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Open Science Clusters' Action for Research & Society

Funded Project

Enhancing AI-Readiness of Bioimaging Data with Content-Based Identifiers (BIO-CODES)

Sylvia Le Dévédec, Leiden University, ORCID: 0000-0002-0615-9616

Implemented by

Universiteit Leiden

ISCC Foundation

German BioImaging
Gesellschaft für Mikroskopie und Bildanalyse

NL-BIOIMAGING AM

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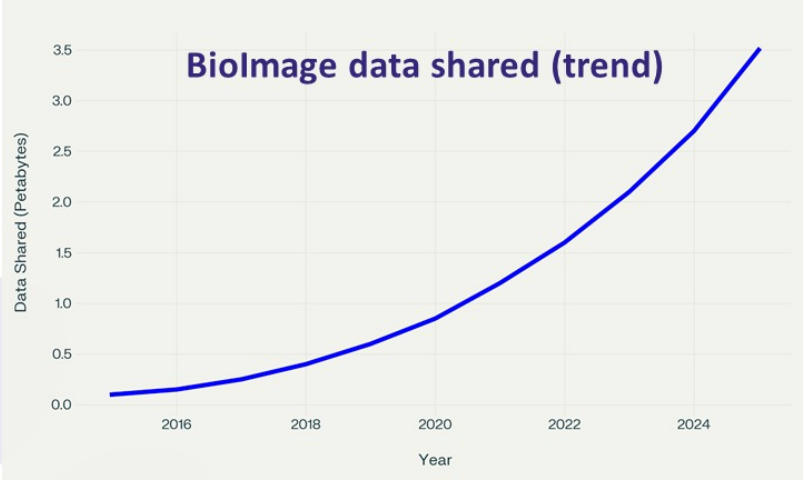
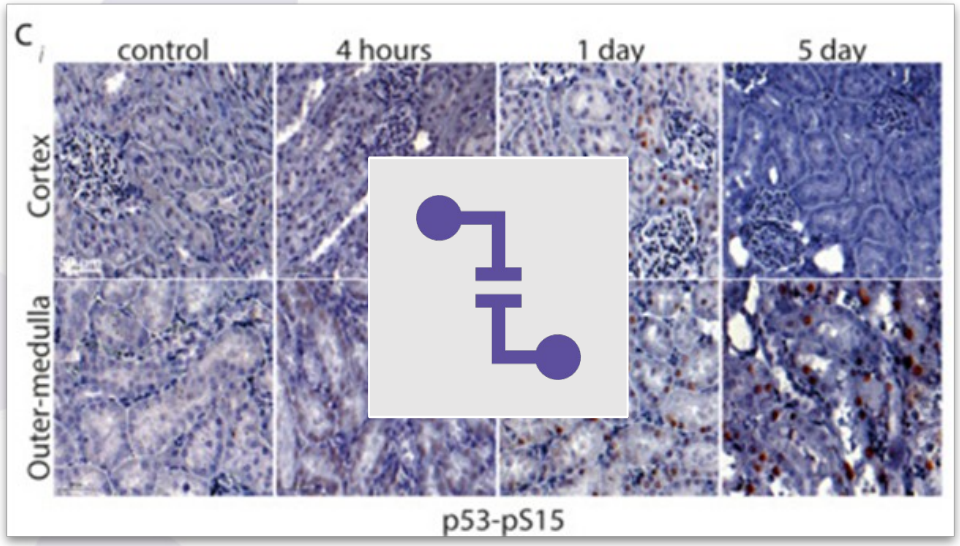
CHALLENGE IN BIOIMAGING

- **Growing volume of data**: Bio(imaging) data exist at different states — raw, repository, publications — with no shared identity across them.
- **No Audit Trail:** Challenges to verify data integrity or detect manipulation after the fact.
- **Lost Provenance:** Published figures are disconnected from raw data and the processing steps that produced them.





Lukas S Wijaya et al., Cell Biol Toxicol . 2025

SOLUTION: ISCC (International Standard Content Code)

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- **International Standard Content Code (ISCC ISO 24138)**. Open and open-source. Interoperable content identification & fingerprinting system. Computed directly from the asset itself — can never be removed or decoupled from the data.

- **Anyone can compute ISCCs from available data** — independently and without any central authority. Use the ISCC Generator at https://iscc.io/resources/

- **Generating, signing, and timestamping ISCCs** creates persistent identifiers to securely reference and link data in repositories with images in papers.

SOLUTION: ISCC (International Standard Content Code)

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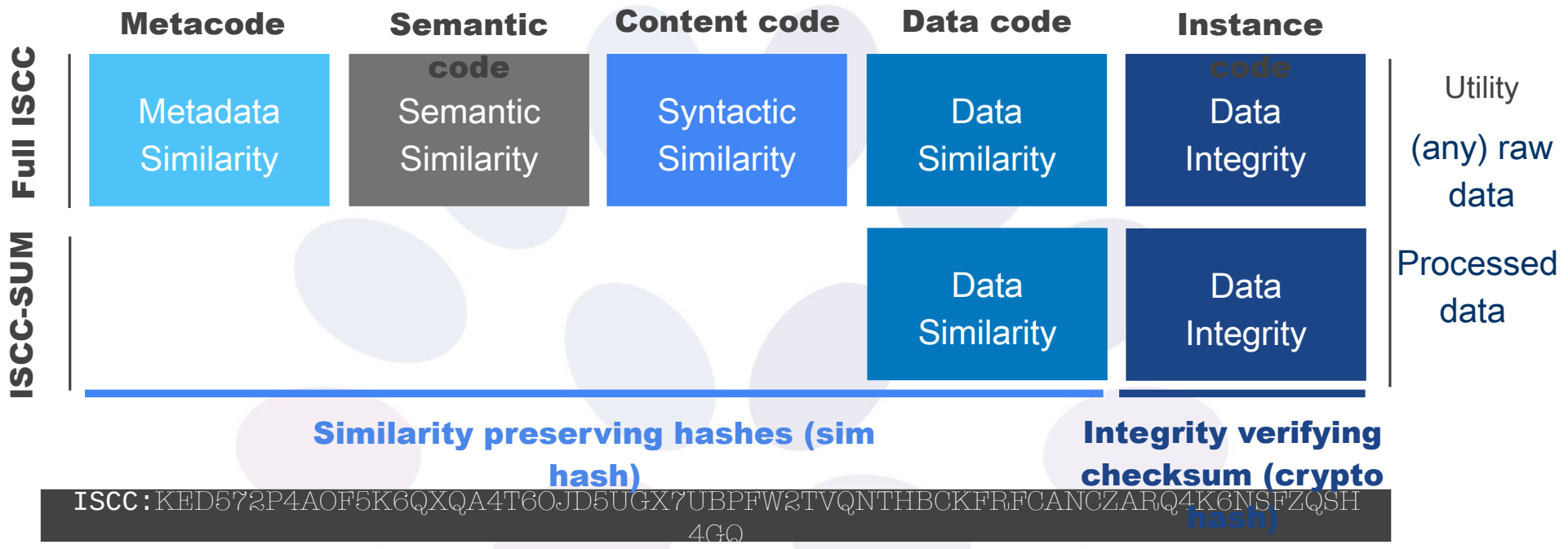
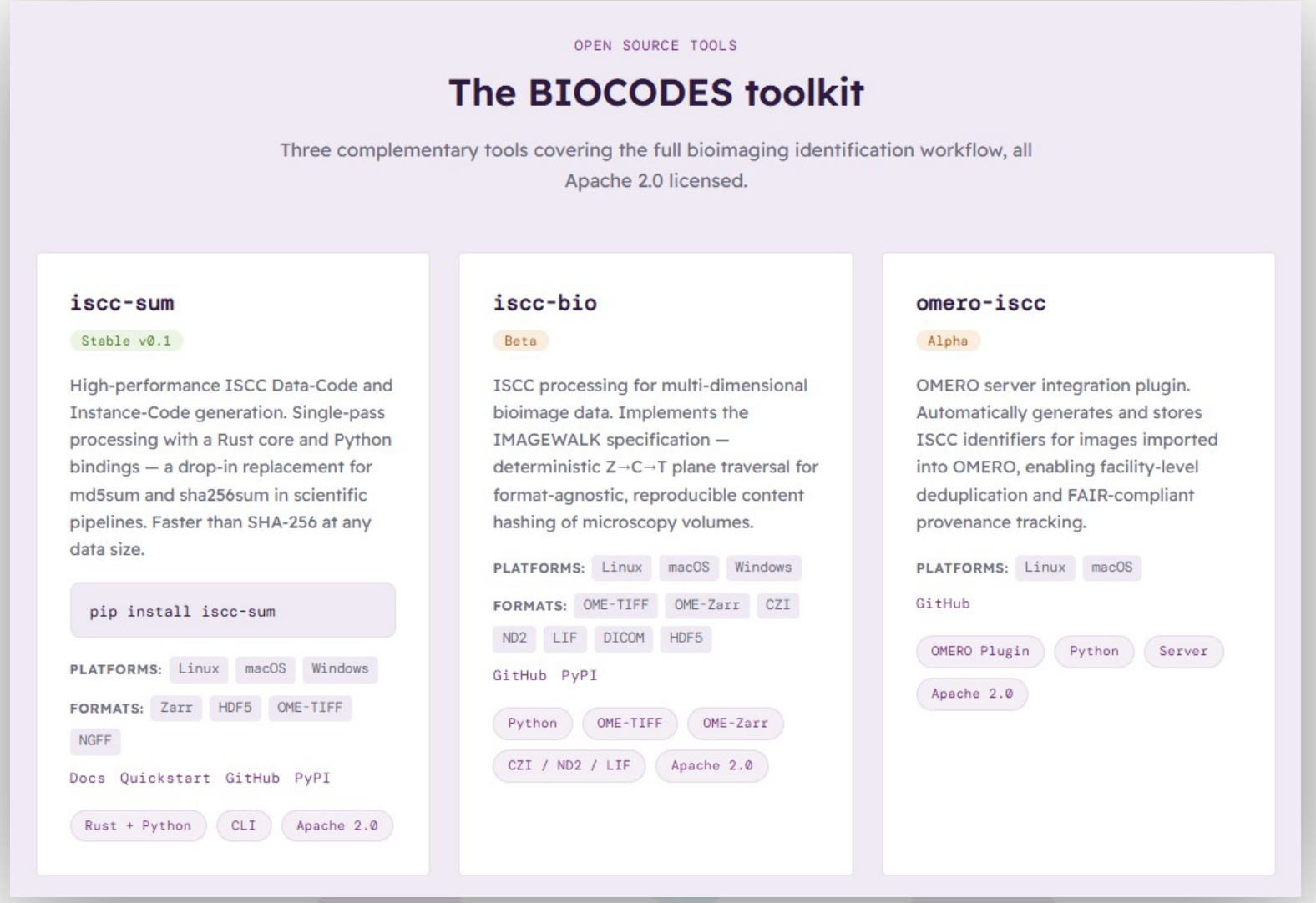
The DNA of your digital content



- **Standardized (ISO 24138) multi-component fingerprint** for various media types and files formats
- **Computed from the asset itself** (can never be removed)
- Can assess similarity at semantic, syntactic and data level



OPEN SOURCE TOOLS

The BIOCODES toolkit

Three complementary tools covering the full bioimaging identification workflow, all Apache 2.0 licensed.

iscc-sum

Stable v0.1

High-performance ISCC Data-Code and Instance-Code generation. Single-pass processing with a Rust core and Python bindings — a drop-in replacement for md5sum and sha256sum in scientific pipelines. Faster than SHA-256 at any data size.

```
pip install iscc-sum
```

PLATFORMS: Linux macOS Windows

FORMATS: Zarr HDF5 OME-TIFF NGFF

Docs Quickstart GitHub PyPI

Rust + Python CLI Apache 2.0

iscc-bio

Beta

ISCC processing for multi-dimensional bioimage data. Implements the IMAGEWALK specification — deterministic Z→C→T plane traversal for format-agnostic, reproducible content hashing of microscopy volumes.

PLATFORMS: Linux macOS Windows

FORMATS: OME-TIFF OME-Zarr CZI ND2 LIF DICOM HDF5

GitHub PyPI

Python OME-TIFF OME-Zarr CZI / ND2 / LIF Apache 2.0

omero-iscc

Alpha

OMERO server integration plugin. Automatically generates and stores ISCC identifiers for images imported into OMERO, enabling facility-level deduplication and FAIR-compliant provenance tracking.

PLATFORMS: Linux macOS

GitHub

OMERO Plugin Python Server Apache 2.0

https://bio-codes.io/

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COMMUNITY & INTEGRATIONS

Built for the open bioimaging ecosystem

BIOCODES integrates with the tools researchers already use — no new infrastructure required.

OMERO

Available

Server plugin for automatic ISCC generation on image import. Enables facility-level deduplication and provenance tracking within OMERO's image management infrastructure.

- Automatic ISCC generation on import
- Facility-level deduplication
- FAIR-compliant metadata annotation

`omero-iscc`

Galaxy

Available

Galaxy tools for ISCC generation, near-duplicate detection, and content verification within reproducible Galaxy workflows. Part of the BMCV galaxy-image-analysis tool suite.

- iscc_sum — ISCC code generation for any file
- iscc_similarity — near-duplicate detection across datasets
- iscc_verify — content integrity verification

`galaxy-image-analysis / iscc-sum`

Napari

Planned

Plugin integration for interactive image analysis and ISCC annotation within the Napari viewer.

- Interactive ISCC annotation
- In-viewer provenance display

https://bio-codes.io/

TEAM

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Titusz Pan

Martin Etzrodt

Kira Lemke

Sebastian Posth

Maarten Paul

Sylvia Le Dévédec

Josh Moore

ISCC Foundation

Universiteit Leiden

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Project homepage: https://bio-codes.io/

Soon to come: ISCC / BIO-CODES community on Image.sc