



# 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 WHO<sup>1</sup>, most labs store their data not in a standardized way and lack way behind clinical standards such as GCP (Good Clinical Practice) compliant data management<sup>2</sup>. Researchers tend to underestimate the importance of a centralized and smart data handling, which is interfering with their efforts in basic research and translational approaches<sup>3</sup>. 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 REDCap<sup>4</sup>) and electronic laboratory notebooks (eLNs)<sup>5</sup>.

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

## Common ways to organize experimental data

Electronic laboratory notebook  
Spreadsheet software(Excel)  
Written documentation (lab notebook)

## 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

Standardization  
Backup to cloud/local storage  
Price-performance ratio  
Free version vs. licensing model

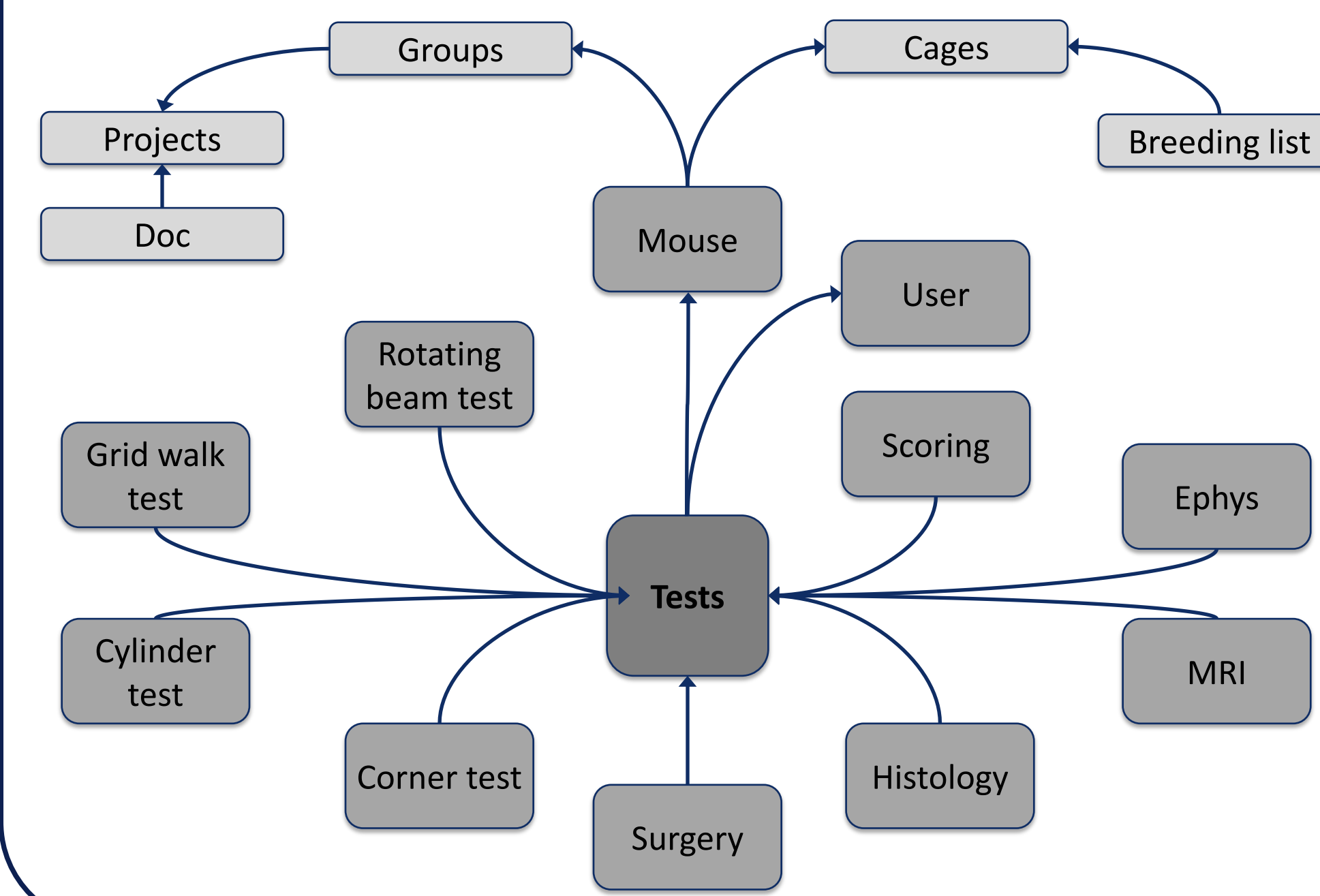
Specific requirements for in vivo, longitudinal data

In vivo and ex vivo experiments with one subject (e.g. behavior, microscopy, MRI)

Repeated measurements with the same subject (e.g. longitudinal imaging)

Different experimental subgroups (e.g. treatment vs. sham)

## Relational database model



## Web interface

Cloud-based – access via web or app  
User-friendly design, pre-set field types and automated calculations

## Data entry

Mouse List

All tests of one Mouse

One particular test of one Mouse

Behaviour

## User management

Admin read+write

Editor read+write

Guest read

User enters data → Analysis done

User has no access to the data

Data remains visible in table view

## Plot function

Documentation/Print function

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

## Filtering and sorting

Animal protocol-relevant information

Histology

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

## 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

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