

The DRIVER recommendations

Designing and Reporting *In Vitro* Experiments Responsibly

The DRIVER recommendations provide a practical framework to improve the quality of *in vitro* research. They set out six items – core principles that support researchers design high-quality *in vitro* studies and report them transparently. Developed by an international working group of experts, the recommendations also include the essential information required by reviewers and editors to assess the methodological rigour, reproducibility and reliability of the work.

Evidence suggests that *in vitro* studies are often not reported with sufficient detail for readers to fully understand the methods used and interpret the results, which raises concerns about the reliability of the studies and the translational value of their findings. Poorly designed or inadequately reported studies waste time, funding and other resources, and where biological samples originate from animals, can lead to unnecessary animal use. These shortcomings can undermine confidence in *in vitro* models and limit their wider adoption as credible alternatives to animal models. To address this, the NC3Rs has developed the DRIVER recommendations, which provide tailored support for improving the reliability and transparency of *in vitro* research.



Further information

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The recommendations are intended to:

- Establish a core set of principles applicable across all *in vitro* models and methods.
- Promote key experimental design practices that strengthen the methodological rigour of *in vitro* studies.
- Define the essential information that should be reported in manuscripts to support transparent presentation, critical appraisal and interpretation of the findings of *in vitro* studies.
- Introduce a flexible framework that supports the reliability and reproducibility of *in vitro* experiments while allowing tailoring to specific experimental contexts.

Who are the DRIVER recommendations for?

- **Researchers:** To support the design, conduct and reporting of *in vitro* studies through practical guidance, worked examples and interactive learning resources.
- **Journals:** To support the assessment and peer review of *in vitro* studies through a framework for evaluating study design and reporting.
- **Funders:** To support the evaluation of funding applications and research outputs through clear expectations for the design, conduct and reporting of *in vitro* research.
- **Universities:** To support education, training and quality improvement in *in vitro* research by providing a benchmark for good practice and researcher development.

The DRIVER recommendations online resource

An online resource supports the use of the recommendations in practice. This includes:

- Webpages with guidance, explanations and practical tips to support the implementation of the design and reporting recommendations for each of the six items.
- Interactive content providing detailed exploration of the underlying concepts, worked examples and knowledge checks to support learning and understanding.

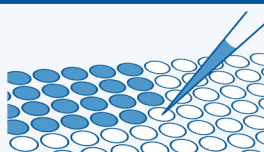
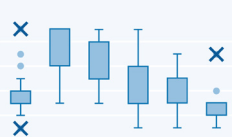
How the recommendations were developed

The DRIVER recommendations were developed with an international group representing a broad range of expertise from across the scientific community, including researchers from academia, industry and government agencies, statisticians and methodologists, and representatives from journals and research funding organisations.

A list of members is provided here:

nc3rs.org.uk/our-portfolio/driver-recommendations#working-group

The development of the recommendations followed an evidence-led, multi-stage process. An initial draft prepared by the NC3Rs was reviewed and built on by the working group through a series of consensus meetings, including a prioritisation exercise to refine the content. User testing with *in vitro* researchers was undertaken to assess the clarity, usability and relevance of the recommendations, and inform the scope and development of the online resource.

Item		Design recommendations	Reporting recommendations
1. Experimental unit		Identify the experimental and biological units for each experiment.	Define the experimental and biological units used in each experiment.
2. Risk of bias		Identify potential sources of bias and methods to mitigate them for each experiment.	Report whether and how risks of bias were considered and addressed in the design of each experiment.
3. Experimental model		Identify the characteristics of the experimental models to be used, their maintenance requirements and the quality control measures to be applied.	Provide details of the model used in each experiment, including (if applicable) the identity, source and life stage of any cells used, information on microenvironmental (i.e. physical and biochemical) conditions and quality control metrics.
4. Experimental procedures		Document all experimental procedures and test their suitability.	For each experiment, describe the experimental procedures in detail, including what was done, when and how often, and using which equipment and reagents.
5. Experimental groups and exclusions		Establish criteria for handling and reporting data from all experiments.	Report all data obtained from all experimental groups (including controls) and justify any exclusions.
6. Data availability and presentation		Establish how data will be shared and presented transparently.	Share and present data transparently.

When to use the recommendations

The recommendations are intended to be applied throughout the research process:

During study planning:

Providing guidance on key concepts to consider when designing *in vitro* experiments to support reliability.

During the conduct of a study:

Highlighting key details that should be recorded for subsequent reporting.

When writing a manuscript:

Acting as an *aide memoire* to ensure the manuscript contains all relevant information.

When reviewing a manuscript:

Enabling an assessment of whether sufficient information has been provided to evaluate the research.



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