



National Centre  
for the Replacement  
Refinement & Reduction  
of Animals in Research

# The ARRIVE guidelines:

## *Animal Research: Reporting of In Vivo Experiments*

# ARRIVE Guidelines

- What are the ARRIVE guidelines?
- Why were the ARRIVE guidelines developed?
- Why do we need to improve the reporting of animal research?
- Who supports the ARRIVE guidelines?
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# What are the ARRIVE guidelines?

The ARRIVE guidelines were developed as part of an NC3Rs initiative to improve the reporting of biomedical research using animals.

The ARRIVE guidelines consist of a checklist of 20 items, containing key information necessary to describe a study comprehensively and transparently.

The ARRIVE guidelines can be used to ensure reproducibility of animal research and avoid unnecessary animal use.

**NC3Rs** National Centre for the Replacement, Refinement & Reduction of Animals in Research

## The ARRIVE Guidelines

Animal Research: Reporting of In Vivo Experiments

The ARRIVE (Animal Research: Reporting of In Vivo Experiments) guidelines were developed as part of an NC3Rs initiative to improve the design, conduct and reporting of research using animals. Information submitted published and unpublished manuscripts. The guidelines were published in the journal *PLoS Biology* in June 2010 and are currently endorsed by scientific journals, major funding bodies and national societies.

The guidelines are intended to:

- Improve reporting of research using animals.
- Enable authors to fulfil their ethical obligations.

The guidelines are NOT intended to:

- Replace the ethical, administrative or regulatory activities which apply to the use of animals in research.
- Replace the ethical, administrative or regulatory activities which apply to the use of animals in research.

What kind of research areas do the guidelines apply to?

- The guidelines apply to all research on the use of animals in research.
- The guidelines apply to all research on the use of animals in research.

How might these guidelines be used?

- The guidelines are intended to improve the quality of research reporting.
- The guidelines are intended to improve the quality of research reporting.

ARRIVE Objectives

The NC3Rs, primarily, aims to improve the quality of research reporting and to ensure that the guidelines are used to improve the quality of research reporting.

| ITEM                      | RECOMMENDATION                                                                                                                                                                                   | Reporting on laboratory     | Reporting on fieldwork      |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|
| Title                     | 1 Provide an accurate and concise description of the content of the article as written.                                                                                                          | 4 Provide a brief abstract. | 4 Provide a brief abstract. |
| Abstract                  | 2 Provide an accurate summary of the background, research objectives, including details of the species or group of animals used, key methods, experimental design and statistical analysis.      | 5                           | 5                           |
| Introduction              | 3 A include sufficient scientific background (including references) to allow a reader to understand the motivation and aim for the study, and describe the experimental objectives and protocol. | 6                           | 6                           |
| Objectives                | 4 Clearly describe the primary and any secondary objectives of the study or specific experimental objectives.                                                                                    | 7                           | 7                           |
| Methods                   | 5                                                                                                                                                                                                | 8                           | 8                           |
| Statistical analysis      | 6                                                                                                                                                                                                | 9                           | 9                           |
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**ARRIVE** The ARRIVE Guidelines: Animal Research: Reporting of In Vivo Experiments. Originally published in *PLoS Biology*, June 2010.



# Why were the ARRIVE guidelines developed?

- The ARRIVE guidelines were proposed following an extensive review on the reporting of animals in research (Kilkenny et al., 2009). This was the largest survey of the quality of reporting of publically funded animal research in the UK and US.

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PLoS one

## Survey of the Quality of Experimental Design, Statistical Analysis and Reporting of Research Using Animals

Carol Kilkenny<sup>1\*</sup>, Nick Parsons<sup>2</sup>, Ed Kadyszewski<sup>3</sup>, Michael F. W. Festing<sup>4</sup>, Innes C. Cuthill<sup>5</sup>, Derek Fry<sup>6</sup>, Jane Hutton<sup>7</sup>, Douglas G. Altman<sup>8</sup>

- The survey identified key areas for improvement:

### Experimental design

Most papers did not report randomisation (88%) or blinding (86%) to reduce bias in animal selection and outcome measurements.

### Statistical analysis

Only 70% of publications fully described statistical methods and presented the result with a measure of variability.

### Reporting of studies

Only 59% included three important pieces of information: hypothesis, number of animals and characteristics of animals.

- The ARRIVE guidelines were created in response to this survey to improve the reporting of animal research.

# Why do we need to improve the reporting of animal research?

- Improved reporting is needed to maximise information published and minimise unnecessary animal studies leading to improved translation of pre-clinical research.
- Failures in reporting of animal research have been demonstrated in a variety of research fields.

## Cancer

Hess, KR. Statistical design considerations in animal studies published recently in Cancer Research. [Cancer Research](#) (2011) 71:625.

## Stroke

Macleod, MR et al., Systematic review and metaanalysis of the efficacy of FK506 in experimental stroke. [Journal of Cerebral Blood Flow & Metabolism](#) (2005) 1-9.

## Pain

Rice, ASC et al., Animal models and the prediction of efficacy in clinical trials of analgesic drugs: A critical appraisal and call for uniform reporting standards. [Pain](#) (2008) 139(2):243-7.

## Multiple sclerosis

Vesterinen, HM et al., Improving the translational hit of experimental treatments in multiple sclerosis. [Multiple Sclerosis](#) (2010) 16(9): 1044-55.

# Who supports the ARRIVE guidelines?

The ARRIVE guidelines are endorsed by journals, funders and learned societies.

## Journals



Over 300 journals have incorporated the ARRIVE guidelines in their Instructions to Authors

## Funders



The major funding bodies of biomedical research in the UK support the ARRIVE guidelines.

## Learned Societies



A growing number of learned societies are endorsing the ARRIVE guidelines and sharing with their members.

# How can you use the ARRIVE guidelines?

The guidelines can be used when reporting research. In brief, the ARRIVE guidelines include the following:

## Title

1. Accurate & concise description

## Abstract

2. Background, objectives, methods, key findings and conclusions

## Introduction

3. Background
4. Objectives

## Methods

5. Ethical statement
6. Study design (blinding/randomisation)
7. Experimental procedures (How? When? Where? Why?)
8. Experimental animals (species, sex, weight)
9. Housing and husbandry
10. Sample size
11. Allocation experimental groups
12. Experimental outcomes
13. Statistical methods

## Results

14. Baseline Data
15. Numbers Analysed
16. Outcomes & estimation
17. Adverse events

## Discussion

18. Interpretation & implications
19. Generalisability and translation
20. Funding

# Why should you use the ARRIVE guidelines?

The ARRIVE guidelines can help the reporting of your research to be:

- Reproducible
- Transparent
- Accurate
- Comprehensive
- Concise
- Logically ordered
- Well written

The ARRIVE guidelines can be used when:

- Writing a manuscript
- Preparing a PhD thesis
- Designing experiments

The ARRIVE guidelines can help promote the 3Rs by ensuring maximal output from animal experiments and reduce the need for excessive animal use.

# What resources are available?

The following resources are available :

## Checklist

A checklist that can be used when writing manuscripts to record each item of the ARRIVE guidelines.

## Examples

Examples for each point of the ARRIVE guidelines demonstrating how they can be used in practice to report animal research across a variety of research fields.

## Presentation

A copy of this presentation and accompanying speaker notes can be used as reference.

Resources can be downloaded by visiting [www.nc3rs.org.uk/ARRIVE](http://www.nc3rs.org.uk/ARRIVE)

## Z Cards

A handy pocket sized reference guide of the ARRIVE guidelines, available upon request from the NC3Rs



# Conclusions & Further Information

The ARRIVE guidelines are designed to improve reproducibility and reporting standards.

To download the ARRIVE guidelines and for further information, please visit:

[www.nc3rs.org.uk/ARRIVE](http://www.nc3rs.org.uk/ARRIVE)



Kilkenny, C., Browne, W. J., Cuthill, I. C., Emerson, M., & Altman, D. G. (2010). Improving bioscience research reporting: the ARRIVE guidelines for reporting animal research. *PLoS Biol*, 8(6), e1000412. doi:10.1371/journal.pbio.1000412