

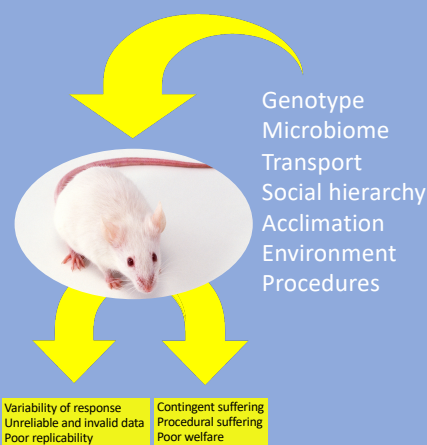
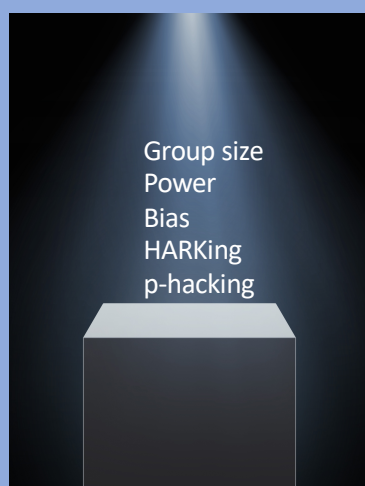
PREPARE for better Science: guidelines for animal research

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The present debate about the so-called "reproducibility crisis" within preclinical studies has been dominated by eloquent papers focusing on the very real, but more "mathematical" issues. These are only part of the problem.

The solution to this crisis must involve greater attention to the animal-related issues and the facilities in which they are kept. These issues may be less obvious to those who have not worked in an animal unit, but they constitute by far the greatest potential source of variation in preclinical studies.



To make matters worse, it is frequently stated that the solution lies in better **reporting** of animal studies. An experiment cannot be improved by describing it. Our firm belief, after many years of working within animal facilities, is that the clue lies in closer collaboration between all parties from day one of planning. In this way, specialists in laboratory animal science, statisticians and scientists can attend to the many factors which will determine the outcome of the study: both its validity and the animals' welfare.

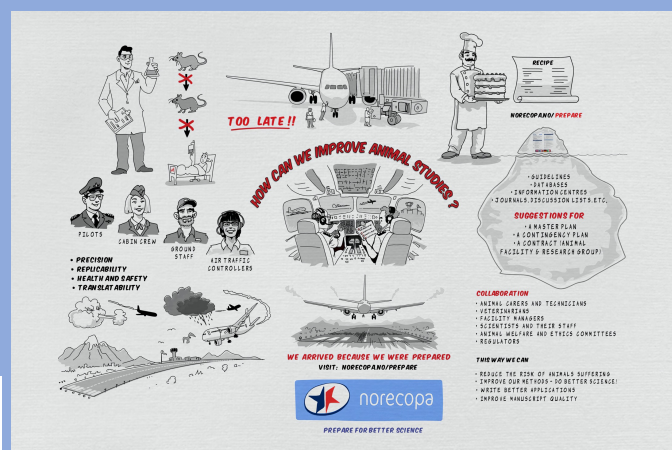
The PREPARE Guidelines have been written to solve this challenge. They are based on experiences over the last 30 years in conducting and supervising preclinical research.

PREPARE consists of a 2-page checklist, in 20 languages, and, importantly, webpages with guidance on each of the 15 topics on the checklist. The PREPARE webpages are part of the Norecopa website, which contains over 8,500 pages of resources designed to attend to the 3Rs: Replacement, Reduction and Refinement of animal research.

norecopa.no/PREPARE



PREPARE	
The PREPARE Guidelines Checklist	
1. Planning and design	
1.1. Objectives	1.1.1. Are the objectives clearly defined and measurable?
1.2. Hypotheses	1.2.1. Are the hypotheses clearly defined and measurable?
1.3. Experimental design	1.3.1. Is the experimental design appropriate for the objectives and hypotheses?
1.4. Statistical analysis	1.4.1. Are the statistical methods appropriate for the data and objectives?
1.5. Power analysis	1.5.1. Is a power analysis performed to determine the sample size?
1.6. Randomization	1.6.1. Is randomization used to minimize bias?
1.7. Blinding	1.7.1. Is blinding used to minimize bias?
1.8. Replication	1.8.1. Is replication used to ensure reliability?
1.9. Contingency plan	1.9.1. Is a contingency plan in place for potential problems?
1.10. Ethics approval	1.10.1. Is the study approved by an ethics committee?
1.11. Animal welfare	1.11.1. Are animal welfare considerations addressed?
1.12. Data management	1.12.1. Is a data management plan in place?
1.13. Reporting	1.13.1. Are reporting standards followed?
1.14. Publication	1.14.1. Are publication standards followed?
1.15. Archiving	1.15.1. Are data and materials archived?
2. Implementation and monitoring	
2.1. Personnel	2.1.1. Are personnel trained and qualified?
2.2. Facilities	2.2.1. Are facilities appropriate for the study?
2.3. Equipment	2.3.1. Is equipment calibrated and maintained?
2.4. Materials	2.4.1. Are materials of appropriate quality?
2.5. Procedures	2.5.1. Are procedures followed as planned?
2.6. Monitoring	2.6.1. Is the study monitored for progress and problems?
2.7. Data collection	2.7.1. Is data collected accurately and completely?
2.8. Reporting	2.8.1. Are progress reports submitted?
2.9. Animal welfare	2.9.1. Are animal welfare considerations addressed?
2.10. Contingency plan	2.10.1. Is the contingency plan followed if needed?
2.11. Data management	2.11.1. Is data managed according to the plan?
2.12. Publication	2.12.1. Are publication standards followed?
2.13. Archiving	2.13.1. Are data and materials archived?
3. Completion and evaluation	
3.1. Data analysis	3.1.1. Are data analyzed according to the plan?
3.2. Reporting	3.2.1. Are final reports submitted?
3.3. Publication	3.3.1. Are final publications submitted?
3.4. Archiving	3.4.1. Are final data and materials archived?
3.5. Evaluation	3.5.1. Is the study evaluated for lessons learned?
3.6. Feedback	3.6.1. Is feedback sought from stakeholders?
3.7. Dissemination	3.7.1. Are findings disseminated to the community?
3.8. Impact	3.8.1. Is the impact of the study assessed?
3.9. Sustainability	3.9.1. Are findings sustainable for future research?
3.10. Ethics approval	3.10.1. Is the study approved by an ethics committee?
3.11. Animal welfare	3.11.1. Are animal welfare considerations addressed?
3.12. Data management	3.12.1. Is data managed according to the plan?
3.13. Publication	3.13.1. Are publication standards followed?
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We have produced a 3-minute cartoon film to illustrate this, using the aviation industry as an analogy with its impressive ability to ensure quality and reproducibility, despite variable traffic conditions and the risk of human errors.

<https://norecopa.no/PREPARE/film>