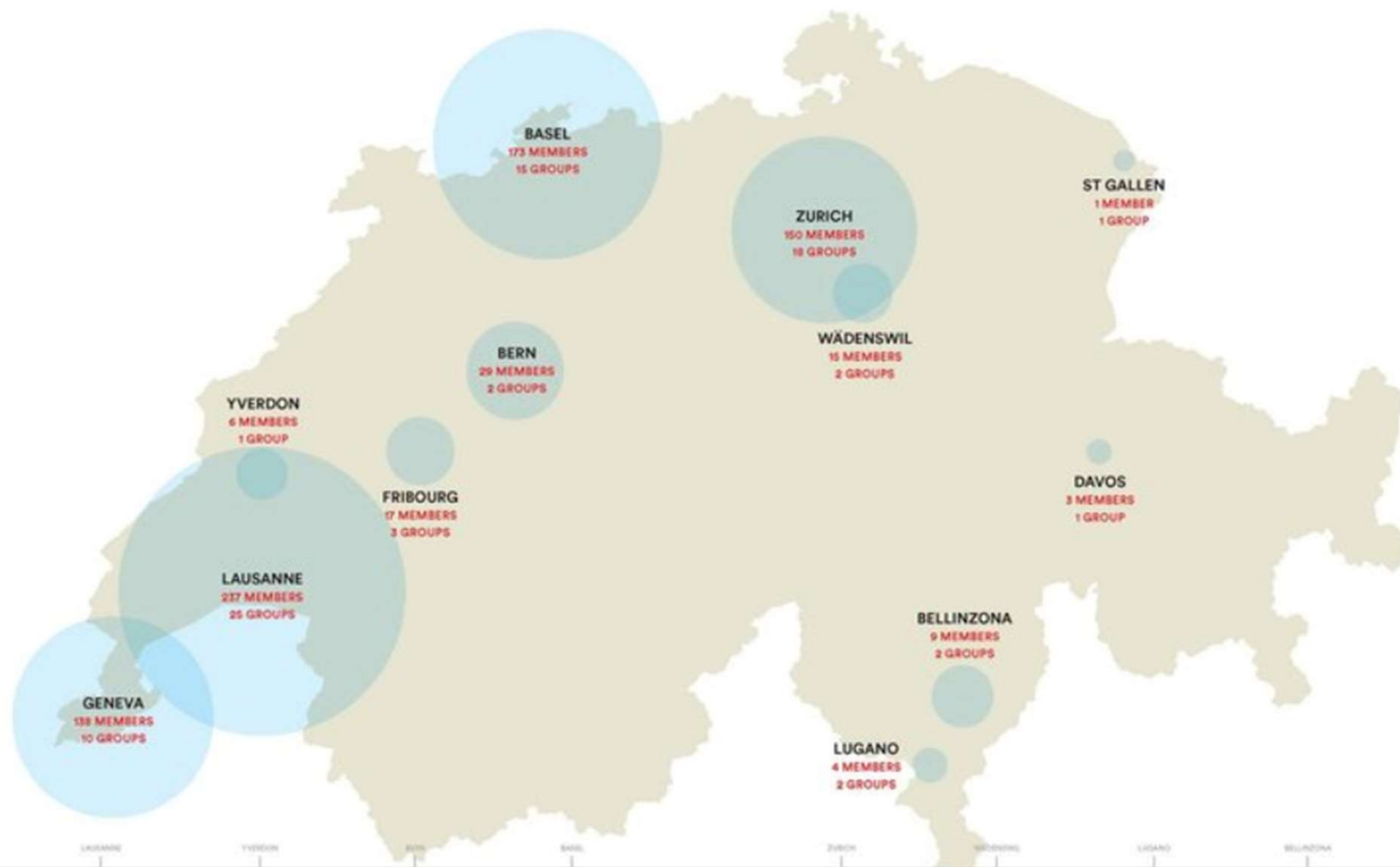
• e-BioDiv

04

• Biotic interaction graph

05

• Conclusion



GENÈVE	LAUSANNE	YVERDON	BERN	BASEL	ZÜRICH	WÄDENSWIL	LUGANO	BELLINZONA	ST GALLEN

Swiss Institute of Bioinformatics

- Created in 1995 in Geneva as a public-funded private foundation
- Main funders: SEFRI and NIH
- 900+ bioinformaticians
- 88 research groups, incl. 5 internal group leaders

Most group leaders are university professors [me @HES-SO Geneva]

Literatures Services ~12 FTE

Management of all literature contents to support molecular biology

2012-2015 first projects in the field of biodiversity [FAO, NIBR]

Today: Swiss Bio Data ecosystem (SBDe) project 2024-2025...

Today: Metabarcoding + Biodiversity director being recruited

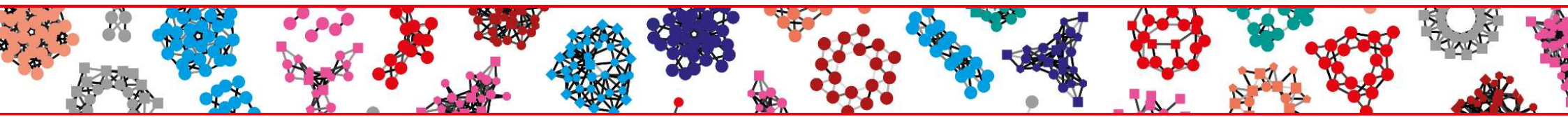
Today: growing portfolio of EU projects (Infradev, Biodiversa, ...)

Scientific use cases

SIB is managing data to broadly support the work of **Swiss** – and beyond – biologists from precision medicine up to plant biology

- UniProt: the protein encyclopedia, whereby 50 biocurators capture (putatively) all knowledge in the field, e.g. sequences, functions, phenotypes, polymorphism, interactions, ...
 - OMA «Orthologous matrix»: support characterization accross species
 - Collaborate with various plant biodiversity projects: e.g., natural product chemistry GBGI @ Botanical Garden Fribourg [with Plazi/TB]
 - Invasive species / zoonosis: virus spillover detection @ Arizona State University [with Plazi/TB]
 - Sars-cov-2 data management, e.g. sequences, COVoc & COVTriage
 - Future projects, HES-SO internal call for ecology [e.g., P. Prunier]
Bring Your Own Needs, e.g. 2024 BioHackathon Europe in Barcelona
-

Overview



01

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• **From SIBiLS to Biodiversity PMC**

03

• e-BioDiv

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• Biotic interaction graph

05

• Conclusion

> [Nucleic Acids Res.](#) 2020 Jul 2;48(W1):W12-W16. doi: 10.1093/nar/gkaa328.

SIB Literature Services: RESTful customizable search engines in biomedical literature, enriched with automatically mapped biomedical concepts

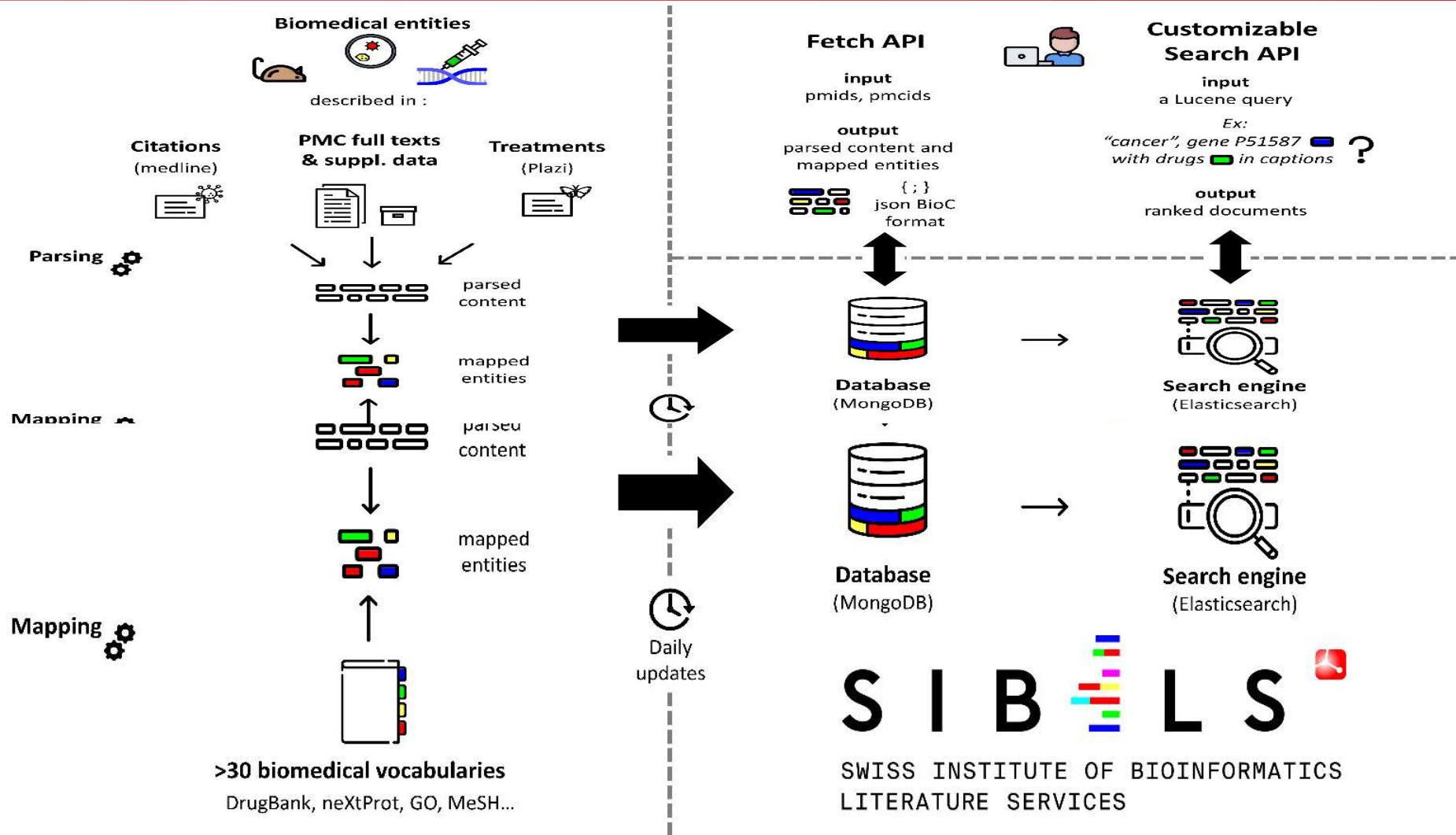
[Julien Gobeill](#)^{1 2}, [Déborah Caucheteur](#)², [Pierre-André Michel](#)¹, [Luc Mottin](#)², [Emilie Pasche](#)^{1 2},
[Patrick Ruch](#)^{1 2}

Affiliations + expand

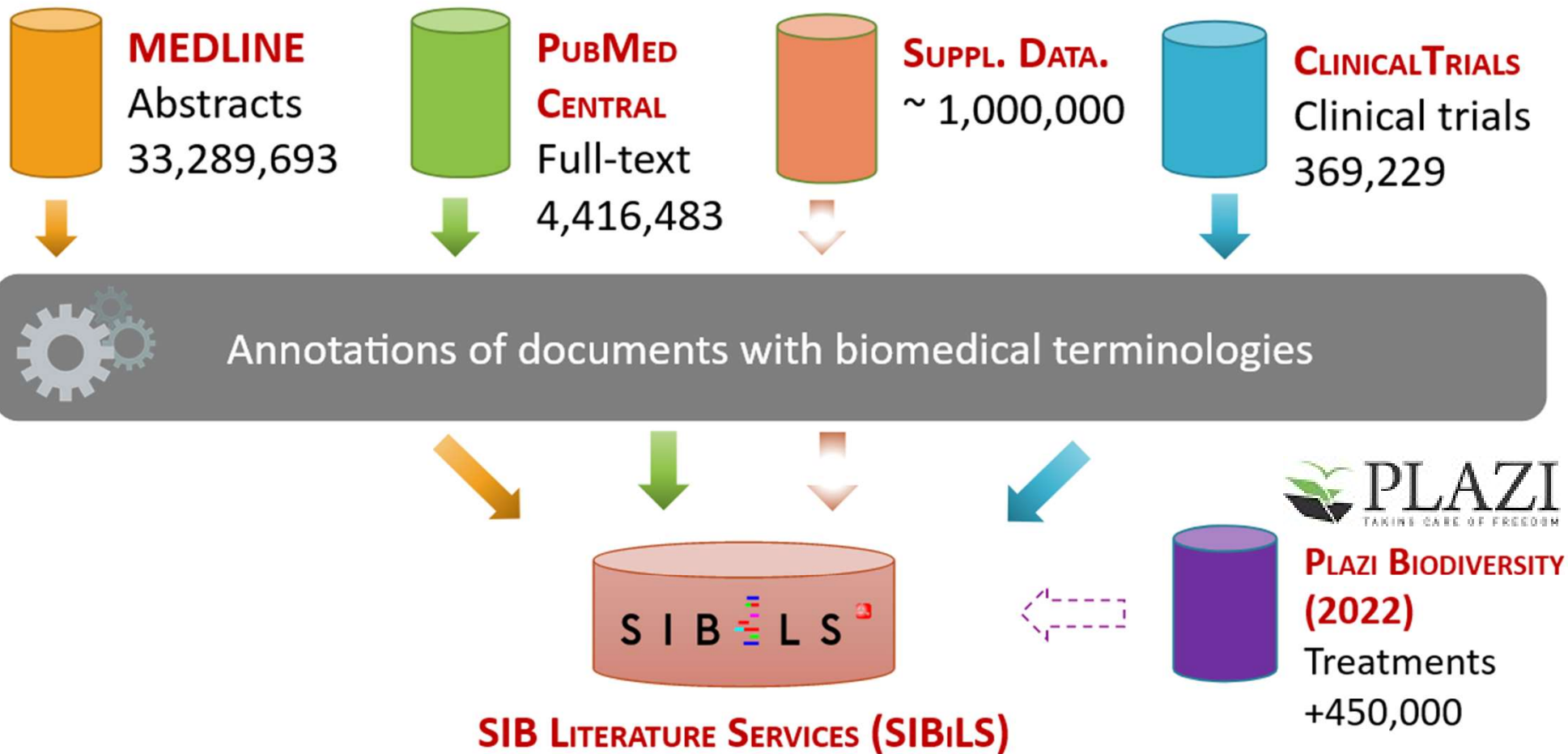
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[Free PMC article](#)

Global workflow



SIB Literature Services



A growing collection of publications

Pensoft



A sample collection (N=2000) has been imported

All PenSoft publications (N > 60 000) currently being added

TB processed: European Journal of Taxonomy

BICIKL-CETAF Publisher round table: 14-15 in Geneva



Frontiers

Discussions have started

→ UnPayWall

Annotations ~12 billions

	Medline	PMC	PMC (Author manuscripts)	PMC (Supplementary data)	Plazi	Total
Nb documents (files for suppdata)	35,559,059	5,254,751	833,920	6,121,241	495,952	48,264,923
Nb annotations	3,102,013,867	6,975,800,183	507,804,897	1,367,371,339	43,538,961	11,996,529,247
Avg anns/doc (anns/fils for suppD)	87	1,328	1,640	83	88	249

- Regularly updates (daily in most cases)
 - Automatic annotation process
 - 21 terminologies/ontologies, including 3 taxonomies [OToF/CoL, NCBI, ASU Mammals]
-

Original article in PubMed Central

[Biomedicines](#). 2021 Jul; 9(7): 819.

PMCID: PMC8301361

Published online 2021 Jul 14. doi: [10.3390/biomedicines9070819](https://doi.org/10.3390/biomedicines9070819)

PMID: [34356883](https://pubmed.ncbi.nlm.nih.gov/34356883/)

Hexapod Assassins' Potion: Venom Composition and Bioactivity from the Eurasian Assassin Bug *Rhynocoris iracundus*

[Nicolai Rügen](#),¹ [Timothy P. Jenkins](#),² [Natalie Wielsch](#),³ [Heiko Vogel](#),⁴
[Benjamin-Florian Hempel](#),^{5,6} [Roderich D. Süssmuth](#),⁵ [Stuart Ainsworth](#),⁷
[Alejandro Cabezas-Cruz](#),⁸ [Andreas Vilcinskis](#),^{1,9,10} and [Miray Tonk](#)^{9,10,*}

Leonardo Caputo, Academic Editor

[▶ Author information](#) [▶ Article notes](#) [▶ Copyright and License information](#) [▶ Disclaimer](#)

Keywords: assassin bugs, venom, transcriptomics, proteomics, bioactivity, paralysis, cytolysis, antibacterial, neurolysis

1. Introduction

[Go to: ▶](#)

Venoms typically consist of a plethora of highly diverse toxins that affect a complex range of physiological targets [1]. Consequently, venom components have become highly specialized with the ability to perform complex and

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8301361/>

Processing JATS documents

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Consequently, venom components have become highly
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organism [2]. This ability to precisely manipulate
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Cynolebias nioni Berkenkamp, Reichert & Prieto, 1997: 31 ( type locality: temporary swamp in canada Los Cinco Saucos, rio Negro system [rio Uruguay basin] the road Ruta 26, Departamento de Tacuarembó, northwestern [correctly northeastern] Uruguay, 32°10'S 55°15'W [correctly 32°5.45'S 55°8.90'W]; holotype: SMF 18455 ).
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Beyond information retrieval, e.g. Question-Answering

Results for Where Conyza canadensis is Invasive ?

MEDLINE (5 answers)

PLAZI (0 answers)

(Total: 5 answers)

1

semiarid perennial grassland in Central Hungary.

Experimental drought indirectly enhances the individual performance and the abundance of an invasive annual weed. During environmental change, invasive species may be favored by increased resource input or reduced resource use of the resident community. Plasticity in certain plant traits of invasive species may be one possible mechanism behind their ability to quickly exploit unused resources. We tested whether rainfall manipulations (severe drought, moderate drought, watering) alter the growth and reproductive success of the invasive annual *Conyza canadensis*, and if it translates into a change in the abundance of the species in a **semiarid perennial grassland in Central Hungary**. Overall, *C. canadensis* exhibited greater individual performance and higher abundance in drought plots than in control and watered plots. At individual level, plants showed the strongest response to moderate drought: they grew 2.5-times taller than in control and watered plots, and produced twice and 2.5-times more seeds than in watered and control plots, respectively. Reproductive phenology was advanced in response to rain exclusions. Although severe drought caused 40% mortality, the cumulative performance of *C. canadensis*, expressed as plot-level aboveground biomass, was consistently greater in severe drought plots than in control and watered plots throughout the 3 years of the study. The higher performance of *C. canadensis* in drought plots is most likely due to the decreased abundance and, thus, decreased competitive effect of previously dominant perennial grasses caused by the rain exclusions. We conclude that drier summers that suppress perennial grasses will favor this alien annual forb, and phenotypic plasticity in growth and reproduction may contribute to its invasion success.

score
0.12

Experimental drought indirectly enhances the individual performance and the abundance of an **invasive** annual weed.

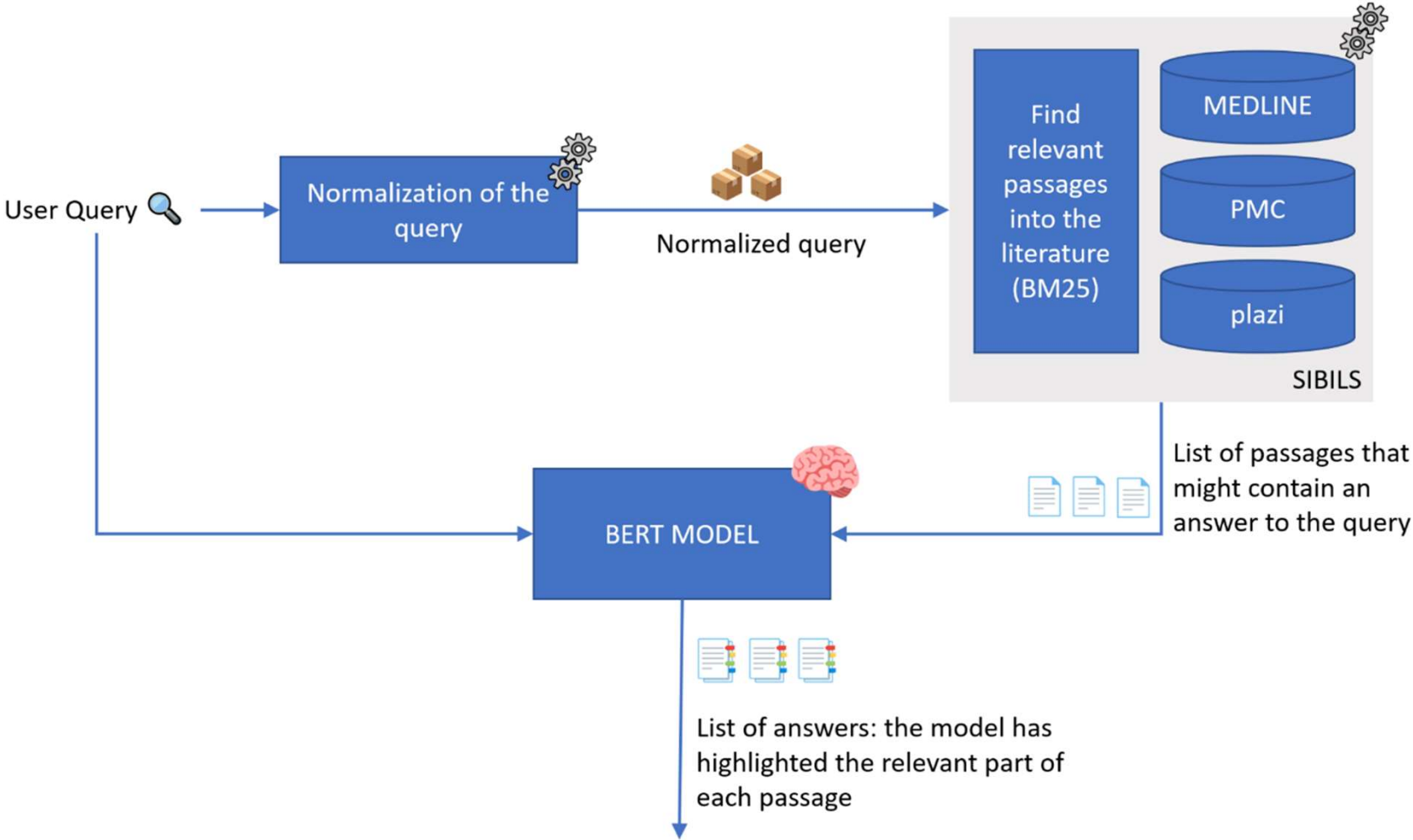
32676821. Mojzes Andrea, Ónodi Gábor, Lhotsky Barbara, Kalapos Tibor, Kröel-Dulay György. 2020-07-18. Oecologia. Journal Article. **MEDLINE. PubMedCentral. EuropePMC. SIBiLS.**

Abstract

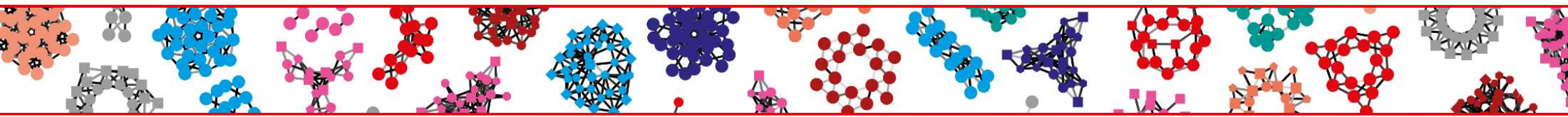
During environmental change, **invasive** species may be favored by increased resource input or reduced resource use of the resident community. Plasticity in certain plant traits of **invasive** species may be one possible mechanism behind their ability to quickly exploit unused resources. We tested whether rainfall manipulations (severe drought, moderate drought, watering) alter the growth and reproductive success of the **invasive** annual *Conyza canadensis*, and if it translates into a change in the abundance of the species in a semiarid perennial grassland in Central Hungary. Overall, *C. canadensis* exhibited greater individual performance and higher abundance in drought plots than in control and watered plots. At individual level, plants showed the strongest response to moderate drought: they grew 2.5-times taller than in control and watered plots, and produced twice and 2.5-times more seeds than in watered and control plots, respectively. Reproductive phenology was advanced in response to rain exclusions. Although severe drought caused 40% mortality, the cumulative performance of *C. canadensis*, expressed as plot-level aboveground biomass, was consistently greater in severe drought plots than in control and watered plots throughout the 3 years of the study. The higher performance of *C. canadensis* in drought plots is most likely due to the decreased abundance and, thus, decreased competitive effect of previously dominant perennial

<https://sibils.text-analytics.ch/search/?query=Where%20Conyza%20canadensis%20is%20Invasive%20%3F#results-section>

Search + re-rank & extract answers with fine tune language models



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e-Biodiv Matching Service

BACKGROUND

- Publications often contain references to biological specimen in natural history museum and botanical garden collections
- But references between publication and specimens are often not bidirectional

OBJECTIVE

- Develop a matching service to help bridge the gap between material citations and specimens... and vice-versa !
 - Based on crowdsourcing
 - Semi-automatic matching approach suggesting possible match along with scores indicating the probability of a match
 - Specimen are provided by GBIF.org
 - Material citations are provided by Plazi Treatment Bank
-

eBiodiv Matching Service

- 1) The process starts with the selection of an institution and a dataset

Note: additional access ways are currently being developed:

- Country
- Taxon
- Article
- Author
- ...

The screenshot shows the eBiodiv Matching Service interface. The header is green with the logo on the left, the title "eBioDiv Matching Service" in the center, and "About" and "Login" links on the right. Below the header, there is a section for "Institution" with a dropdown menu showing "Conservatoire et Jardin botaniques de la Ville de Genève". Below that is a section for "Datasets" with a table of four datasets: "Geneva Herbarium - Burnat Herbarium (G-BU)", "Geneva Herbarium - De Candolle's Prodrômus (G-DC)", "Geneva Herbarium - Boissier's Flora Orientalis (G-BOIS)", and "Geneva Herbarium - General Collection (G)". At the bottom, there are two buttons: "See specimens" and "See material citations".

<https://sandbox.ebiodiv.org/>

https://prod.ebiodiv.org/?institutionKey=d200fcbc-972e-4488-bcb6-eaa47209148d&datasetKeys=4b0ccaf3-36eb-4dc8-acba-6d08fb9004bb,63e9e22d-a649-4087-b39e-acb1651af077,c72d40da-9245-44e5-91a6-febbf6496322,f577c9f3-ae71-4278-b6bf-512ba1dfaa21&format=specimen_matcit

eBiodiv Matching Service

2) The list of specimens or material citations is displayed and the user can use facets to filter the list

3) The user can select the occurrence to edit

See specimens See material citations

Specimens for Conservatoire et Jardin botaniques de la Ville de Genève

345 specimens with your filters (Total: 345 specimens)

Specimen ID	Scientific name	Type	Record	Date	Material citation nb	Status	
1144559003	Astragalus L.	Lectotype	Specimen	1845	27	<div style="width: 100%;"></div>	
1144559597	Aspidosperma parvifolium A.DC.	Holotype	Specimen		1	<div style="width: 100%;"></div>	
1144559600	Aspidosperma multiflorum A.DC.	Holotype	Specimen		1	<div style="width: 100%;"></div>	
1144559604	Aspidosperma discolor A.DC.	Holotype	Specimen		1	<div style="width: 100%;"></div>	
1144559612	Aspidosperma oblongum A.DC.	Holotype	Specimen		1	<div style="width: 100%;"></div>	
1144559784	Aspidosperma vargasii A.DC.	Holotype	Specimen		1	<div style="width: 100%;"></div>	
1144560405	Alternanthera aquatica (Parodi) Chodat	Type	Specimen		1	<div style="width: 100%;"></div>	
1144560406	Alternanthera aquatica (Parodi) Chodat	Type	Specimen		1	<div style="width: 100%;"></div>	
1144560411	Alternanthera aquatica (Parodi) Chodat	Type	Specimen		1	<div style="width: 100%;"></div>	
1144560419	Alternanthera aquatica (Parodi) Chodat	Type	Specimen		1	<div style="width: 100%;"></div>	
1144560429	Alternanthera aquatica (Parodi) Chodat	Type	Specimen		1	<div style="width: 100%;"></div>	
1144561343	Alternanthera puberula (Mart.) D.Dietr.	Isotype	Specimen		1	<div style="width: 100%;"></div>	
1144561350	Alternanthera puberula (Mart.) D.Dietr.	Isotype	Specimen		1	<div style="width: 50%;"></div>	
1144562358	Allium corsicum Jauzein, J.-M.Tison, Deschâtres & H.Couderc		Specimen	1981	1	<div style="width: 50%;"></div>	
1144564186	Hieracium marsillyanum Arv.-Touv.	Lectotype	Specimen	1906	1	<div style="width: 100%;"></div>	
1144564565	Asteraceae	Syntype	Specimen		1	<div style="width: 100%;"></div>	
1144564572	Asteraceae	Syntype	Specimen		1	<div style="width: 100%;"></div>	

Sort and highlight

By ID By scientific name By date By matching number

Filters

Date 0 2012

Dataset

Curation status

not-done (313) finished (31) partial (1)

Country

Madagascar (74) France (58) Paraguay (36)

Full Name

eBiodiv Matching Service

The matching screen presents the selected specimen and one or several material citations that are potentially matching the selected specimen.

The user can decide whether it is matching the specimen or not and save the decision. It requires to be logged with ORCID.

Note:
In the next version, a third decision (unknown) will be possible, as well as the possibility to write a comment.

eBioDiv Matching Service
Linking material citations to specimens

About Donat Agosti

Specimen 1144562358

Key	Family	Genus	Specific epithet	Coordinates	Elevation	Locality	Country	Date	Institution code	Collection code	Catalog nb	Individual nb	Collector (recorded by)	Type	Record	
1144562358	Amaryllidaceae	Allium	corsicum	42.083N, 9.300E		secteur Incudine-Bavella : Lugo-di-Nazza - Lugo di Nazza/Collectivité Territoriale de Corse	France	17/6/1981	G	Geneva Herbarium - General Collection (G)	G-G-318154/1		Deschatres, R.		Specimen	

Material citations associated with the specimen 1144562358

1 suggested material citation to curate

Please indicate for each suggested material citation whether it matches the specimen or not (Yes / No).

Key	Score	Family	Genus	Specific epithet	Coordinates	Elevation	Locality	Country	Date	Institution code	Collection code	Catalog nb	Individual nb	Collector (recorded by)	Type	Record	Yes	No	Save	
3466701314	0.80	Amaryllidaceae	Allium	corsicum	42.083N, 9.300E	200	Lugo di Nazza	France	17/6/1981		G		1	Deschatres, R.		Specimen	<input type="checkbox"/>	<input type="checkbox"/>	Save	

+ Add another material citation

Back to list Save

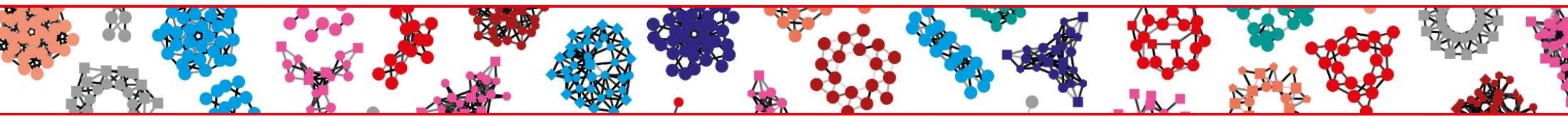
Color legend for the matching score

1 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0

Outreach

- Workshop on June 12 @HES-SO Neuchatel (15-20 participants)
«Text Mining to Support Biodiversity»
 - Training material: <http://plazi.org/posts/2023/03/specimen-material-citation-matching-service-training-course/>
 - TNA services
 - Funding - call for projects to support digitalization of collections and literature FAIR-ification – DBGI
 - Insertion in Biodiversity PMC with the related services: e.g. entity recognition (taxon, chemistry, phenotypes if available)
-

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Biotic interactions

With which species *Ficus citrifolia* do/can have a interaction of "pollinates"?

MEDLINE (2 interactions)

2 interactions with your filters (Total: 2 interactions)

	Species 1	Interaction	Species 2	Documents	Passages	Score	
1	<i>Ficus citrifolia</i> [197210]	pollinates	Vespidae [130014]	1	1	2.00	
2	<i>Pegoscapus tonduzi</i> [1078082]	pollinates	<i>Ficus citrifolia</i> [197210]	1	1	2.00	

16906292

1 passage in this document:

in **abstract**
1 sentence

Studying *Pegoscapus tonduzi* which **pollinates** *Ficus citrifolia* in Brazil, we analysed the effect of LMC (number of foundresses) on the sex ratio of the offspring of pollinating wasps.

<< < 1 > >>

Sort

By rank

By nb of docs

By nb of passages

By species 1

By species 2

By interaction

Filters

Interactions

pollinates (2)

Species 1

SPARQL endpoint

SPARQL Query Editor About Tables ▾

Conductor Permalink

Extensions: [cxml](#) [save to dav](#) [sponge](#) User: **SPARQL**

Default Data Set Name (Graph IRI)

Query Text

```
select distinct ?Concept where {[] a ?Concept} LIMIT 100
```

Results Format

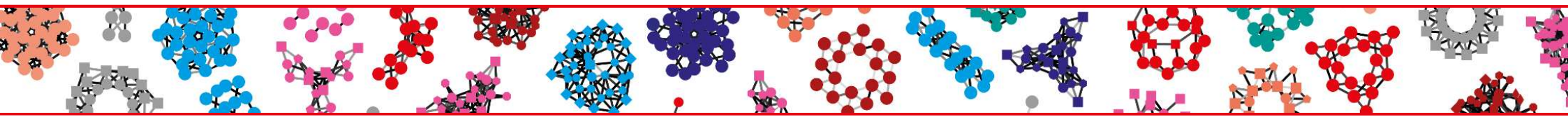
HTML

Execute Query

Reset

<https://sibils.text-analytics.ch/sparql>

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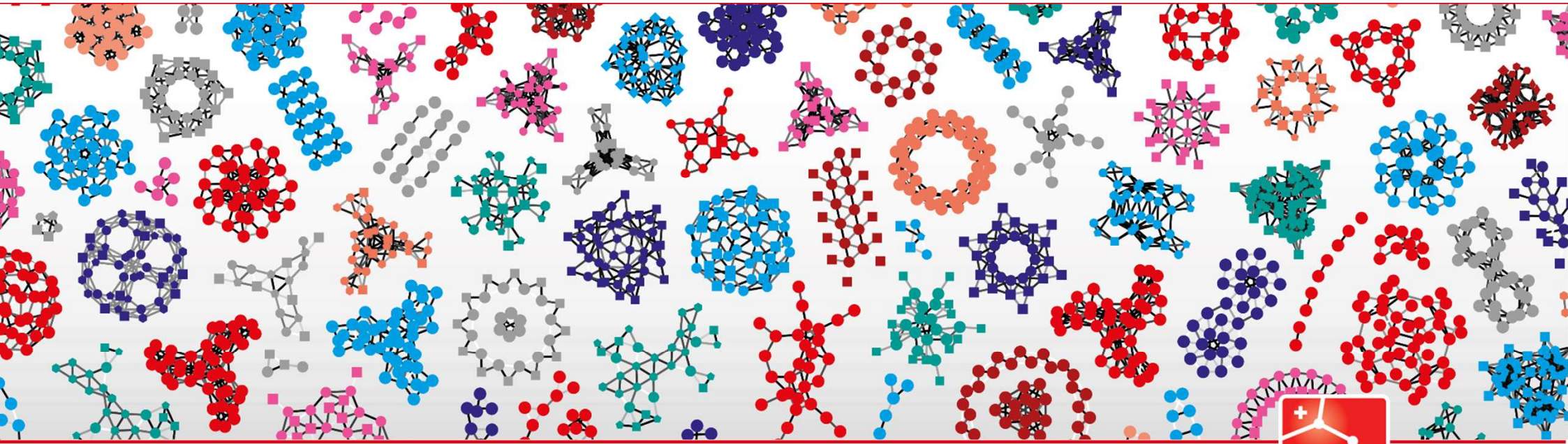
05

• **Conclusion**

Recap and conclusion

- We have a few assets (services and databases) but we acknowledge we need to learn from those who curate collections
 - Biodiversity PMC and e-BioDiv are research projects but SIB works to turn projects into sustainable resources provided it meets user needs

 - SIB is investing in biodiversity with federal (e.g. SEFRI via SBDe, FOEN) and international support (e.g. ELIXIR, GBIF, NIH, GBC)
 - We are open for discussion to identify actionable items far beyond digitalisation of collections !
-



Swiss Institute of
Bioinformatics

Thank you very much for the invitation !

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