

Living up to the potential of a fully digital herbarium

Quentin Groom



*“You can’t really
know where you are
going until you know
where you have
been.”*

— Maya Angelou



Where have we come from?

- With biodiversity literature herbaria are the foundation of modern plant taxonomy
- A source of research on evolution, plant variation and environmental change
- A source of evidence for historical research
- A tool for the identification of plants

So why can't we keep it as it is?

- Catalogued using one taxonomy
- Fragile
- Toxic
- Remote from researchers
- Disconnected from the research it generated
- Elitist



What is the potential?



A globally connected research infrastructure
for the study of plant life



Dynamic, innovative & pivotal



How do we realize that potential?

- Every specimen identified uniquely
- All label data fully digital
- Searchable by any data element
- High quality images of every specimen
- Everyone recognised for the contributions
- Open to analysis
- Globally connected and accessible
- Interoperable
- Readable by people and machines
- Open

Meise Botanic Garden digitization (DOE!)

- It cost > 3 million euros
- 2.7 million specimens
- Six years
- Ongoing costs
 - A lot!

< BACK

ANNOTATE SPECIMEN

Oxalis purpurea L.

Cite as: <https://www.botanicalcollections.be/specimen/BR0000027650172V>

Specimen



**Plantentuin
Meise**

Herbarium Meise Botanic Garden

Barcode BR0000027650172V

Country Australia

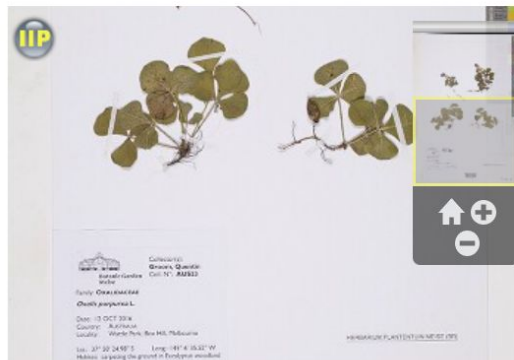
Locality Wattle Park, Box Hill, Melbourne

Date 2016-10-12

Collector Groom Q.

Collector AUS23

Image



Locality

Map

Satellite

South
Pacific
Ocean

Coordinates: -37.84027 lat,
-145.10986 long



Every specimen identified uniquely

Readable by machines

```
<?xml version="1.0"?>
```

```
<rdf:RDF
```

```
  xmlns:dc="http://purl.org/dc/terms/"
```

```
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
```

```
  xmlns:dwc="http://rs.tdwg.org/dwc/terms/"
```

```
  xmlns:owl="http://www.w3.org/2002/07/owl#"
```

```
  xmlns:dwciri="http://rs.tdwg.org/dwc/iri/" >
```

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<rdf:Description rdf:about="https://www.botanicalcollections.be/specimen/BR0000027650172V/rdf">
```

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  <dc:created>Tue May 17 16:43:04 UTC 2022</dc:created>
```


```
  <dc:creator>Botanical Garden Meise</dc:creator>
```

```
  <dc:subject rdf:resource="https://www.botanicalcollections.be/specimen/BR0000027650172V"/>
```



DOE·DAT • Plants of South Africa (I) BR0000020407476.jpg
Barcode BR0000020407476

Skip Create forum topic Tutorial



Barcode: BR0000020407476
Taxon: ERIC. Erica ripens

1. Identification Shrink

Scientific name as given *

Vernacular name

Uses

2. Collection data

Collector(s) as given *

Collector (standard) *

Collection number *

Collection date *
(Year) DD MM YYYY

(Month) DD MM YYYY

Habitat

Cultivated?

Plant description

Miscellaneous

3. Spatial data

Locality as given *

Altitude From - to

IFEG grid cell

Coordinates as given

If the geographic coordinates do not appear on the label, find them using the mapping tool below.

Mapping tool

Latitude

Longitude

Coordinate uncertainty (metres)

Administrative division

Country *



All label data fully digital

[Get data](#)[How-to](#)[Tools](#)[Community](#)[About](#)[Login](#)

OCCURRENCE DATASET | REGISTERED MAY 3, 2018

Meise Botanic Garden Herbarium (BR)

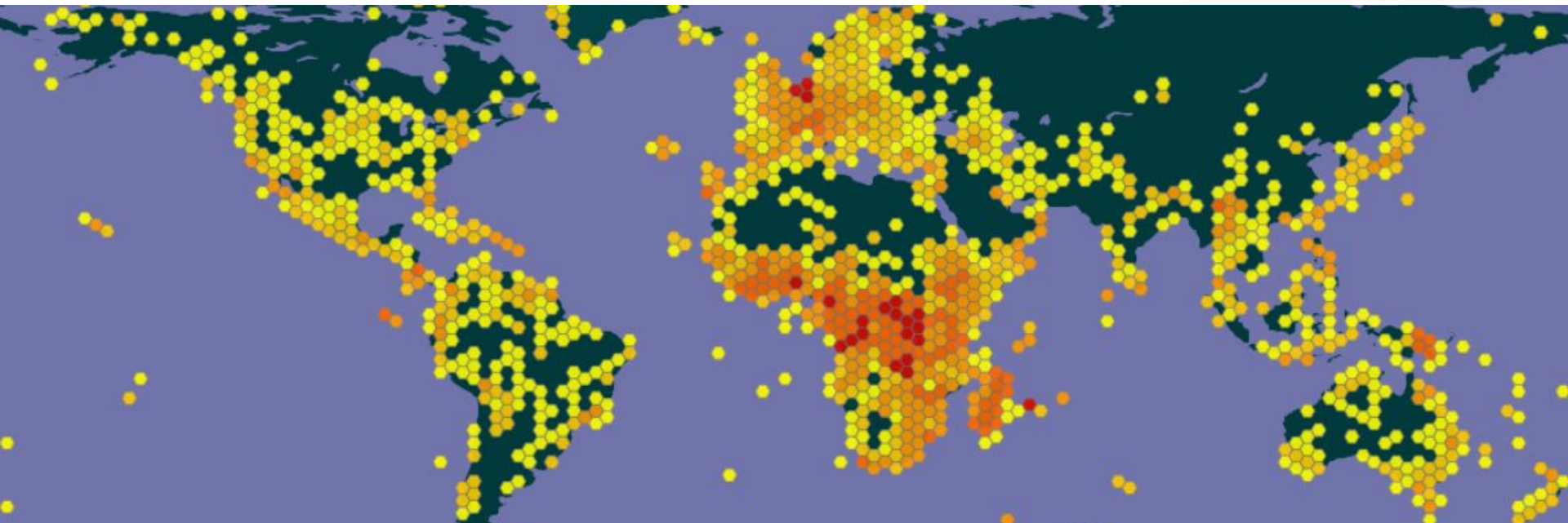
Published by [Meise Botanic Garden](#)

Meise Botanic Garden

[DATASET](#)[PROJECT](#)[METRICS](#)[ACTIVITY](#)[↓ DOWNLOAD](#)[↔ HOME PAGE](#)

1,827,944 OCCURRENCES

598 CITATIONS



Col. data | Herbaria | Tools | Community | About

occurrence | 10 million 000

Mussaenda afzelii G. Don

Collected in Liberia

Plantae | Tracheophyta | Magnoliopsida | Gentianales | Rubiaceae | Mussaenda

DETAILS

Species: *Mussaenda afzelii* G. Don
Location: Liberia
Basis of record: Preserved specimen

Dataset: Meise Botanic Garden Herbarium (BIN)
Publisher: Meise Botanic Garden
Reference: <http://www.botanicgardens.be/specimen/BIN0000...>

Sierra Leone
Ivory Coast
Ghana
Liberia

? No media identifier provided

Title: *Mussaenda afzelii* G. Don
Description: IFF Herbarium for specimen BIN000022893208V
Creator: Meise Botanic Garden
Record ID: <http://www.mbg.org/ipl/1.1>
Rights holder: Meise Botanic Garden
Identifier: <https://nbn-resolving.org/urn:nbn:nl:meise:23230821-mba-11111>
Suggested attribution: "*Mussaenda afzelii* G. Don" *Mussaenda afzelii* G. Don
collected in Liberia by Meise Botanic Garden. Download under
<http://creativecommons.org/licenses/by/4.0/>

Title: *Mussaenda afzelii* G. Don
Description: image of the holotype specimen BIN000022893208V
Creator: Meise Botanic Garden
Record ID: <http://www.mbg.org/ipl/1.1>
Rights holder: Meise Botanic Garden
Identifier: <https://nbn-resolving.org/urn:nbn:nl:meise:23230821-mba-11111>
Suggested attribution: "*Mussaenda afzelii* G. Don" *Mussaenda afzelii* G. Don
collected in Liberia by Meise Botanic Garden. Download under
<http://creativecommons.org/licenses/by/4.0/>

High quality images available of every specimen

Occurrence | 10 March 2020

Mussaenda afzelii G. Don



Collected in Liberia

Phytol. Tracheophyta · Magnoliopsida · Geraniales · Rubiales · Mussaenda

DETAILS

Species: *Mussaenda afzelii* G. Don
 Location: Liberia
 Basis of record: preserved specimen

Dataset: Meise Botanic Garden Herbarium (BGI)
 Publisher: Meise Botanic Garden
 Reference: <http://www.botanicagardens.org/specimen/BGI0000...>

no media identifier provided

Title: *Mussaenda afzelii* G. Don
 Description: Image of herbarium specimen BGI0000289808897
 Creator: Meise Botanic Garden
 Record ID: <http://www.mbg.org/specimen/BGI0000289808897>
 Rights holder: Meise Botanic Garden
 Identifier: <http://www.mbg.org/specimen/BGI0000289808897>
 Suggested attribution: "*Mussaenda afzelii* G. Don" · *Mussaenda afzelii* G. Don collected in Liberia by Meise Botanic Garden. Download under <http://creativecommons.org/licenses/by/4.0/>

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IIF — International Image Interoperability Framework



Meise
Botanic Garden

Occurrence | 10 March 2020

Mussaenda afzelii G. Don


Collected in Liberia

Plantae - Tracheophyta - Magnoliopsida - Cornales - Rubiaceae - Mussaenda

DETAILS


Species: *Mussaenda afzelii* G. Don
 Location: Liberia
 Basis of record: Preserved specimen

Dataset: Herbario Botánico de Madrid (BM)
 Publisher: Meise Botanic Garden
 Reference: <http://www.botanicagarden.org/specimen/BR0000>.



no media identifier provided

Title: *Mussaenda afzelii* G. Don
 Description: Image of herbarium specimen BR000025869088V
 Creator: Meise Botanic Garden
 Record ID: <http://www.meisebotanicgarden.org/specimen/BR000025869088V>
 Rights holder: Meise Botanic Garden
 Identifier: <http://hdl.handle.net/10101/10101/10101>
 Suggested attribution: "*Mussaenda afzelii* G. Don" - *Mussaenda afzelii* G. Don collected in Liberia by Meise Botanic Garden. Download under <http://creativecommons.org/licenses/by/4.0/>



Title: *Mussaenda afzelii* G. Don
 Description: Image of herbarium specimen BR000025869088V
 Creator: Meise Botanic Garden
 Record ID: <http://www.meisebotanicgarden.org/specimen/BR000025869088V>
 Rights holder: Meise Botanic Garden
 Identifier: <http://hdl.handle.net/10101/10101/10101>
 Suggested attribution: "*Mussaenda afzelii* G. Don" - *Mussaenda afzelii* G. Don collected in Liberia by Meise Botanic Garden. Download under <http://creativecommons.org/licenses/by/4.0/>

Mussaenda afzelii G. Don (BR0000025869088V)



1 of 1 - BR0000025869088V-0

IIIF — International Image Interoperability Framework

In recent years, CETAF (Consortium of European Taxonomic Facilities) institutions have started to enrich their collection data with links to semantic resources (e.g. persons or geographical units). In this way, it is possible for the first time to represent distributed collections as a unified information space and to enhance them with various external resources. An example of this approach is this "Botany Pilot", in which diverse data on collectors of botanical specimens are made accessible by linking a reliable and stable person ID (e.g. a so called QID in Wikidata). This includes, for example, biographical data from Wikidata, specimens in different herbarium collections, publications in BHL (Biodiversity Heritage Library) and, more recently, entries from <https://bionomia.net/>. Based on a single person identifier, the respective information is dynamically pulled together with linked data mechanisms from a growing number of web resources.

Best practices on CETAF identifiers in general are compiled at https://cetafidentifiers.biowikifarm.net/wiki/Main_Page. For further information you can contact us under [✉ biodiversitydata@bgbm.org](mailto:biodiversitydata@bgbm.org).

Participating institutions



Biography

Richard Spruce
 * 1817 † 1893
 British botanist and explorer (1817-1893)
 Spruce



Specimen data from herbarium databases

- Berlin Botanic Garden and Botanical Museum
- Botanic Garden Meise
- Royal Botanical Garden Edinburgh
- University of Vienna
- Natural History Museum Vienna

Linked data from other information systems

- BHL
- BIONOMIA
- VIAF
- Europeana

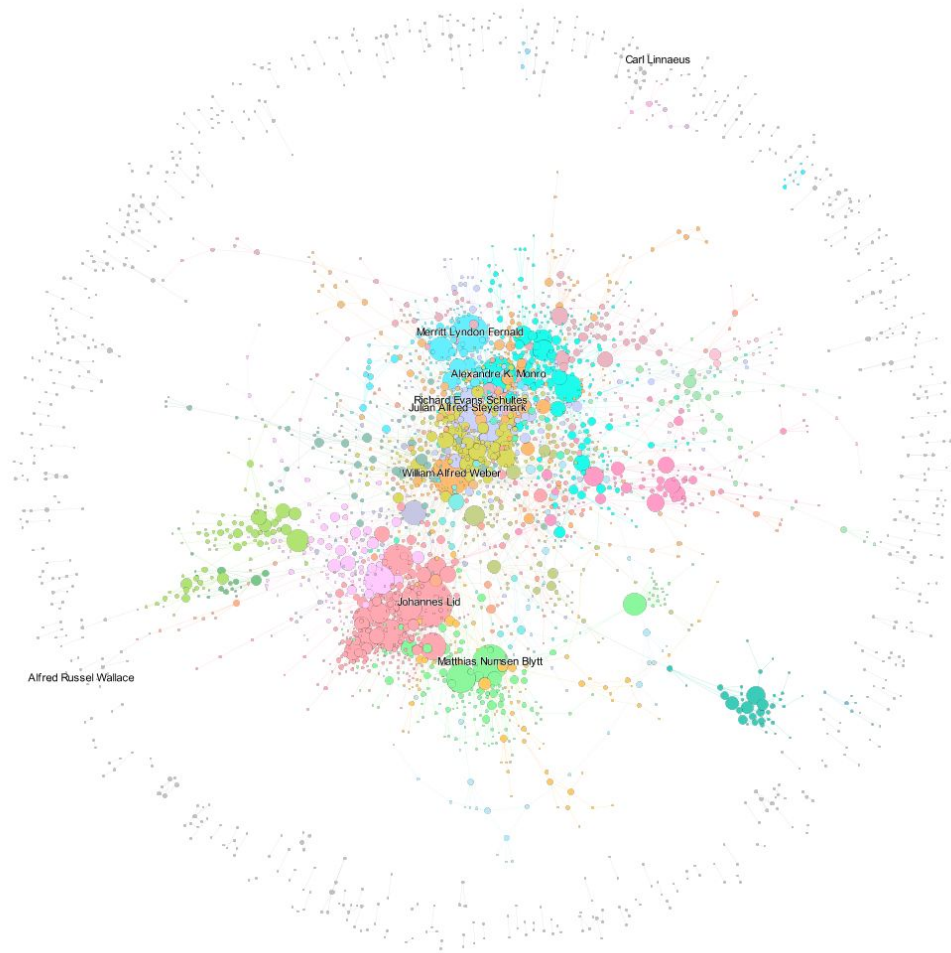
Güntsche A, Groom Q, Ernst M, Holetschek J, Plank A, et al. (2021) A botanical demonstration of the potential of linking data using unique identifiers for people. *PLOS ONE* **16**(12): e0261130.

<https://doi.org/10.1371/journal.pone.0261130>



Link natural history specimens to the world's collectors

All the collectors, identifiers, researchers, curators recognised for the contributions to science



#BioHackEU21

Alicia Lourteig

Born
December 1913

Nationality
Argentina

Co-recorders
15



Lourteig was a French - Argentinian botanist of the 20th century. She travelled the world, collecting plants and visiting all the main herbaria of the world. At 43 she became the curator of the New World botanic collection at the National Museum of Natural History, France in Paris.

Lake Alicia in the Kerguelen Islands in French Antarctica is named after her as are about twenty plant taxa, including *Lourteigia* in the Asteraceae and *Lourtella* in the Lythraceae.

Meeus, S., August, T., Trekels, M., Reyserhove, L., & Groom, Q. J. (2021, December 7). Network analysis of specimen co-collection.

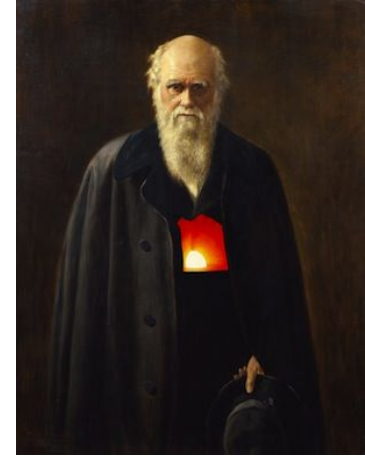
<https://doi.org/10.37044/osf.io/4ahnq>



**Meise
Botanic Garden**

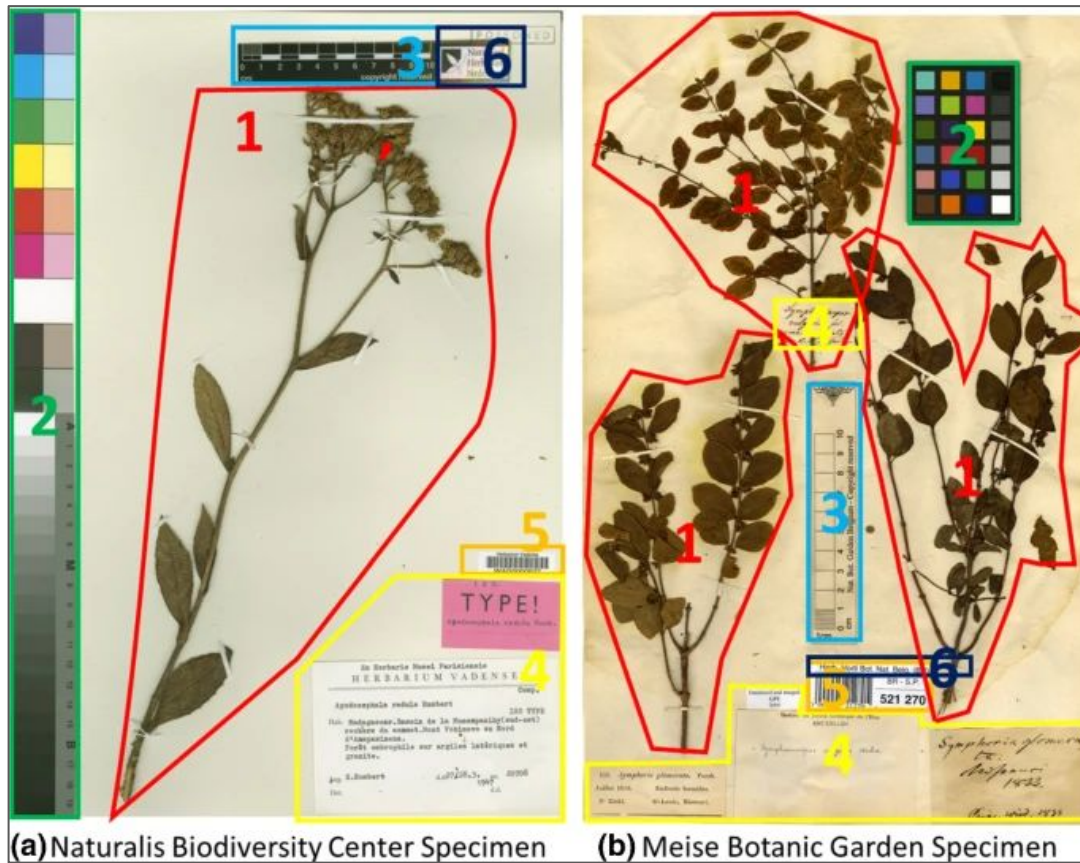


ORCID



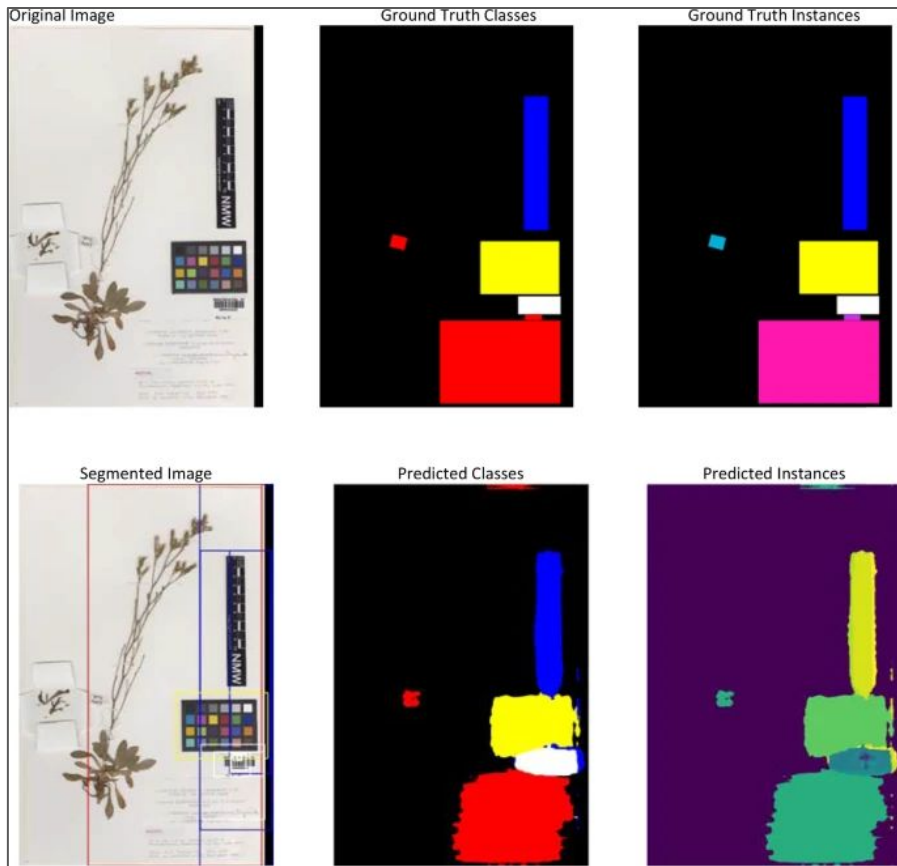
Biodiversity
Information
Standards
TDWG

Interoperable



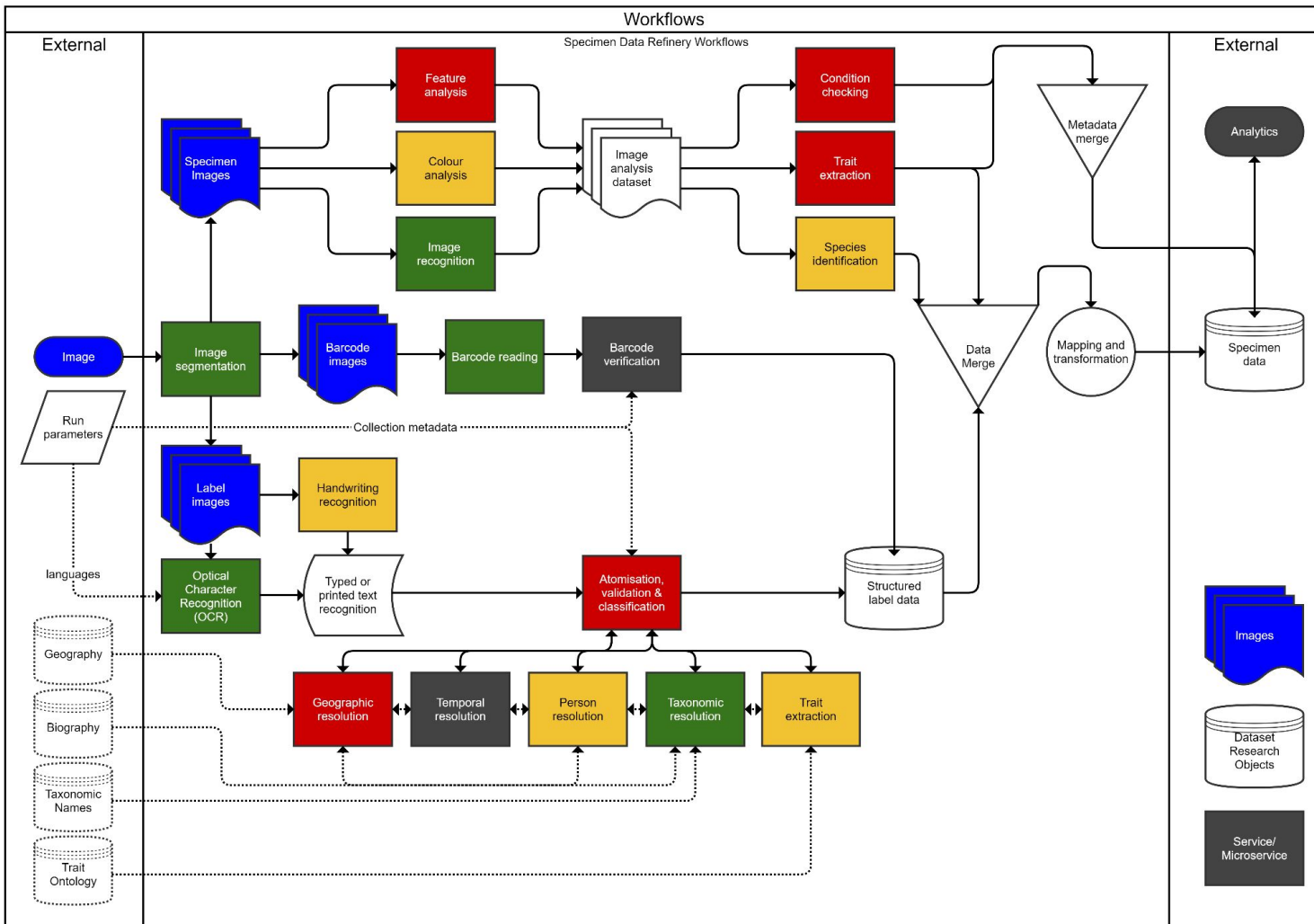
de la Hidalga, A.N., Rosin, P.L., Sun, X. et al. Cross-validation of a semantic segmentation network for natural history collection specimens. *Machine Vision and Applications* **33**, 39 (2022).
<https://doi.org/10.1007/s00138-022-01276-z>

Machine learning



de la Hidalga, A.N., Rosin, P.L., Sun, X. et al. Cross-validation of a semantic segmentation network for natural history collection specimens. *Machine Vision and Applications* **33**, 39 (2022).
<https://doi.org/10.1007/s00138-022-01276-z>

Linking to sequences



Walton S, Livermore L, Bánki O, Cubey RWN, Drinkwater R, Englund M, Goble C, Groom Q, Kermorvant C, Rey I, Santos CM, Scott B, Williams AR, Wu Z (2020) Landscape Analysis for the Specimen Data Refinery. Research Ideas and Outcomes 6: e57602. <https://doi.org/10.3897/ri.o.6.e57602>

What is the future?



Integration, inference, Big Data



Education, Citizen Science, Awareness



Decolonization & equity



Contributing to sustainable development goals, and the other great challenges of our age





The team

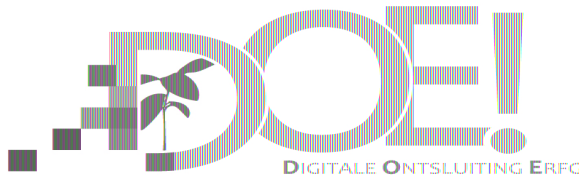
Digitization management: Sofie De Smedt & Ann Boeaerts

Database management: Henry Engledow

Informatics infrastructure and quality control: Niko De Meeter, Paul Van Wambeke,
Jean Van Onacker

Biodiversity Informatics: Quentin Groom, Mathias Dillen, Pieter Huybrechts,
Maarten Trekels

And many more!!!



Meise
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ICEDIG.EU



Thank you!!!



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