



Cloud-based relational database for managing large amounts of multimodal animal data

Objective

Data management becomes prone to user-errors when working with extensive multimodal and longitudinal datasets. Although outlined in the GLP (Good Laboratory Practice) of the WHO¹, most labs store their data not in a standardized way and lack way behind clinical standards such as GCP (Good Clinical Practice) compliant data management². Researchers tend to underestimate the importance of a centralized and smart data handling, which is interfering with their efforts in basic research and translational approaches³. Here, we present a database specifically designed to meet the requirements for large multimodal imaging studies with the aim to provide an advantage compared to conventional paper lab notebooks, Excel sheets as well as data management tools (e.g. REDCap⁴) and electronic laboratory notebooks (eLNs)⁵.

Amount of data scales with number of subjects, subgroups and measurements:

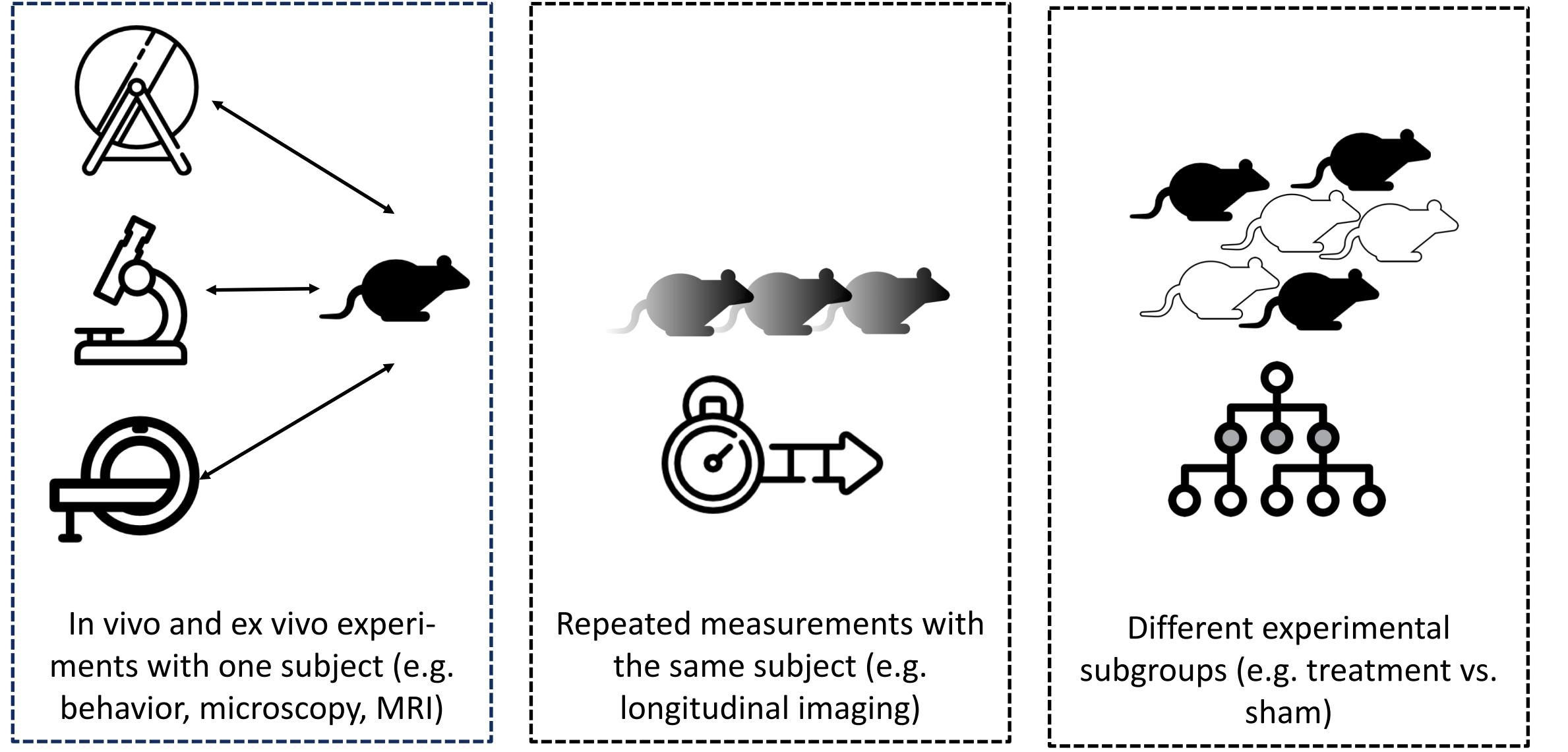
100 mice in 2 subgroups x 6 tests (e.g. in vivo imaging and behavior) x 5 time points
= **3000 data points**

Requirements

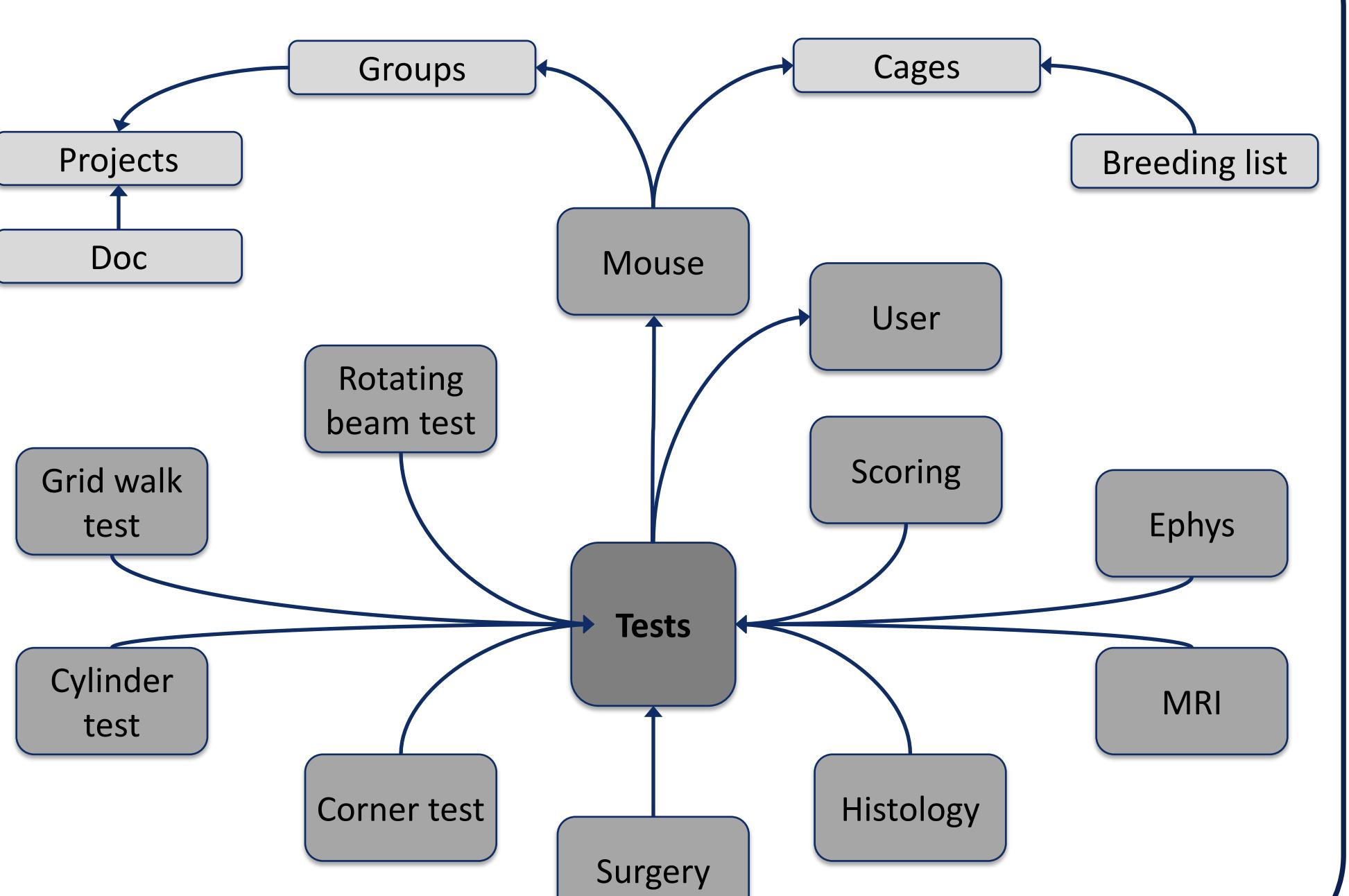
General requirements for storing data in a central database

- Real-time cooperation
- User rights management
- Calendar integration
- Indexed search
- Intuitive GUI
- Safety & Costs
- Flexibility
- Adapt to experimental workflows
- Multimodal data and no data size limit
- Relational entries, instrument integration

Specific requirements for in vivo, longitudinal data



Relational database model



Web interface

Cloud-based – access via web or app

User-friendly design, pre-set field types and automated calculations

Data entry

1 User enters data → Necessary fields highlighted in red

2 When last field is finished, the new button Done? appears

3 User confirms the data entry

4 Only the admin keeps control to re-set confirmation

User management

1 User enters data → Analysis done

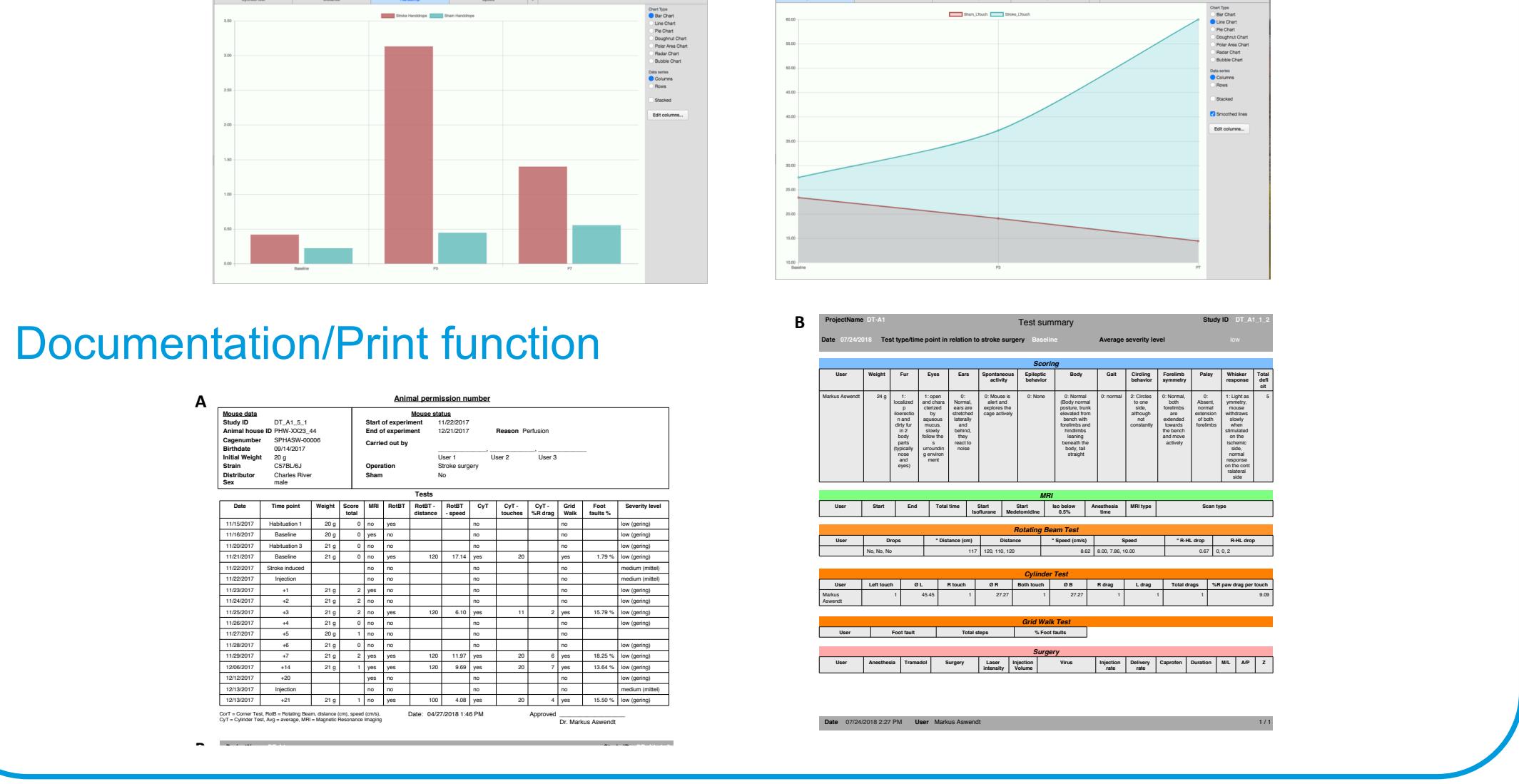
2 User has no access to the data

3 Data remains visible in table view

Filtering and sorting

Automated calculation of animal numbers per project/group/sub-group in relation to animal protocol permission

Plot function



Conclusion

- Keep track of experimental data & groups, number of animals used per project
- Quick and platform-independent multi-user access, blinded experimenter
- Only minimal programming skills necessary to modify/extend the database
- Secure sharing of experimental raw & processed data with colleagues and guests
- Comprehensive documentation and animal protocol reporting

References

- Organization, W. Handbook: good laboratory practice (GLP): quality practices for regulated non-clinical research and development. (2010).
 - Step, I. Integrated addendum to ICH E6 (R1): Guideline for Good Clinical Practice E6 (R2). Current Step (2015).
 - Lapchak, PA & Zhang, JH. Data standardization and quality management. *Translational Stroke Research* (2017).
 - Harris, P. A. et al. Research electronic data capture (REDCap) a metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of biomedical informatics* 42, 377–381 (2009).
 - Dirmagi, U. & Preszinger, I. A pocket guide to electronic laboratory notebooks in the academic life sciences. *F1000research* 5, 2 (2016).
 - Francis Crick (1958/59). "The Replication of DNA. Wellcome Library for the History and Understanding of Medicine. Francis Harry Compton Crick Papers, licensed under a Creative Commons Attribution 4.0 International license.
 - <http://www.faz.net/aktuell/wirtschaft/rezept-gegen-unordnung-simplify-your-office-11527408/we-isst-noch-mal-die-rechnung-11528426.html>
- Icons from <https://www.flaticon.com/>

Acknowledgements

This work was supported by the Friebe Foundation. The database runs on Ninox software (www.ninoxdb.de). The authors received no financial support by the Ninox GmbH.

FRIEDE-STIFTUNG