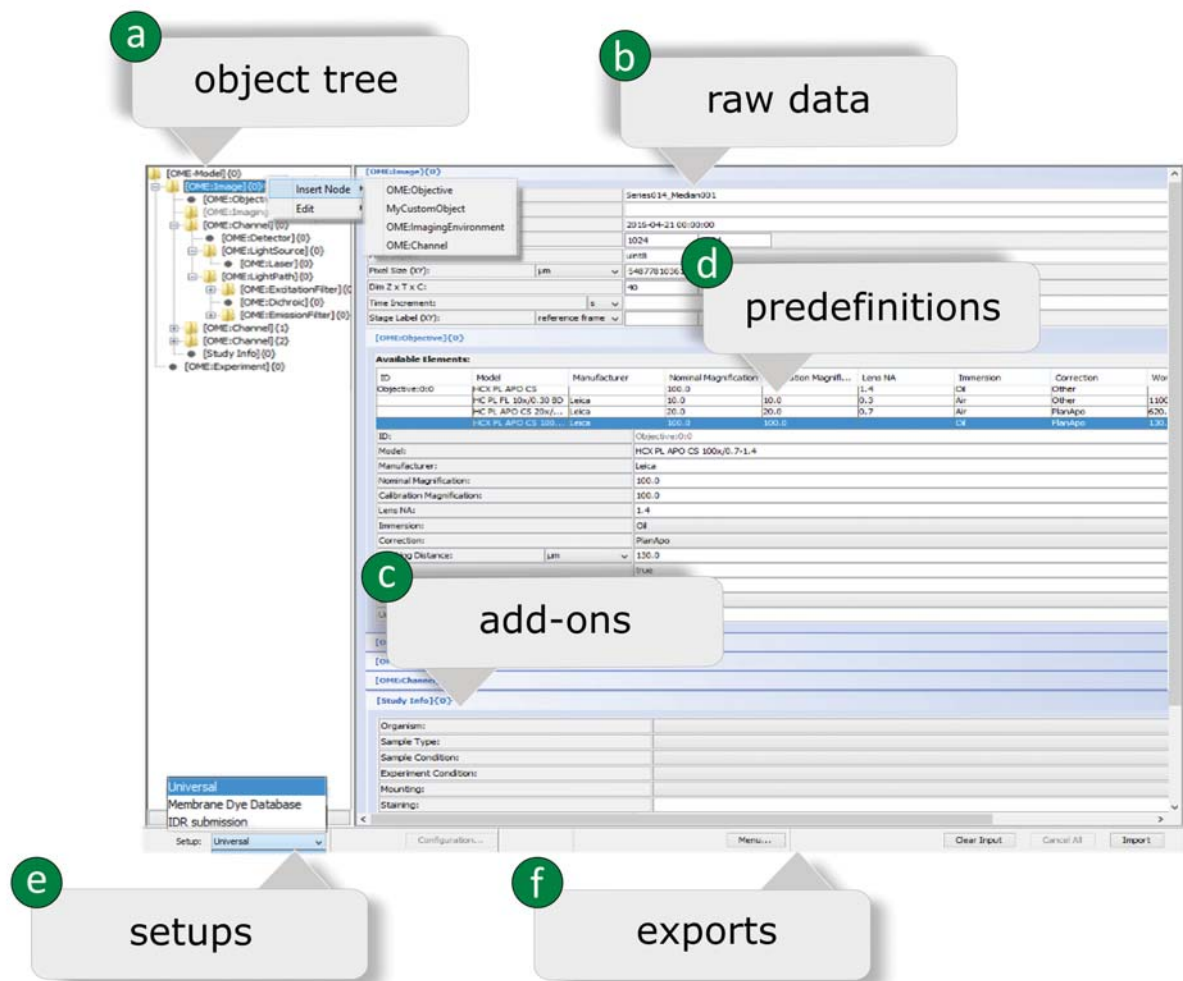**Supplementary information**

# MDEmic: a metadata annotation tool to facilitate management of FAIR image data in the bioimaging community

In the format provided by the authors and unedited

Supplemental Figure 1: Graphical user interface of MDEmic.
**a)** The object tree is based on the structure of the OME data model and can be extended by objects of this data model or self-defined objects. Objects are a collection of related metadata. The extension can be done manually at runtime by using the context menu or by selecting the appropriate setup from the configuration file. **b)** The technical metadata stored in the image file is read using Bio-Formats and provided in the input forms as editable values. **c)** The user can define new objects with defined metadata keys and a selection of predefined values by specifying them in the configuration file. These values can also be loaded automatically by reference to an ontology class. **d)** Predefined metadata can be specified for all objects in the configuration, which the user can choose from. **e)** A setup is a bundle of data model modifications, input form configurations and/or various associated predefinitions (such as hardware definitions of a microscope setup or an experiment protocol). **f)** All metadata can be exported directly to a text file or as a reusable template for later annotation using MDEmic.
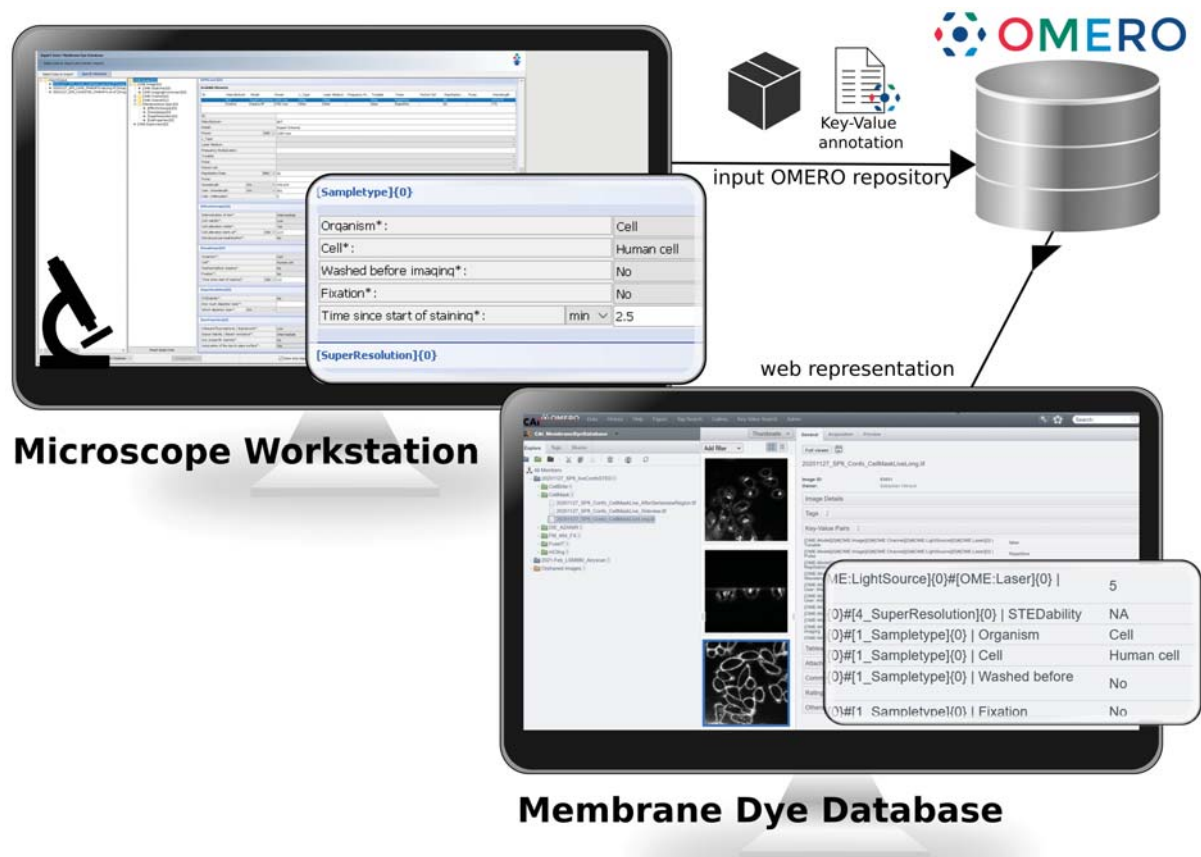
Supplemental Figure 2: The workflow from microscopes to (tailored) OMERO repositories. After data acquisition on the microscope, start the software tool (OMERO.importer) for data transfer to the Membrane Dye Database. For the selected data, the metadata contained in the data container are read out using Bio-Formats. Now the required metadata for a membrane dye dataset can be added using the given input mask and predefinitions. Finally, the data and the added metadata are transferred to the Membrane Dye Database.
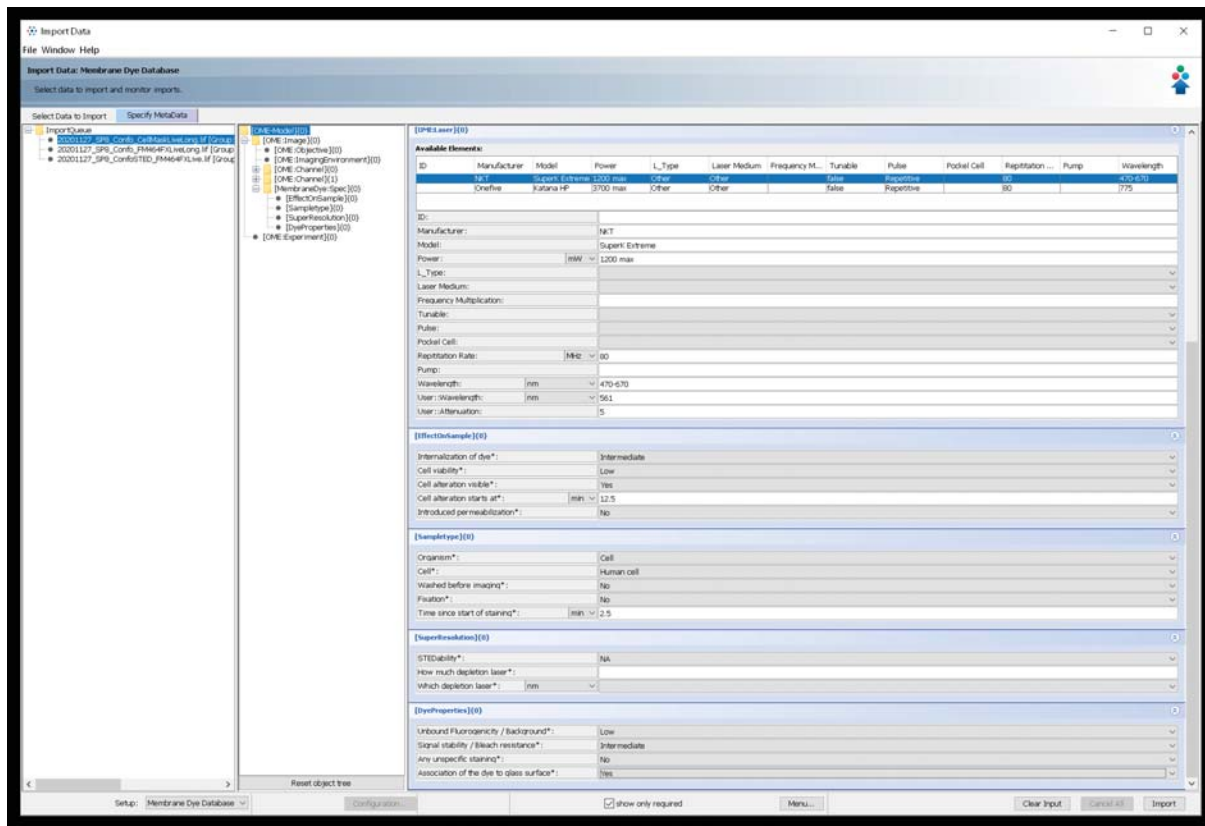
Supplemental Figure 3: Completed annotation in OMERO.mde of a membrane dye data set. In the *Membrane Dye Database* setup, the corresponding additionally defined metadata objects integrated in advance in the OME Data Model are displayed as an input form (specification in https://zenodo.org/record/5138039/files/mdeConfiguration.xml). The predefined metadata of the objects for this setup, e.g. for the laser object, are loaded automatically and the user can accept the matching objects as input.
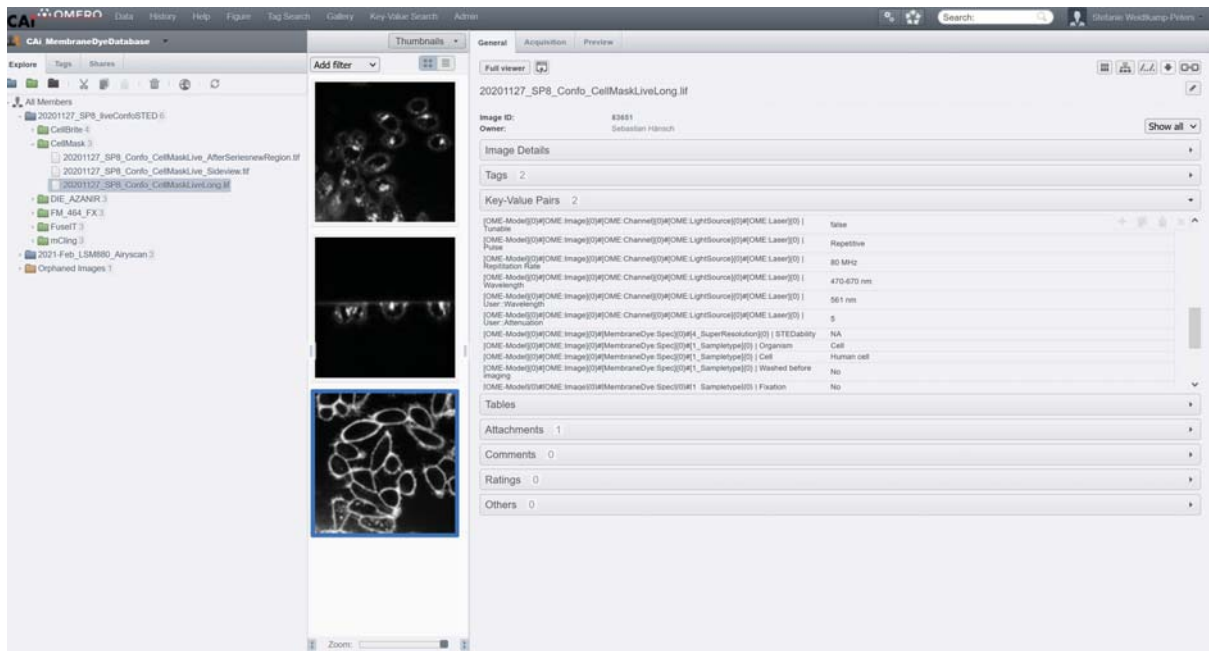
Supplemental Figure 4: A membrane dye data set described with OMERO.mde in OMERO.web.

All user specifications in OMERO.mde are automatically linked to the image as key-values after the image has been transferred to the local repository. This metadata can be displayed via the OMERO software, here e.g. OMERO.web.
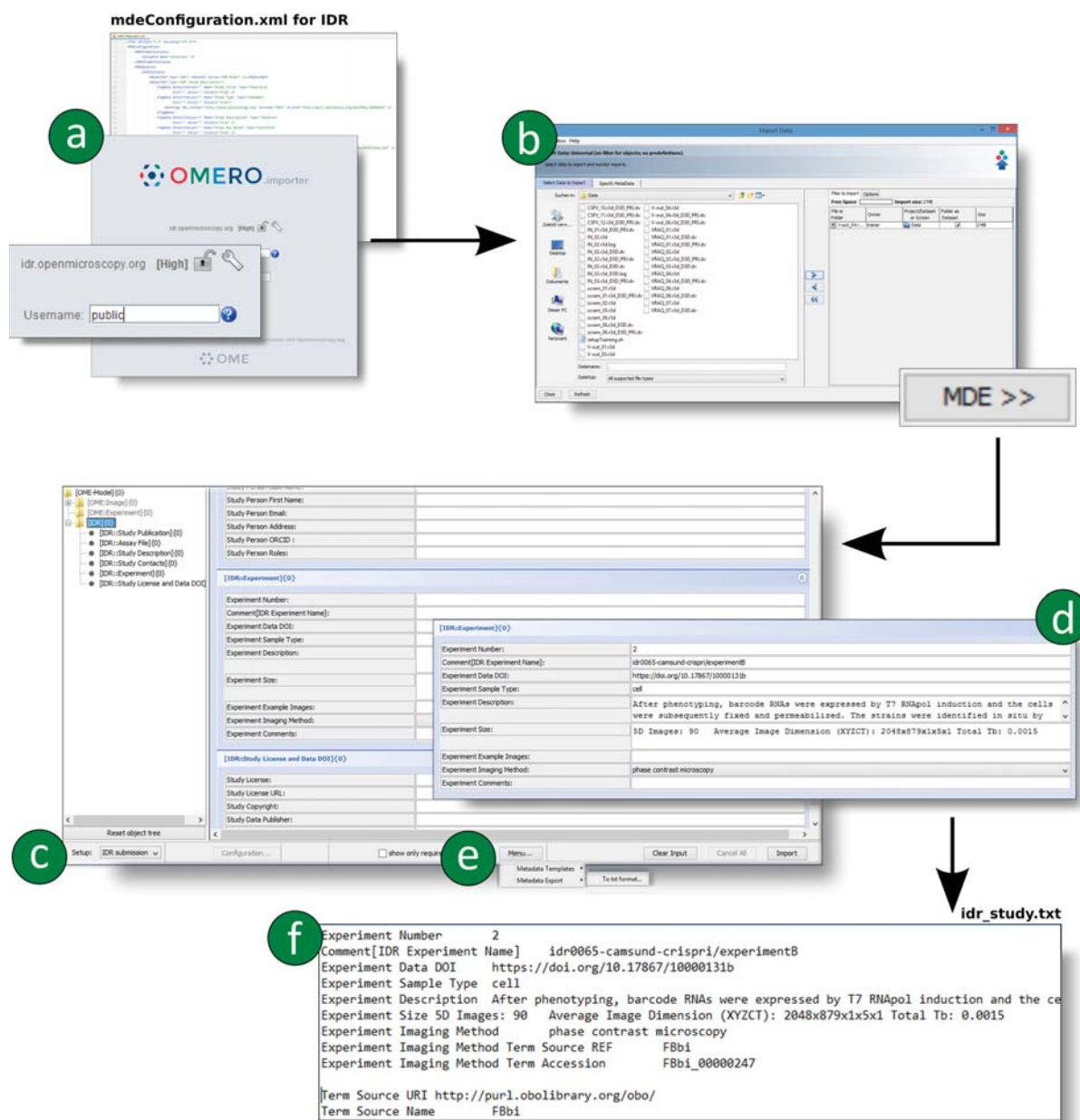
Supplemental Figure 5: Capture required metadata for IDR submission with MDEmic integrated in OMERO.

Workflow for collecting the required metadata for an IDR submission using OMERO.mde. **a)** After downloading the mdeConfiguration.xml (https://zenodo.org/record/5138039/files/mdeConfiguration.xml) for the IDR submission, you can adapt the used ontology classes to your needs. OMERO.mde loads all subclass terms from the linked ontology class and makes them available as a selection list. Start the OMERO.importer. By referencing the publicly accessible IDR server, anyone can use the OMERO.importer even without a local OMERO server. **b)** Select your data and switch to the mde input field. **c)** Select the *IDR submission* setup to load the IDR-specific input masks. **d)** Fill in the fields. **e)** Exporting the input to an IDR-formatted file automatically creates an **f)** idr_study.txt file with the input as key-value pairs and the references to the selected ontology class.
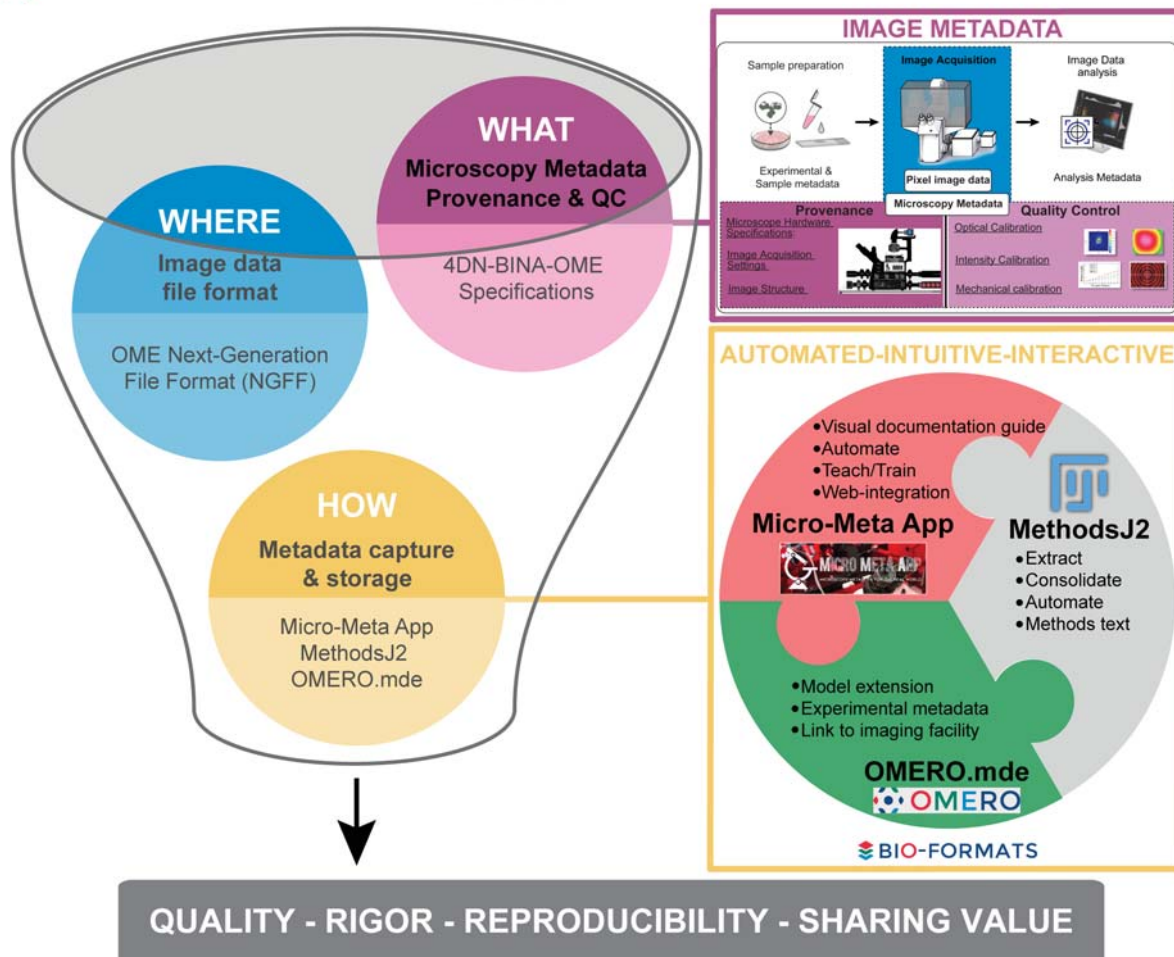
Supplemental Figure 6: Quality, rigor, reproducibility and sharing value for imaging experiments require the definition of community-driven Microscopy Metadata specifications and the adoption of easy-to-use metadata collection tools to facilitate the documentation and quality control tasks for experimental scientists.

The establishment of FAIR (Wilkinson et al., 2016), community-driven Microscopy Image Data Standards implies parallel development on three interrelated fronts: 1) Next- Generation File Formats (NGFF) where the ever-increasing scale and complexity of image data and metadata would be contained for exchange (Moore et al., 2021); blue bubble). 2) Community-driven specifications for what 'data provenance' information (microscope hardware specifications, image acquisition settings and image structure metadata) and quality control metrics are essential for rigor, reproducibility, and reuse and should therefore be captured in Microscopy Metadata (magenta bubble). 3) Shared rules for how the (ideally) automated capture, representation and storage of Microscopy Metadata should be implemented in practice (yellow bubble). Micro-Meta App, MethodsJ2 and OMERO.mde are three highly interoperable and complementary tools that function to train users on the importance of documentation and quality control, facilitate metadata extraction, collection and storage, and automatically write Methods sections.

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## Supplemental Table:

**Supplemental Table 1:**

| Code/Files | Access |
|---|---|
| OMERO.mde source code | https://github.com/ome/omero-insight |
| OMERO.mde guide | https://omero-guides.readthedocs.io/en/latest/mde/docs/index.html <br> https://github.com/ome/omero-guide-mde |
| mdeConfiguration.xml | https://doi.org/10.5281/zenodo.5138039 |
| 20201127_SP8_Confo_CellMaskLiveLong.lif | https://doi.org/10.5281/zenodo.5138039 |

## Supplemental References:

Moore, J., C. Allan, S. Besson, J.-M. Burel, E. Diel, D. Gault, K. Kozlowski, D. Lindner, M. Linkert, T. Manz, W. Moore, C. Tischer, and J.R. Swedlow. 2021. OME-NGFF: scalable format strategies for interoperable bioimaging data. *bioRxiv*. 2021.03.31.437929. doi:10.1101/2021.03.31.437929.

Wilkinson, M.D., M. Dumontier, I.J.J. Aalbersberg, G. Appleton, M. Axton, A. Baak, N. Blomberg, J.-W. Boiten, L.B. da Silva Santos, P.E. Bourne, J. Bouwman, A.J. Brookes, T. Clark, M. Crosas, I. Dillo, O. Dumon, S. Edmunds, C.T. Evelo, R. Finkers, A. Gonzalez-Beltran, A.J.G. Gray, P. Groth, C. Goble, J.S. Grethe, J. Heringa, P.A.C. 't Hoen, R. Hooft, T. Kuhn, R. Kok, J. Kok, S.J. Lusher, M.E. Martone, A. Mons, A.L. Packer, B. Persson, P. Rocca-Serra, M. Roos, R. van Schaik, S.-A. Sansone, E. Schultes, T. Sengstag, T. Slater, G. Strawn, M.A. Swertz, M. Thompson, J. van der Lei, E. van Mulligen, J. Velterop, A. Waagmeester, P. Wittenburg, K. Wolstencroft, J. Zhao, and B. Mons. 2016. The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data*. 3:160018. doi:10.1038/sdata.2016.18.