

Advice on how to search for alternatives *(with the main focus on Replacement)*

Adrian Smith

adrian.smith@norecopa.no

norecopa.no/SAALAS

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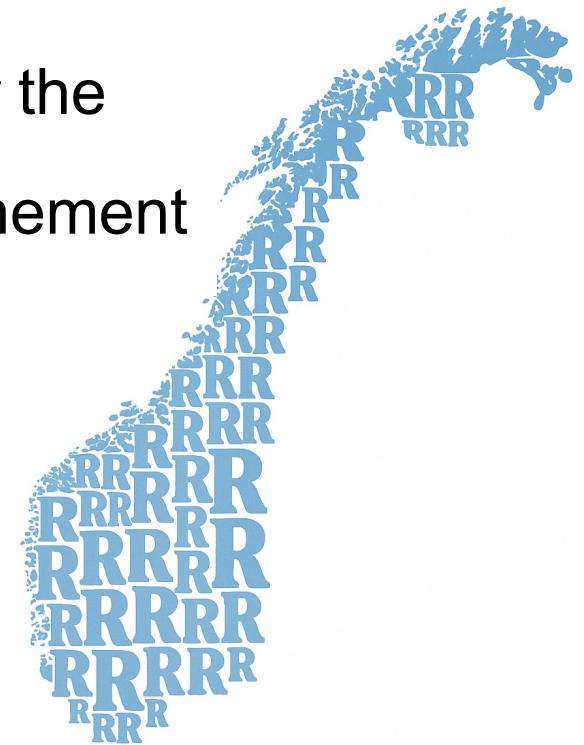
Norway's National Consensus Platform for the
Three Rs: Replacement, Reduction and Refinement

norecopa.no: 11,000 webpages
>1,000 hits a day
PREPARE planning checklist in 38 languages
A Refinement Wiki
6-7 detailed newsletters a year

<https://norecopa.no>

founded 2007

Norecopa: PREPARE for better Science



2027:
National 3R Centre

What is 'better science'?

Replacement is only a part of that...



- ✓ Replacement if possible
- ✓ Reduction and Refinement if not possible to replace
- ✓ Valid data (a true treatment effect)
- ✓ Reproducible and Translatable experiments
- ✓ Best possible animal welfare
- ✓ Health & Safety (of animals and people)
- ✓ Culture of Care at the animal facility
- ✓ Communication of best practice to others



Ignorance of ways to achieve these creates bad science

The pathway to open (better) science



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<https://riojournal.com/article/105198>

ARRIVE study plan

Please fill in all sections of the ARRIVE study plan.

Study details

Study title:	Title or ID	Grant code:	Enter
Start date:	Enter a start date	End date:	Enter an end date
Project licence or permit number:	E.g. PPL number or permit number	Project lead:	Name, email (e.g. of PPL holder)
Protocol numbers:	List protocols and steps being used	Expected severity:	Details of the severity classification
Primary responsible:	Name (e.g. of PPL holder)	Contact details:	Email/phone
Secondary contact:	Name	Contact details:	Email/phone

Experimental animals

Species	Strain/Genotype	Sex	Age	Weight	Source	Number
e.g. Mouse	e.g. C57Bl/6J	Select	e.g. 6 weeks	e.g. 20-22g	Enter here	e.g. 10
Total number						Enter

Experimental procedures

What is done and how it is done, when and how often.

Procedures:	Include the route, frequency and duration of all the procedures taking place.
Surgical procedures:	Details of any surgical procedures, including pre- and post-operative care regime.
Anaesthesia:	Type and duration
Analgesia:	Pre- and post-surgery analgesia regime
Locations:	e.g. rooms, surgical suites, experimental suites
Acclimatisation period:	Details of acclimation into the unit, during procedures or after surgery.

PREPARE



The PREPARE Guidelines Checklist

Planning Research and Experimental Procedures on Animals: Recommendations for Excellence

Adrian J. Smith^a, R. Eddie Clutton^a, Elliot Lilley^a, Kristine E. Aa. Hansen^a & Trond Bratteli^b

^aNorecopa, c/o Norwegian Veterinary Institute, P.O. Box 750 Sentrum, 0106 Oslo, Norway; ^bRoyal (Dick) School of Veterinary Studies, Easter Bush, Midlothian EH25 9RG, U.K.; ^cResearch Animals Department, Science Group, RSPCA, Wilberforce Way, Southwicks, Harbourn West Sussex, BN1 1 9R; ^dSection of Experimental Biomedicine, Department of Production Animal Clinical Sciences, Faculty of Veterinary Medicine, Norwegian University of Science, P.O. Box 8148 Dep., 0033 Oslo, Norway; ^eDivision for Research Management and External Funding, Western Norway University of Applied Sciences, 5030 Bergen, Norway

PREPARE¹ consists of planning guidelines which are complementary to reporting guidelines such as ARRIVE². PREPARE covers the three broad areas which determine the quality of the preparation for animal studies:

1. Formulation of the study

2. Dialogue between scientists and the animal facility

3. Quality control of the components in the study

The topics will not always be addressed in the order in which they are presented here, and some topics overlap. The PREPARE checklist can be adapted to meet special needs, such as field studies. PREPARE includes guidance on the management of animal facilities, since in-house experiments are dependent upon their quality. The full version of the guidelines is available on the Nor website, with links to global resources, at <https://norecopa.no/PREPARE>. The PREPARE guidelines are a dynamic set which will evolve as more species- and situation-specific guidelines are produced, and as best practice within Laboratory Animal Science progresses.

Formulation of the study

1. Literature searches

☐ Form a clear hypothesis, with primary and secondary outcomes.

☐ Consider the use of systematic reviews.

☐ Decide upon databases and information specialists to be consulted, and construct search terms.

☐ Assess the relevance of the species to be used, its biology and suitability to answer the experimental questions with the least suffering, and its welfare needs.

☐ Assess the reproducibility and translatability of the project.



There are fillable versions of ARRIVE and PREPARE that can be used as Study Plans - AI tools are under development...

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arriveguidelines.org/resources/study-plan
norecopa.no/prepare/prepare-checklist

norecopa.no/PREPARE



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PREPARE			
The PREPARE Guidelines Checklist Planning Research and Experimental Procedures on Animals: Recommendations for Excellence Adrian J. Smith*, R. Eddie Clutton†, Elliot Lilley‡, Kristine E. Aa. Hansen§ & Trond Bratteli¶ *Norecopa, c/o Norwegian Veterinary Institute, P.O. Box 750 Sentrum, 0106 Oslo, Norway; †Royal (Dick) School of Veterinary Studies, Easter Bush, Midlothian, EH25 9RG, U.K.; ‡Research Animals Department, Science Group, RSPCA, Wilberforce Way, Southwater, Herts, West Sussex, RH13 9RS, U.K.; §Section of Experimental Biomedicine, Department of Production Animal Clinical Sciences, Faculty of Veterinary Medicine, Norwegian University of Life Sciences, P.O. Box 8146 Dep., 0033 Oslo, Norway; ¶Division for Research Management and External Funding, Western Norway University of Applied Sciences, 5020 Bergen, Norway.			
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Topic		Recommendation	
(A) Formulation of the study			
1. Literature searches	☐ Form a clear hypothesis, with primary and secondary outcomes. ☐ Consider the use of systematic reviews. ☐ Decide upon databases and information specialists to be consulted, and construct search terms. ☐ Assess the relevance of the species to be used, its biology and suitability to answer the experimental questions with the least suffering, and its welfare needs. ☐ Assess the reproducibility and translatability of the project.		
2. Legal issues	☐ Consider how the research is affected by relevant legislation for animal research and other areas, e.g. animal transport, occupational health and safety. ☐ Locate relevant guidance documents (e.g. EU guidance on project evaluation).		
3. Ethical issues, harm-benefit assessment and humane endpoints	☐ Construct a lay summary. ☐ In dialogue with ethics committees, consider whether statements about this type of research have already been produced. ☐ Address the 3Rs (replacement, reduction, refinement) and the 3Ss (good science, good sense, good sensibilities). ☐ Consider pre-registration and the publication of negative results. ☐ Perform a harm-benefit assessment and justify any likely animal harm. ☐ Discuss the learning objectives, if the animal use is for educational or training purposes. ☐ Allocate a severity classification to the project. ☐ Define objective, easily measurable and unequivocal humane endpoints. ☐ Discuss the justification, if any, for death as an end-point.		
4. Experimental design and statistical analysis	☐ Consider pilot studies, statistical power and significance levels. ☐ Define the experimental unit and decide upon animal numbers. ☐ Choose methods of randomisation, prevent observer bias, and decide upon inclusion and exclusion criteria.		
Topic		Recommendation	
(B) Dialogue between scientists and the animal facility			
5. Objectives and timescale, funding and division of labour	☐ Arrange meetings with all relevant staff when early plans for the project exist. ☐ Construct an approximate timescale for the project, indicating the need for assistance with preparation, animal care, procedures and waste disposal/decontamination. ☐ Discuss and disclose all expected and potential costs. ☐ Construct a detailed plan for division of labour and expenses at all stages of the study.		
6. Facility evaluation	☐ Conduct a physical inspection of the facilities, to evaluate building and equipment standards and needs. ☐ Discuss staffing levels at times of extra risk.		
7. Education and training	☐ Assess the current competence of staff members and the need for further education or training prior to the study.		
8. Health risks, waste disposal and decontamination	☐ Perform a risk assessment, in collaboration with the animal facility, for all persons and animals affected directly or indirectly by the study. ☐ Assess, and if necessary produce, specific guidance for all stages of the project. ☐ Discuss means for containment, decontamination, and disposal of all items in the study.		
(C) Quality control of the components in the study			
9. Test substances and procedures	☐ Provide as much information as possible about test substances. ☐ Consider the feasibility and validity of test procedures and the skills needed to perform them.		
10. Experimental animals	☐ Decide upon the characteristics of the animals that are essential for the study and for reporting. ☐ Avoid generation of surplus animals.		
11. Quarantine and health monitoring	☐ Discuss the animals' likely health status, any needs for transport, quarantine and isolation, health monitoring and consequences for the personnel.		
12. Housing and husbandry	☐ Attend to the animals' specific instincts and needs, in collaboration with expert staff. ☐ Discuss acclimatization, optimal housing conditions and procedures, environmental factors and any experimental limitations on these (e.g. food deprivation, solitary housing).		
13. Experimental procedures	☐ Develop refined procedures for capture, immobilisation, marking, and release or rehoming. ☐ Develop refined procedures for substance administration, sampling, sedation and anaesthesia, surgery and other techniques.		
14. Humane killing, release, reuse or rehoming	☐ Consult relevant legislation and guidelines well in advance of the study. ☐ Define primary and emergency methods for humane killing. ☐ Assess the competence of those who may have to perform these tasks.		
15. Necropsy	☐ Construct a systematic plan for all stages of necropsy, including location, and identification of all animals and samples.		
References 1. Smith AJ, Clutton RE, Lilley E, Hansen KEA & Bratteli T. PREPARE: Guidelines for Planning Animal Research and Testing. <i>Laboratory Animals</i> . 2017. DOI: 10.1177/0023677217724823. 2. Kilkenny C, Browne WJ, Cuthill IC et al. Improving Bioscience Research Reporting: The ARRIVE Guidelines for Reporting Animal Research. <i>PLoS Biology</i> . 2010. DOI: 10.1371/journal.pbio.1000412.			
Further information https://norecopa.no/PREPARE post@norecopa.no @norecopa			

PREPARE:

Planning Research and Experimental Procedures on Animals: Recommendations for Excellence



PREPARE covers 15 topics:

Formulation of the study

1. Literature searches
2. Legal issues
3. Ethical issues, harm-benefit assessment and humane endpoints
4. Experimental design and statistical analysis

Dialogue between scientists and the animal facility

5. Objectives and timescale, funding and division of labour
6. Facility evaluation
7. Education and training
8. Health risks, waste disposal and decontamination

Methods

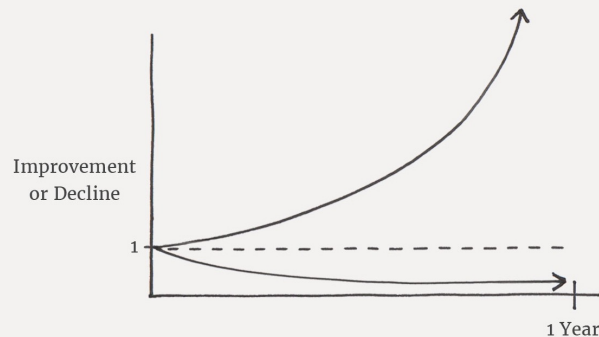
9. Test substances and procedures
10. Experimental animals
11. Quarantine and health monitoring
12. Housing and husbandry
13. Experimental procedures
14. Humane killing, release, reuse or rehoming
15. Necropsy



Rome wasn't built in a day – but every little helps!

Aggregation of marginal gains

1% better every day $1.01^{365} = 37.78$
1% worse every day $0.99^{365} = 0.03$



JamesClear.com

Habits are the compound interest of self-improvement.

<https://jamesclear.com/marginal-gains>

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OPINION

Refinement: Lessons from the 2012 Olympics

Elliot Lilley and Maggy Jennings

Until the day comes when animals are no longer needed for research, refinement needs to be a priority for the scientific community

British road and track cycling has gone through a major renaissance recently, with enormous success at the London Olympics and with Sir Bradley Wiggins winning the Tour de France. One of the reasons that British cycling is leading the world at the moment is the leadership of the head of UK cycling, Dave Brailsford, and in particular, his approach of 'aggregation of marginal gains'.

What does 'aggregation of marginal gains' mean in relation to professional cycle racing? If you wanted to surpass your opponents in terms of team performance, then you could invest your time in looking for the next big paradigm shift in technology (e.g. the Boardman bike), in order to overtake the rest of the field in a single step. Alternatively, you could break down all of the component parts that contribute to a successful cycling performance, and make every single one just a little bit better in a systematic, iterative way; e.g. slight changes to front fork, helmet, and suit design, and improvements to dietary, physiotherapy and psychological support to riders. The combination of a number of small improvements like these can lead to a significant improvement in performance for the elite, with the added benefit of raised standards for all of the team.

But what has this to do with refinement in relation to animal experimentation? In our view, 'aggregation of marginal gains' is a great principle that can also be applied to refinement.

The effective implementation of refinement requires the systematic breakdown of the lifetime experience of the animals involved into its component steps, in order to identify the potential for physical and psychological suffering and to put in place measures to eliminate or ameliorate this suffering. This process should begin during the planning stage of the experiment, and should then evolve as the project unfolds. Refinement has been represented as a 'loop', and this is a good way to think about it.

ment of suffering and so on. Welfare science is a continually developing field, and thus a regular appraisal of the literature is essential to stay abreast of the current state of play with regard to optimising laboratory animal welfare.

Refinement practices, whilst apparently widespread (based on our interactions with the scientific community), are largely absent from the methodological sections of scientific research publications. One reason for this is that individual refinements are often small iterative changes that alone do not appear to be overly significant. However, refinements are not generally implemented in isolation, and the aggregated benefit of several small refinements can have a significant impact on the reduction of suffering and improvement of the welfare of animals used in research.

Efforts to reduce suffering are not simply a moral obligation or an exercise in sympathetic anthropomorphism. Refinement and improved welfare standards are broadly acknowledged to be essential for good quality science. This was well-articulated by Russell and Burch over 50 years ago: "It is widely recognised that the humanest possible treatment of experimental animals, far from being an obstacle, is actually a prerequisite for successful animal experiments",¹ and it has been repeated by many others since then.^{1,2} Poor animal welfare can often be a confounding factor in an experiment, and will therefore increase variability and error,³ yet some people still fail to understand this principle and fail to acknowledge the many factors that can affect welfare. Therefore, it is critical that all the sources of suffering that can occur in an experiment are identified and their impact is minimised.

Under the current UK legislation (the Animals [Scientific Procedures] Act 1986, as amended in December 2012 in compliance with EU Directive 2010/63/EU), there are three categories of suffer-

journals.sagepub.com/doi/10.1177/026119291304100309

Rank ↕	Nation ↕	Gold ↕	Silver ↕	Bronze ↕	Total ↕
1	 Great Britain	8	2	2	12
2	 Germany	1	4	1	6
3	 France	1	3	0	4

en.wikipedia.org/wiki/Cycling_at_the_2012_Summer_Olympics

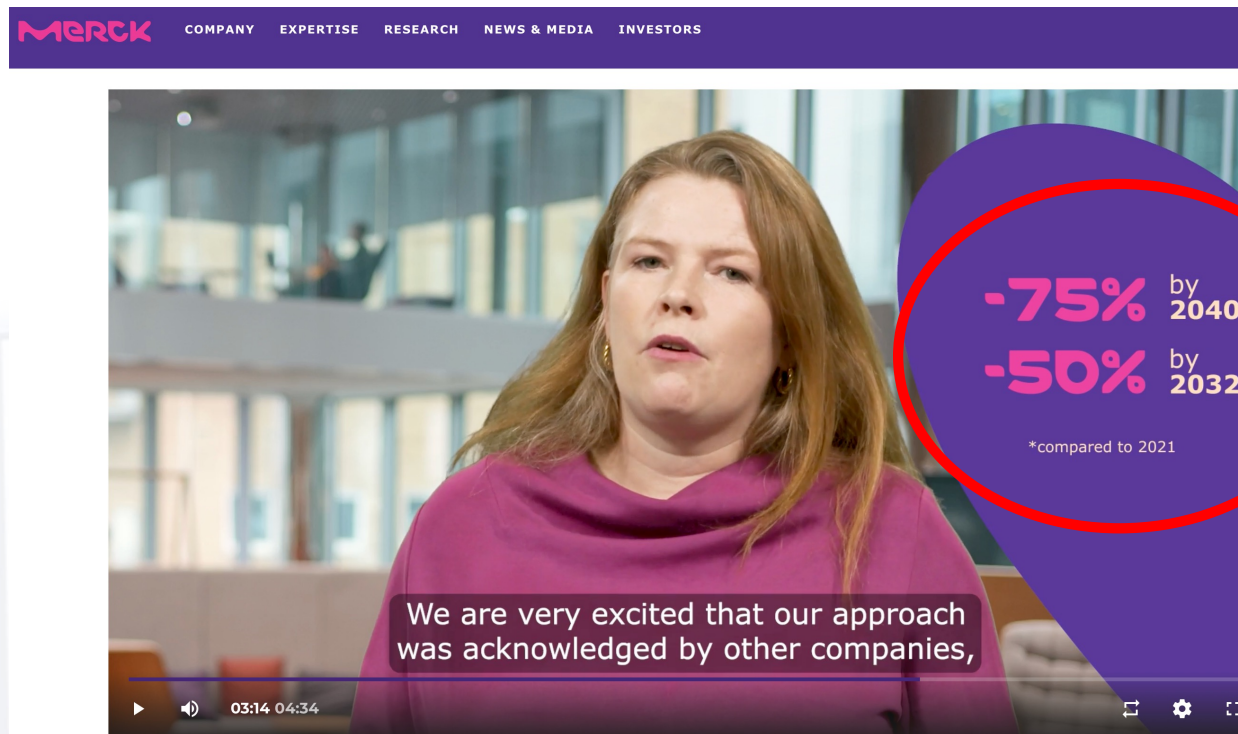
Rome wasn't built in a day – but every little helps!

Merck's Three Basket Concept



<https://www.merckgroup.com/en/sustainability/business-ethics/animal-ethics/our-approach-for-a-roadmap-to-phase-out-animal-testing.html>

Merck's Three Basket Concept



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Begin with the worst...



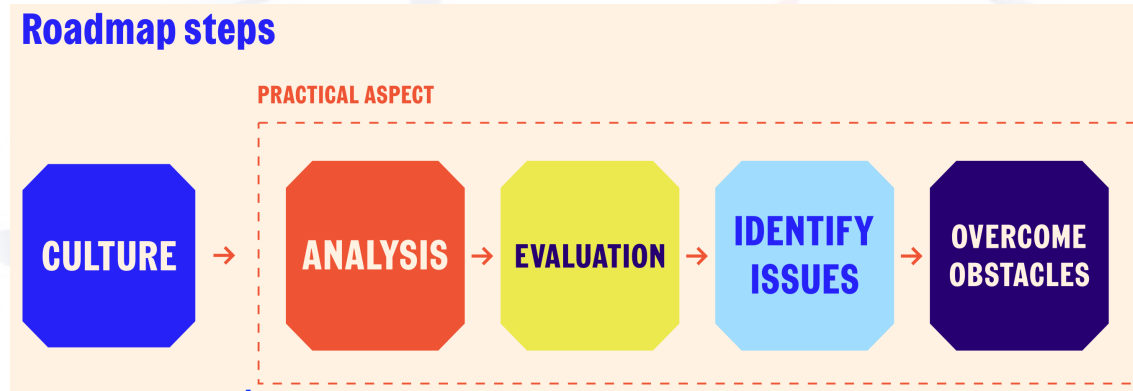
FOCUS ON SEVERE SUFFERING

♥ Donate ≡ Menu

FOCUS ON SEVERE SUFFERING

"Any level of suffering is obviously a concern for everyone, but tackling severe suffering should be a top priority."

Dr Penny Hawkins, RSPCA



norecopa.no/coc

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Don't forget that an "alternative" can be simply *refinement* of a procedure to reduce its (cumulative) severity

Avoiding and reducing

Avoiding and reducing severe suffering helps to fulfil legal requirements, reduce ethical concerns and improve scientific quality. Practical ways to reduce or avoid severe suffering include:

[Refinement](#)

[Welfare assessment](#)

[Humane endpoints](#)

focusonseveresuffering.co.uk

Begin with the worst...

Dissect the procedure into its parts and apply the 3Rs

Focus on procedures

Project licence number	70/6524
Protocol number	2

What does this study involve doing to the animals?	What will the animals experience? How much suffering might it cause? What might make it worse?	How will suffering be reduced to a minimum?	
	Adverse effects and indicators of these	Methodology and interventions	Humane endpoints
Administration of rheumatoid arthritis inducer	Capture and restraint – distress. Aggression, vocalisation, unwilling to be caught. Administration i.d. or s.c. – pain. Flinching, vocalisation, aggression. Pain or ulceration around injection site. Attention to site, reduction in	Competent, empathetic capture (e.g. not by tail) and handling, habituate to handling and restraint. Use gaseous anaesthesia for i.d.; inject into rump, not tail base (if tail base is painful, restraint by the tail will hurt). Minimise volumes and doses, use multiple sites if large volumes. Ensure injectate formulated to minimise adverse effects. Inject into rump (less risk of ulceration); never inject into the	Humane endpoints with respect to administration of inducer in general: – Ulceration that is painful, shows no signs of healing or becomes infected. – If an ulcer reaches >5 mm, the vet or senior animal technologist should be informed and consulted about treatment. Animal should be humanely killed if no signs of healing within 3 days.

<https://www.rspca.org.uk/documents/d/severe-suffering/sheet-2-focus-on-procedures-example>

A simple example to start with:

Replacement, Reduction & Refinement in education & training
- *one of the low-hanging fruits*

N.B. The principles are relevant elsewhere too

***3R alternatives in the education and training
of scientists and lab animal personnel***

Adrian Smith

norecopa.no/IAT2026

Council of Europe Convention (ETS123), 1986:

Article 25, point 3:

*Procedures shall be restricted to those absolutely **necessary** for the purpose of the education or training concerned and permitted only if their **objective** cannot be achieved by **comparably effective** audio-visual or other suitable methods.*

What are your objectives? Decide them first!

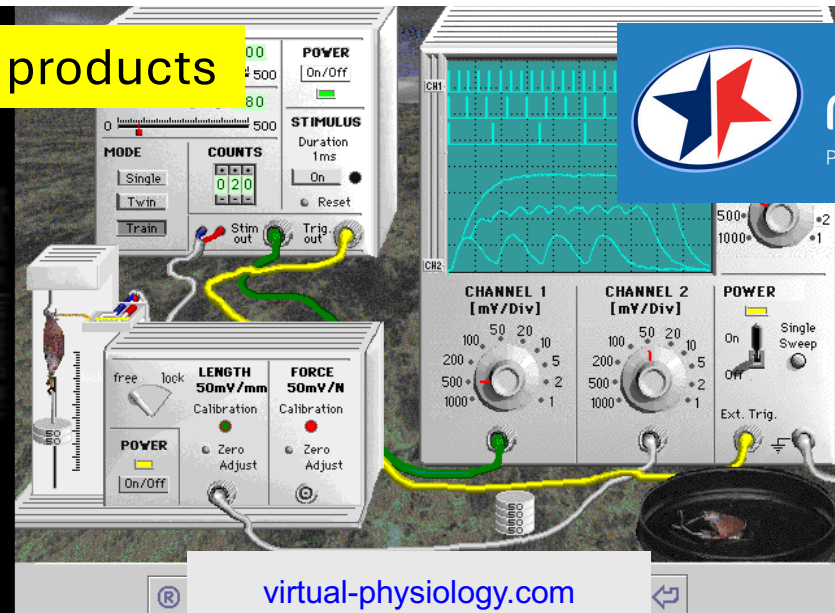
You can't decide whether or not there is an alternative until you know the aim of the experiment.



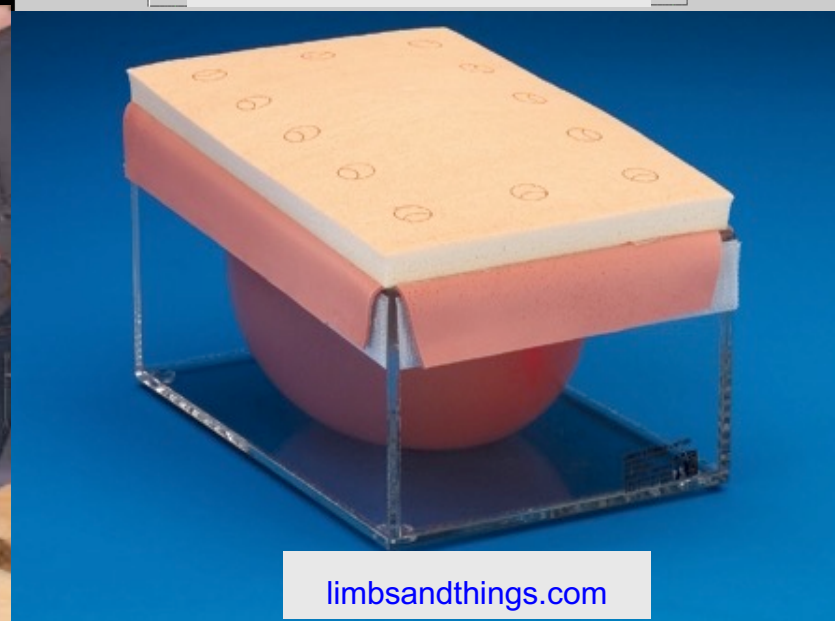
Teaching

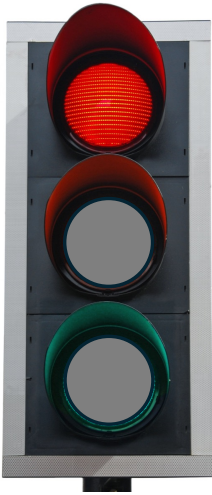
- laboratory skills
- preparation-specific animal skills
- animal handling skills
- imparting good ethical thinking
- experimental design skills
- data handling skills
- communication skills (oral, written)
- group work
- staff-student interactions

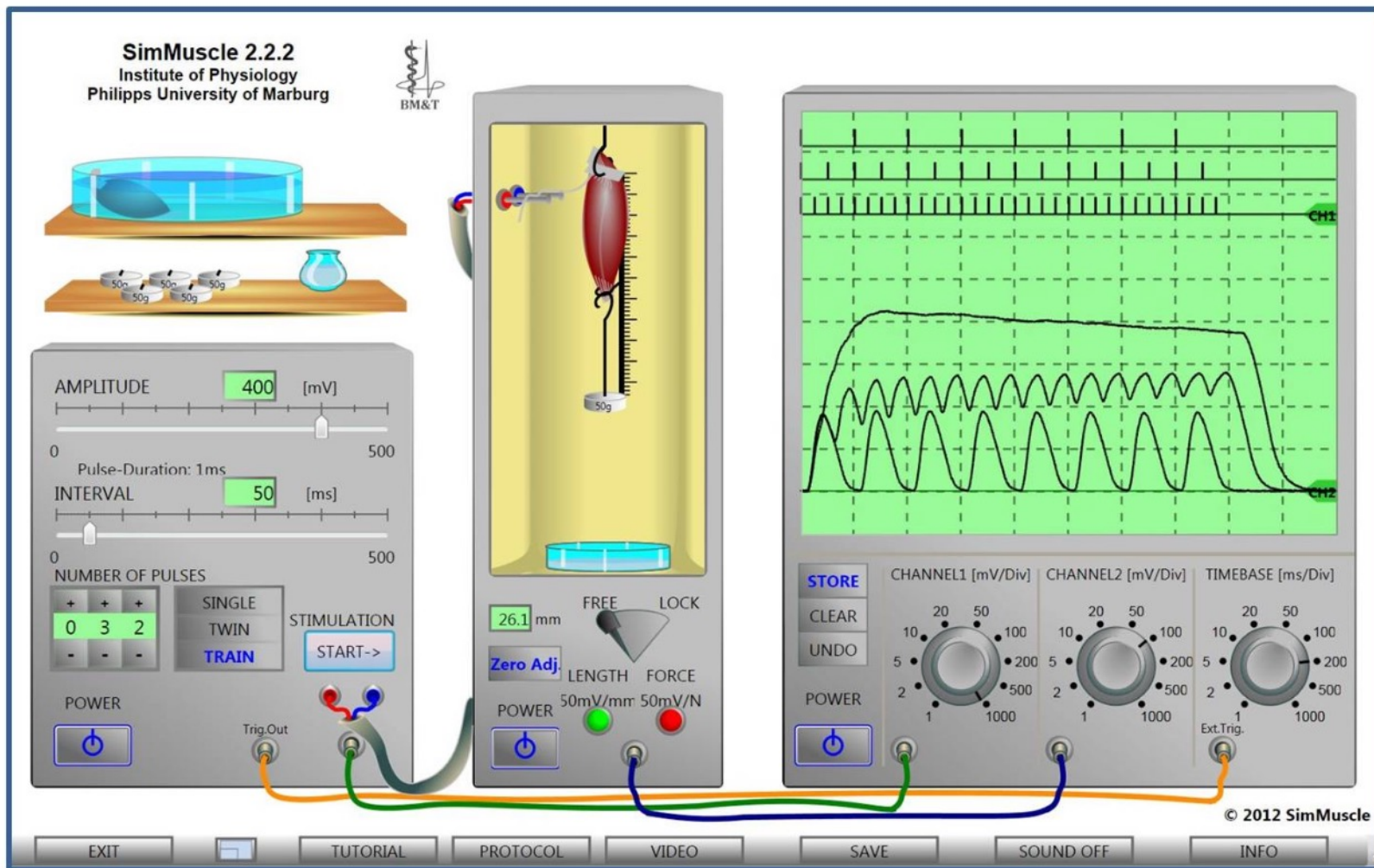
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SimMuscle
Hans Braun, Marberg virtual-physiology.com



Simulation and Clinical Skills at University of Copenhagen

Rikke Langebæk
Associate professor, DVM, PhD
Department of Veterinary Clinical Science
Faculty of Health Sciences

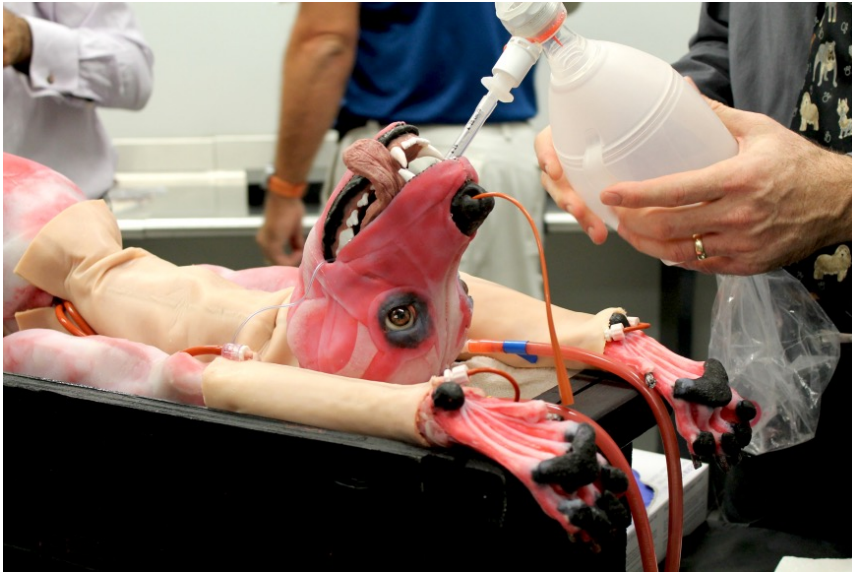
UNIVERSITY OF COPENHAGEN





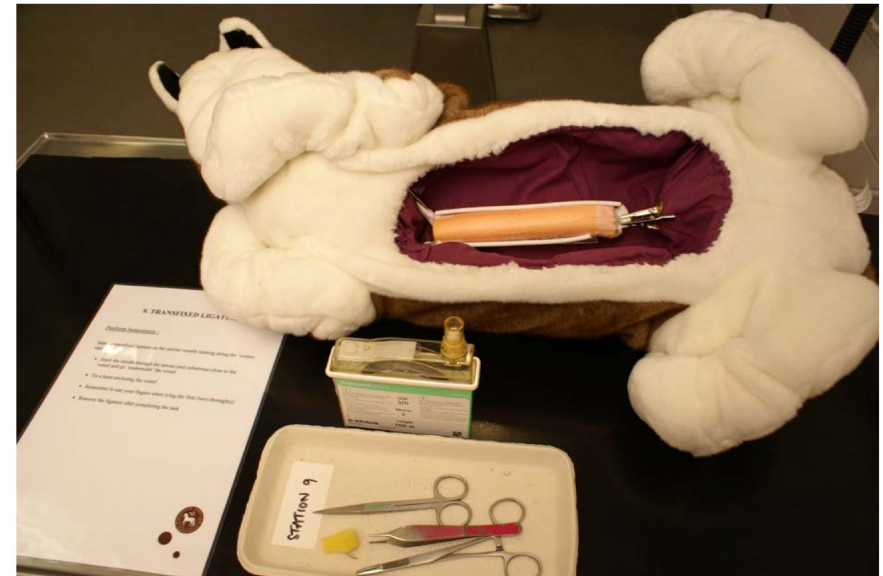
norecopa.no/media/8099/langebæk.pdf

Fidelity and Discrimination



<https://syndaver.com>

High Fidelity, Low Discrimination



Rikke Langebæk, University of Copenhagen

Low Fidelity, High Discrimination

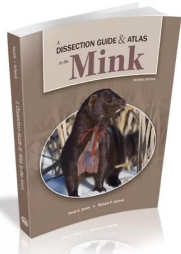
TextBase:

2,200 books

norecopa.no/textbase

Dissection manuals
can be used as
replacements for
dissection

Home > Life Sciences > Biology > Dissection Guides > A Dissection Guide & Atlas to the Mink, 2e



A Dissection Guide & Atlas to the Mink, 2e

By David G. Smith, Michael P. Schenk • © 2020 • 136 Pages
Loose-leaf Format • Print ISBN 9781640430525 • eBook ISBN 9781640430532

Suggested Student Retail Price
\$36.00

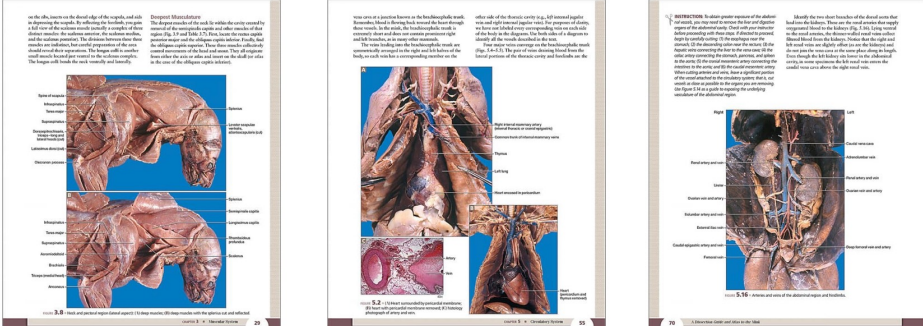
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This full-color dissection manual is intended to provide an introduction to the anatomy of the mink for biology, zoology, nursing, or preprofessional students who are taking a laboratory course in anatomy and physiology or basic vertebrate anatomy.

Examples of interior pages:



<https://www.morton-pub.com/product/a-dissection-guide-atlas-to-the-mink-2e>

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'We may need the animals, as it were, on the night;
but the machines will do very well at rehearsals'

"Alternatives" may be too poor to replace animals totally,
but may be excellent as briefing or debriefing aids.



*Rex Burch & William Russell at a
workshop in Sheringham, UK, in 1995
organised by ECVAM, CAAT and FRAME*

journals.sagepub.com/doi/abs/10.1177/026119299502300614

Generally speaking, searches for alternatives require two special skills

1. Knowledge of how to set up literature searches – and which databases support which search tools
2. Knowledge of the specialised databases within Laboratory Animal Science & related subjects

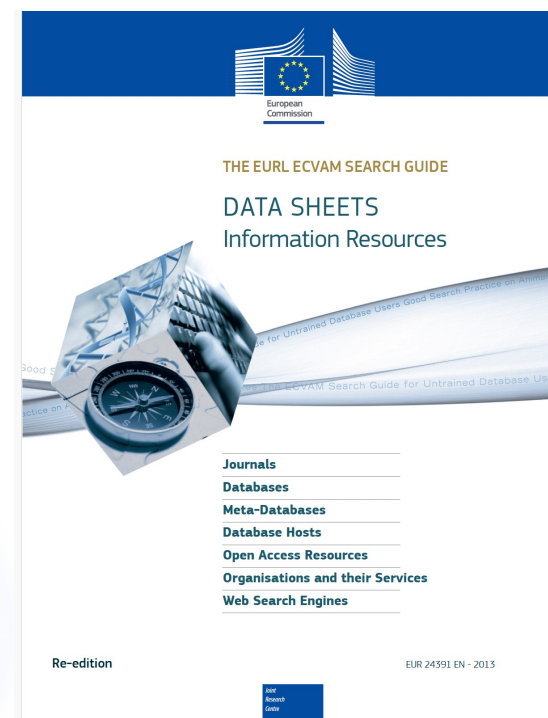
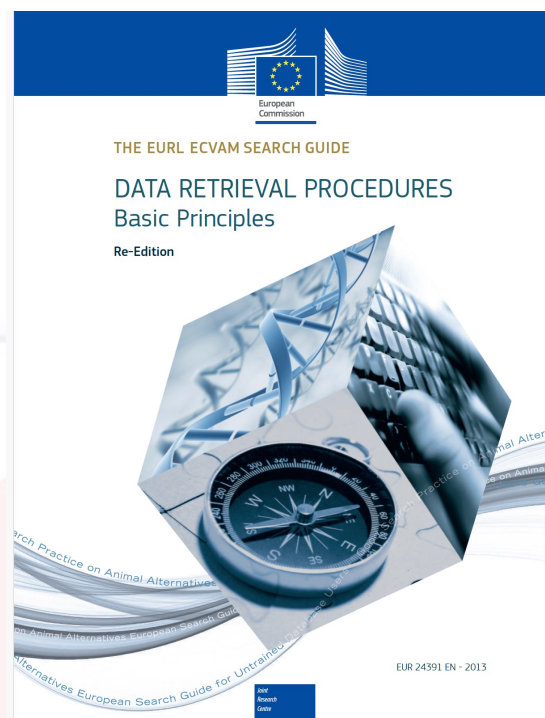
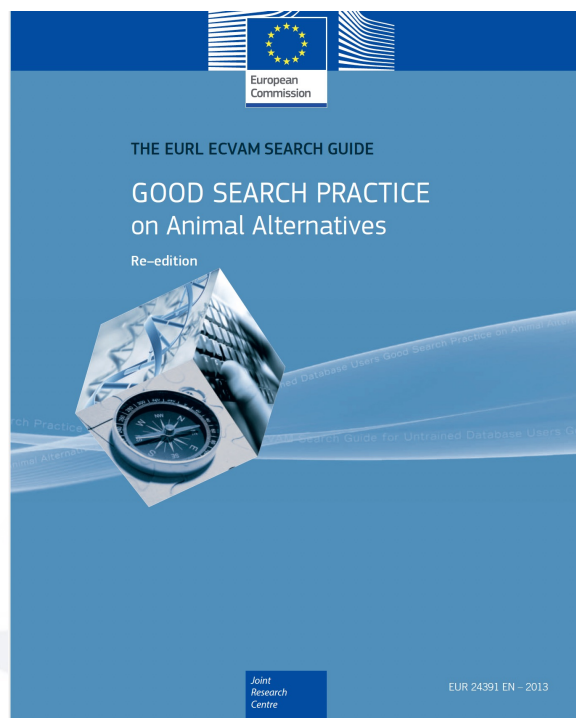
Those who are good at (1) aren't necessarily good at (2), and *vice versa*

All scientists should have a basic knowledge of both – but will also need to seek specialist help on both

And now AI has entered the stage, using tools which we hardly understand and code which no human has written...

- this can lead to “Hallucinations” – a.k.a. fabrication!
- This is currently my greatest headache and the reason why you will not find AI-generated text on Norecopa's website

A good place to start



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<https://op.europa.eu/en/publication-detail/-/publication/8835aa05-f780-454a-ac43-7752b38b394e>



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THE EURL ECVAM SEARCH GUIDE

CHECK LIST for Searching Information on Alternative Methods

Annett J. Roi, Barbara Grune

The 3Rs search procedure checklist is designed to:

- put into practice the principles set out elsewhere in the EURL ECVAM Search Guide as "The Seven Golden Steps to Successful Searching",
- obtain information of the quality required to both consider relevant alternatives, and justify any necessary animal use.

Using the 3Rs search procedure checklist enables scientists to construct systematic and efficient searches.

It includes items that are specific for searching information on alternative methods.

STEP 1. INFORMATION NEED

☐ Clearly define your specific information need:

STEP 2. COMPONENTS OF YOUR APPROACH

☐ Identify the fundamental components of your scientific approach.

a. Field of investigation:

b. Specific objective(s):

c. Methods/Models:

STEP 3. APPROPRIATE INFORMATION RESOURCES

☐ Define the most appropriate information resources.

a. Value-added:

b. Limitable (to a 3Rs-subset of documents) broad coverage: indicate what limitations you plan to use (e.g. MeSH-term-based: *animal use alternatives*).

c. Unlimited broad coverage.



STEP 4. RELEVANT SEARCH TERMS

- ☐ Compile the search terms that best describe your scientific objectives and approach, and need for 3Rs information. Select terms with appropriate levels of specificity/breadth. Consider thesaurus terms, and advanced queries.
- a. Field of investigation:
- b. Objective(s):
- c. Methods/Models:

STEP 5. START YOUR SEARCH WITH A SIMPLE QUERY IN A 3Rs SPECIFIC CONTEXT

- ☐ Start your search in value-added 3Rs sources, trying out different search terms within a simple query, and browsing through the inventory (classification scheme) if available.
- ☐ Evaluate the documents retrieved. Is there information on alternative method(s) that are suitable to reach the scientific purpose of your approach, are there potentially better search terms?

STEP 6. LIMIT SEARCH RESULTS FROM MORE EXTENSIVE RESOURCES

- ☐ If no information on suitable alternatives is found using the value-added sources, continue your search using limitable broad coverage sources.
- ☐ Try different kinds of 3Rs-relevant limitations (e.g. MeSH-term-based, journal-based etc) to limit the results to relevant and manageable lists of documents. Evaluate the results and consider if it is possible to improve your query by adding varying search terms and Boolean operators.
- ☐ Evaluate the most relevant documents retrieved.

STEP 7. BROADEN THE SEARCH HORIZON

- ☐ If no suitable alternative was retrieved by restricting the search by predetermined 3Rs-relevant limitations, repeat step 5 in broader coverage resources with more general limitations consistent with your scientific methodology and objectives.
- ☐ Evaluate the documents retrieved.

op.europa.eu/en/publication-detail/-/publication/8835aa05-f780-454a-ac43-7752b38b394e

THE EURL ECVAM SEARCH GUIDE

TABLE OF DATABASE FEATURES

Database	Subject Coverage					Type		Access
	Agriculture	Biomedicine	Education	Pharmacology & Toxicology	Veterinary medicine	Bibliographic database	Added-value database	Free-of charge database
AGRICOLA	•	•			•	•		•
AGRIS	•	•			•	•		•
ALTBIB		•		•		•		•
AnimAlt-ZEBET		•		•	•		•	•
BIOSIS Previews	•	•		•	•	•		
CAB Abstracts	•	•			•	•		
EURL ECVAM DB-ALM				•			•	•
EMBASE		•		•		•		
HSVMA's Alternatives in Education Database			•				•	•
LAD		•			•	•		•
MEDLINE		•		•	•	•		•
NORINA			•				•	•
PED		•			•	•		•
ScienceDirect	•	•		•				
SciSearch	•	•		•		•		

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THE EURL ECVAM SEARCH GUIDE

TABLE OF JOURNALS relevant to the 3Rs indexed by Databases and Meta-Databases

Journal	Databases							Meta-Databases		
	AGRICOLA	BIOSIS Previews	CAB Abstracts	EMBASE	MEDLINE	ScienceDirect	SciSearch	PubMed	Scopus	Web of Science
Alternative Approaches to Animal Testing, AATEX										
Alternativen zu Tierexperimenten, ALTEX				•	•		•	•	•	•
Alternatives to Laboratory Animals, ATLA				•	•		•	•	•	
Animal Technology and Welfare ATW										
Animal Welfare Journal			•	•			•	•	•	
Institute of Laboratory Animal Resources, ILAR	•			•	•			•	•	•
Journal of Animal Science, JAS	•	•	•		•			•		•
Journal of Applied Animal Welfare Science, JAAWS	•	•	•	•	•		•	•	•	•
Lab Animal	•				•			•	•	•
Laboratory Animals			•	•	•			•	•	•
Toxicology in vitro		•		•	•	•	•	•	•	

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Some more general points

The most valuable information is usually **not** found in one place.
So consult a combination of resources to ask questions like:

- *is animal use actually necessary*
- *how do I design the study optimally if it is*
- *do validated alternatives already exist*

National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs), UK (nc3rs.org.uk)

Experimental design, Refinement
Development of alternative technologies
Funding and case studies

Norecopa (norecopa.no)

Comprehensive international collection of 3R resources
Links to databases of alternative methods
PREPARE and links to international guidelines
Species-specific resources

Animal Welfare Information Center, USDA (nal.usda.gov/programs/awic)

Literature searching services
Workshops

European Centre for the Validation of Alternative Methods (ECVAM), Italy (eurl-ecvam.jrc.ec.europa.eu)

Validated alternative methods within animal testing
The status of regulatory acceptance

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Databases & Guidelines

norecopa.no/databases-guidelines



- > **3R Guide**: a global overview of **databases, guidelines, information centres, journals, email lists, regulations and policies** which may be of use when planning experiments which might include animals. [A quick overview of all the guidelines can be accessed here](#). Norecopa has written several of these, including [the PREPARE guidelines for planning animal research and testing](#).
- > **NORINA**: a global overview of audiovisual aids and other items which may be used as **alternatives or supplements to animals in education and training** at all levels from junior school to University, including [dissection alternatives](#) and surgical simulators.
- > **TextBase**: a global overview of **textbooks and other literature within laboratory animal science** and related topics.
- > **Classic AVs**: a subset of NORINA covering **audiovisual aids that are based on older technology**.

These databases are updated regularly. [Please give us feedback](#) if you discover errors or omissions.

The Norecopa website also includes five other collections:

- > **NAL**: a collection of literature references relating to [the 3Rs](#) from the US National Agricultural Library
- > **European Commission datasets**:
 - ▶ [3Rs Knowledge Sources](#): over 800 resources collected by the Commission in 2016
 - ▶ [3Rs Education and Training Resources](#), over 560 items collected in 2018
 - ▶ [Non-animal models for respiratory tract diseases](#), over 280 models identified in a literature review of over 21,000 papers, published in 2020
 - ▶ [Non-animal models for cardiovascular diseases](#), citing over 400 models, identified in a literature review of over 14,000 papers, published in 2022

Snapshots, but they will provide ideas about who to contact for the latest information

The EU Commission has now published [30 datasets of this type](#).

links to over 70 other databases

Here is [an alphabetical global list of all the databases](#) cited on the Norecopa website.

Literature searching

Look for terms like:

alternative method

replacement

non-animal

New Approach Methodology (NAM)

organoid

organ-on-chip

in vitro

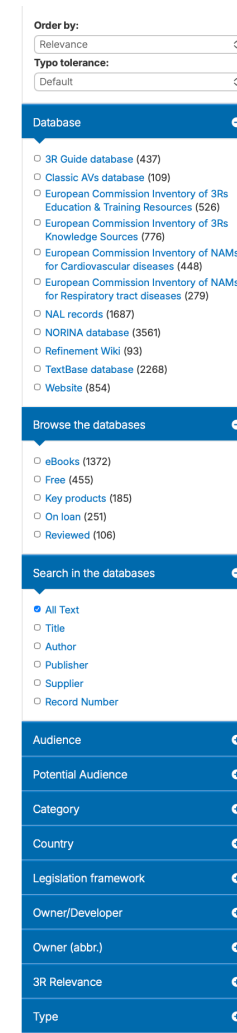
human cell model

computational model

AI

Compile your own search & synonym list!

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The screenshot shows the Norecopa search filters interface. At the top, there are two dropdown menus: 'Order by:' with 'Relevance' selected, and 'Typo tolerance:' with 'Default' selected. Below these are three main sections, each with a blue header and a list of filters:

- Database:** A list of databases with their respective counts: 3R Guide database (437), Classic AVs database (109), European Commission Inventory of 3Rs Education & Training Resources (526), European Commission Inventory of 3Rs Knowledge Sources (776), European Commission Inventory of NAMs for Cardiovascular diseases (448), European Commission Inventory of NAMs for Respiratory tract diseases (279), NAL records (1687), NORINA database (3561), Refinement Wiki (93), TextBase database (2268), and Website (854).
- Browse the databases:** A list of categories: eBooks (1372), Free (455), Key products (185), On loan (251), and Reviewed (106).
- Search in the databases:** A list of search criteria: All Text (selected), Title, Author, Publisher, Supplier, and Record Number.

Below these sections is a vertical list of filters, each with a blue header and a dropdown arrow:

- Audience
- Potential Audience
- Category
- Country
- Legislation framework
- Owner/Developer
- Owner (abbr.)
- 3R Relevance
- Type



search filters on norecopa website

PREPARE	
PREPARE checklist	
Comparison with ARRIVE	
Endorsements	
Film	
1-Literature searches	^
1a Form a clear hypothesis, with primary and secondary outcomes.	
1b Consider the use of systematic reviews.	
1c Decide upon databases and information specialists to be consulted, and construct search terms.	
1d Assess the relevance of the species to be used, its biology and suitability to answer the experimental questions with the least suffering, and its welfare needs.	
1e Assess the reproducibility and translatability of the project.	
2-Legal issues	v
3-Ethical issues, harm-benefit assessment and humane endpoints	v

1-Literature searches

Literature searches help to:

- identify possible non-animal alternatives to all or part of the proposed study
- prevent unnecessary repetition of animal studies
- identify efforts to reduce animal numbers
- identify refinements to procedures in the planned study

1a

Form a clear hypothesis, with primary and secondary outcomes.

General principles

For fish researchers

Literature searches should be well documented, including information on:

1. Evidence from the literature that the animal studies have not been performed previously, or that repetition is justified
2. Consultation of relevant guidelines for specific parts of the study

Using The Replacement Checklist

[Replacing Animal Research](#) have produced [The Replacement Checklist](#) to assist researchers in identifying Replacement Alternatives to animal use. See also:

- > Dukes, Beale & Camp (2025): [Reviewing Current Guidance for the 'R' of Replacement and Rethinking it with the 'Replacement Checklist'](#)
- > [A recorded webinar](#) about use of the checklist
- > A worked example of a literature search, looking for [alternatives to animals in studies of Multiple Sclerosis](#)

There is more information on [Literature searches and systematic reviews](#) and on [this webpage about SYRCLE](#).

More resources

Replacement Checklist



When looking for non-animal technologies, or alternative approaches to the use of animals in research, there are steps to take to thoroughly explore existing opportunities and new approaches to answering a research question.

Similarly, for those reviewing proposals, whether an application for funding or for a licence to use animals in research, there are questions that do not require subject-specialist knowledge that could be asked to provide reassurance that the potential to replace animals has been fully explored.

In the simplest terms, asking the What, Where, When, Who, How and Why questions should provide information to guide both researchers and reviewers of proposals and applications to ensure a thorough exploration of opportunities to avoid animal use has been performed.

What subject area(s) did the search(es) cover?

Are the search terms and variants used provided? Searching for potential animal replacements within any given field requires a combination of search terms: subject-specific terms, and keywords focusing on techniques avoiding animal use. Many non-animal approaches with the potential to provide useful data and replace animal use will not necessarily be tagged in literature with '3Rs', 'replacement', or 'alternative' and so it is helpful to use terms implying non-animal methods e.g. in vitro, microphysiological, model, assay etc.	☐
Are the search terms relevant to the field of study? What subject-specific terms were used to try and identify alternative approaches appropriate to the field? Were any variants of keywords included? (Please note that some databases automatically generate variants of search terms)	☐
Is there anything missing from search methodology?	☐

Where was information obtained?

Which databases were searched? Has a list of the databases or other sources of information been provided? Were multiple sources of information explored?	☐
Which websites were searched? Have specific (and relevant) websites been included in the report of the search for alternatives?	☐
Was any other 'grey literature' included? Has any 'grey literature' been mentioned? Did the search include pre-registered protocols, pre-prints of papers or information produced outside of traditional publishing and distribution channels, including reports, policy literature, newsletters, government documents, white papers or similar?	☐

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Replacement Checklist



How was the search conducted?

What combination of operators and search terms was used? Were search terms combined appropriately?	☐
Were search string(s) constructed? Were the combined search terms and operators recorded?	☐
Were different types of searches used for different sources of information?	☐

When was info published, and search(es) completed?

What publication years were included? Science and technology can progress rapidly, did the search involve the most up to date publications? What years of publication or release were included in the search?	☐
When was the search conducted? How long prior to the application being completed and submitted was the search conducted?	☐
Was it repeated? Was the search repeated at multiple time points, or was it carried out only once?	☐

Who was approached for advice?

Which networks, communities or individuals? Were any peers, or subject specific experts consulted? Or any of the expected beneficiaries of the research?	☐
Were any 3Rs or 1R organisations approached for expert advice? Several organisations exist to progress and promote the 3Rs, and some focus solely on replacement. Were any of them approached for advice?	☐

Why were results of the search(es) rejected?

Were the results of the search provided? Have any references (papers, technical information) about potential techniques, or combinations of techniques, been reported?	☐
Were the results relevant to the field?	☐
Could any identified protocols be adapted to suit? What changes would need to be made to existing techniques in order to achieve research goals? Are any in development?	☐
If results were rejected, was it justifiable to do so? Was the output thoroughly evaluated? Has evidence of assessment been provided? Were any approaches found to be relevant to the research? What were the limitations of the approaches found? What would it take to optimise them to be suitable? Would there be an opportunity to replace part of the overall programme of work?	☐

replacinganimalresearch.org.uk/resources/replacement-checklist



Using The Replacement Checklist

[Replacing Animal Research](#)  have produced [The Replacement Checklist](#)  to assist researchers in identifying Replacement Alternatives to animal use. See also:

- › Dukes, Beale & Camp (2025): [Reviewing Current Guidance for the 'R' of Replacement and Rethinking it with the 'Replacement Checklist'](#) 
- › [A recorded webinar](#)  about use of the checklist
- › A worked example of a literature search, looking for [alternatives to animals in studies of Multiple Sclerosis](#) 

The potential to replace animals is much greater in routine regulatory testing than in basic research

ROUTINE TESTING / REGULATORY TESTING

High potential for replacement



In vitro
assays



Organ-on-chip /
microphysiological
systems



Computational
models /
in silico



High-throughput
screening

HIGH POTENTIAL

Many validated
animal-free
alternatives
available or
emerging



Focus: specific endpoints,
predictable responses,
standardized conditions



OUR GOAL:
Use the right
science for
the right
question –
replace,
reduce and
refine
wherever
possible.

BASIC RESEARCH

Lower potential for replacement

LOWER POTENTIAL

Complex whole-body
systems and behaviours
difficult to replicate
outside the organism



Focus: complex interactions,
emergent properties,
whole-organism context



Behavioural
research



Whole-body
physiology



Surgical
research



Prioritise replacement where it is most achievable – routine testing today, complex research tomorrow.



Areas where Replacement is hopeless?

Surgical research



Replacement? The short answer is **partly—but not yet completely**.

Surgical research covers a wide spectrum, and **the potential to replace animal use depends on the research question.**

Type of research	Can animals often be replaced?	Alternatives
Learning basic surgical skills	Yes	Synthetic models, VR simulators, box trainers
Developing laparoscopic skills	Yes	Virtual reality simulators, augmented reality, task trainers
Planning patient-specific surgery	Yes	3D-printed anatomical models, digital twins
Device design and early testing	Often	Benchtop models, synthetic tissues, computer simulations
Tissue handling and suturing	Yes	Artificial tissues, ex vivo tissues from slaughterhouses
Complex physiological responses	Sometimes	Organ-on-chip systems, perfused organs, computational models
New surgical procedures requiring whole-body physiology	Often not yet	Animal models may still be required in some cases

Areas where Replacement is hopeless?

Surgical research – the difficult scenarios to replace:

- Development of novel transplant procedures
- Research on wound healing involving whole-body immune responses
- Surgical studies of bleeding, shock, and trauma
- Testing implants where long-term integration with living tissues is important
- Some cardiovascular and neurosurgical innovations

Even in these fields, researchers are increasingly combining animal studies with organ-on-chip systems, computational modelling, imaging, and ex vivo tissues to reduce animal use.

As in all other areas:

The question is not whether all surgical research can be replaced, but rather **which components** can be replaced today and where targeted research is still needed to develop human-relevant alternatives.

Areas where Replacement is hopeless?

Behavioural research

- Unlikely to become completely animal-free in the near future
- Many questions involve complex interactions between the brain, body, and environment.
- But human-based methods, digital technologies, and computational models are replacing animals in many areas of psychology and cognitive neuroscience

A useful first question – as in all searches for Replacement – is

"What aspect of behaviour am I trying to understand?"

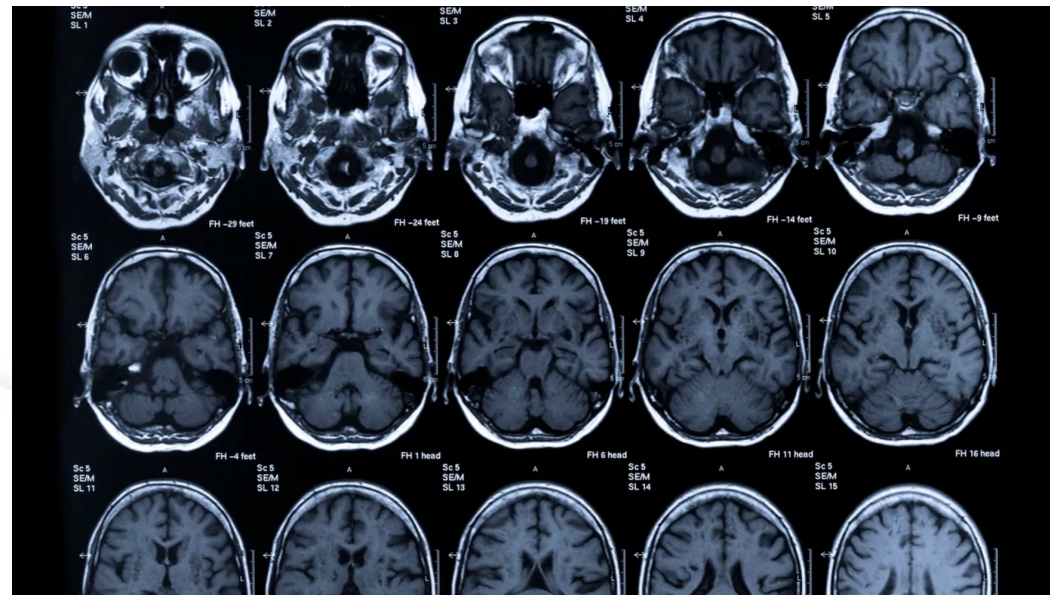
If the aim is to investigate human cognition, perception, or decision-making, human volunteer studies are often the most appropriate model.

If the aim is to understand basic biological mechanisms or disease processes, a combination of human-derived models, computational approaches, and—where still scientifically justified—animal studies may be needed.



Behavioural research

- Non-sentient animals
 - Nematodes (roundworms)
 - Planaria (flatworms)
 - Fruitflies
- Human volunteer studies:
 - Neuroimaging
 - Surveys
 - Smartphone tracking apps
 - Micro-dosing
 - Existing data sets
 - Virtual reality



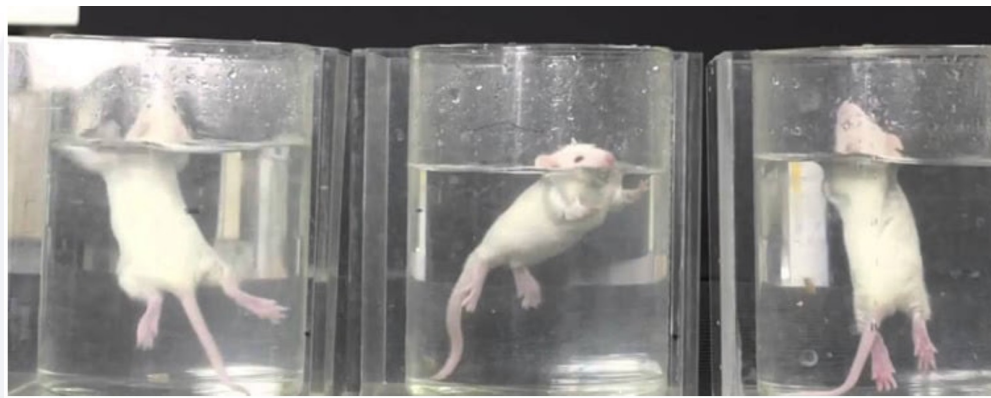
technologynetworks.com/neuroscience/articles/neuroimaging-techniques-and-what-a-brain-image-can-tell-us-363422

Human volunteer studies

Virtual reality enables controlled studies of:

- Navigation
- Fear
- Social behaviour
- Motor learning
- Rehabilitation

Researchers can manipulate environments in ways that would be impossible or unethical in real life.



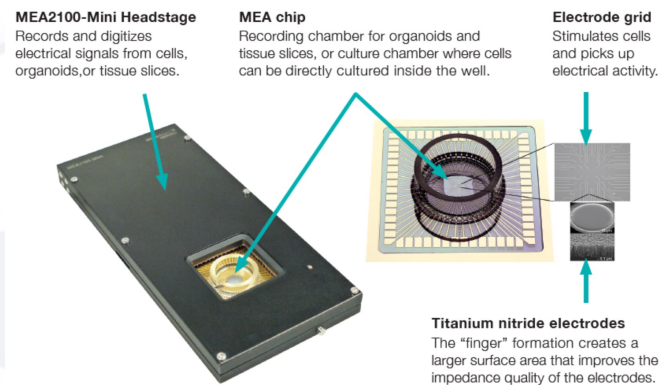
Forced swim test

Human brain models

Researchers are developing:

- Brain organoids
- Neuronal cultures
- Multi-electrode arrays

These models cannot reproduce behaviour itself, but they can help answer questions about neural development, disease mechanisms, and responses to drugs.



harvardbioscience.com/blog/what-is-an-mea-multielectrode-array-or-microelectrode-array

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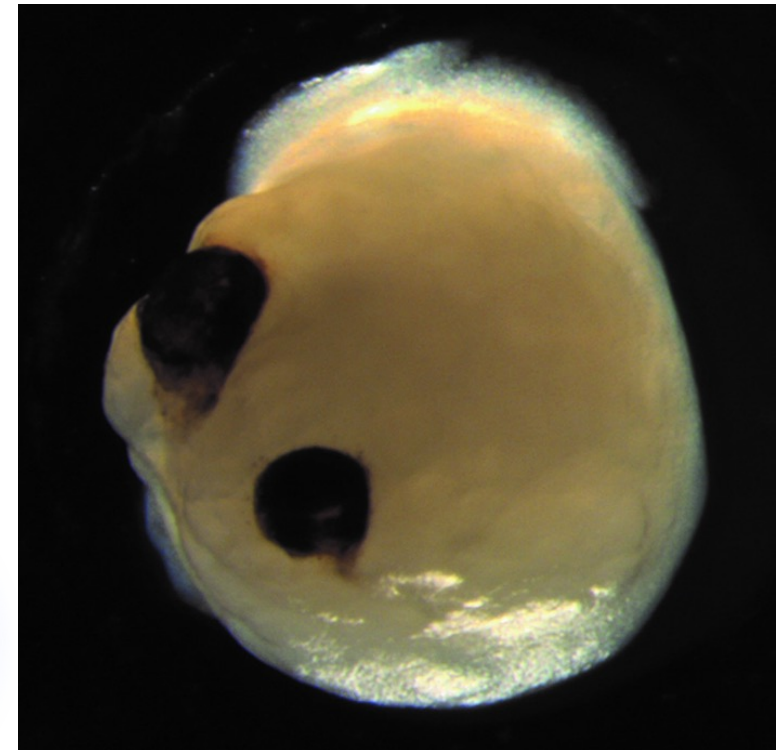
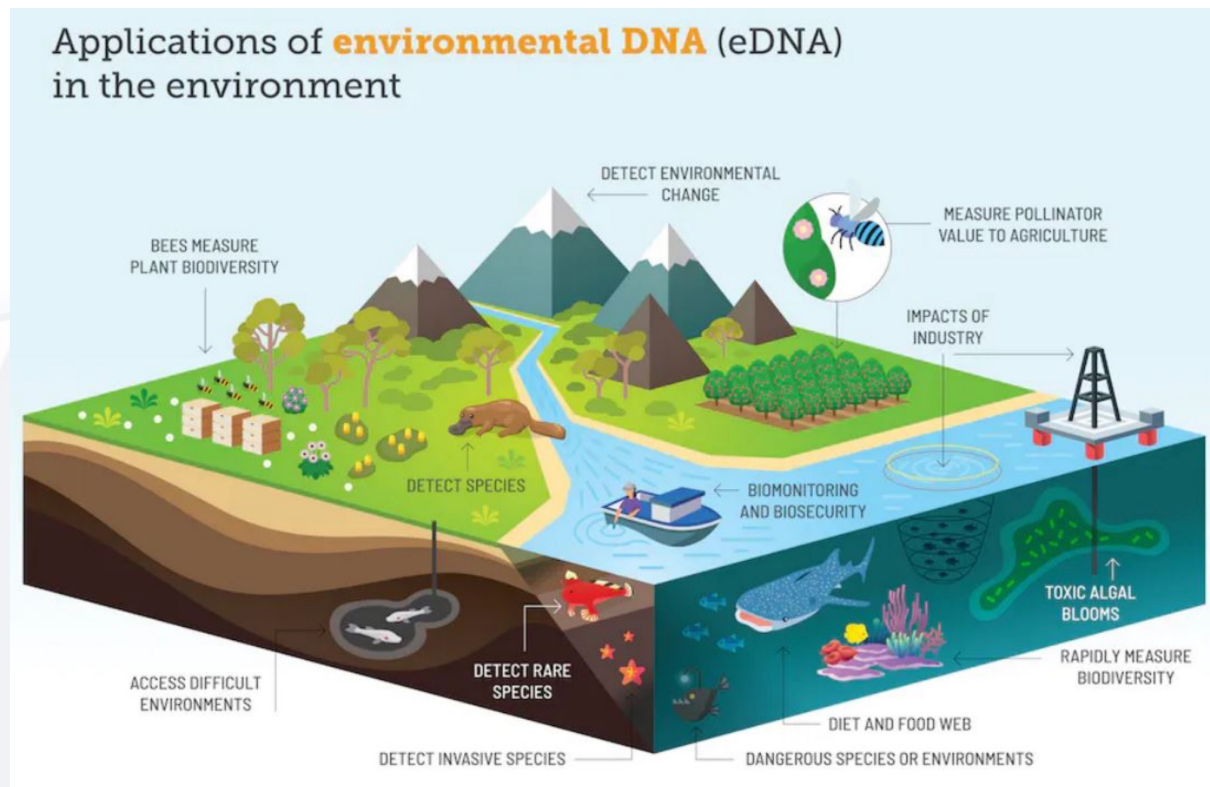


photo: Elke Gabriel
eurekalert.org/multimedia/781762

Areas where Replacement is hopeless?

Field research

Replacing capture studies with collection of eDNA (e.g. hair, faeces, urine)



Non-sentient animals

e.g. Wax moth larvae (*Galleria mellonella*)

- Burn wound healing research
- Infection studies and antimicrobial drug screening
- Toxicity studies
- Drug development
- Modelling viral pathogenesis
- Modelling the human gut genome...



nc3rs.org.uk/our-portfolio/trulav-galleria-mellonella-model-host-infection-studies-toxicity-testing-and-drug-0

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The excitement over NAMs (& NATs)

NAMs: New Approach Methodologies

Avoidance (methods which don't directly replace animal experiments)

e.g. studies on the human placenta
“Read-Across”



colourbox.com

NATs: Non-Animal Technologies

Alternatives to animal experiments

e.g. organoids (mini-organs)
organs-on-chips
experiments on fruit flies

	Chemical 1	Chemical 2	Chemical 3	Chemical 4
Structure	xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
Property 1	● → ○	○	● → ○	○
Property 2	● → ○	○	○ ← ●	●
Property 3	○ ← ●	●	● → ○	○
Activity 1	● → ○	○	● → ○	○
Activity 2	● → ○	○	○ ← ●	●
Activity 3	○ ← ●	●	● → ○	○

● Existing data point ○ Missing data point

norecopa.no/nams-and-nats

NB. Those who work with NAMs may not even be aware that they use a method that can reduce animal use.

It is therefore important to build bridges between the lab animal community, the NAMs/NATs-communities, and those opposed to all animal research and testing.

Assessment of the potential for NAMs

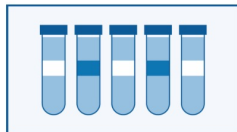
- **Assessment should start with the scientific question, not with a list of NAMs**
- **Deconstruct the experiment** and ask which components can be addressed without animals:
 - e.g. metabolism, behaviour, pharmacokinetics, immune response, tissue mechanics, surgical technique
- Often the answer is not one replacement method but a **combination of approaches**.
- This is why the potential for replacement is generally much greater for **a tightly defined endpoint** such as skin irritation than for a question requiring an intact organism:
 - e.g. EURL ECVAM lists validated full-replacement methods for skin irritation, skin corrosion, skin sensitisation and phototoxicity, whereas it currently lists **no validated alternative test method for repeated-dose systemic toxicity**
- ***Established? Ready for use? Promising? Experimental? Unsupported claim?***

Assessment of the quality of the alternatives

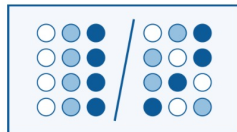
- A sophisticated organoid or organ-on-chip is not automatically good science
- The criteria we apply to *in vivo* studies to improve reproducibility apply there too:
 - Experimental design
 - Appropriate controls
 - Randomisation and blinding
 - Statistical analysis
 - Transparent reporting



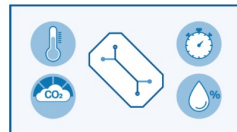
July 2026: NC3Rs launched the **DRIVER recommendations** to improve the design, conduct and reporting of *in vitro* research



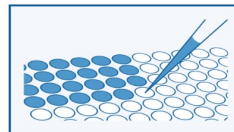
1. Experimental unit



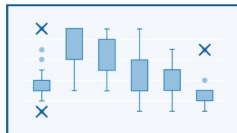
2. Risk of bias



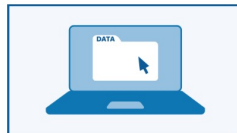
3. Experimental model



4. Experimental procedures



5. Experimental groups and exclusions



6. Data availability and presentation

Designing and Reporting In Vitro Experiments Responsibly

nc3rs.org.uk/3rs-resources/driver-recommendations

Direct one-to-one comparison with an animal assay

May be scientifically inappropriate, particularly where the original animal method was never properly validated



Review of animal use requirements in WHO biologics guidelines

Contents

- Project overview
- Stakeholder engagement
- Working group members
- Publications

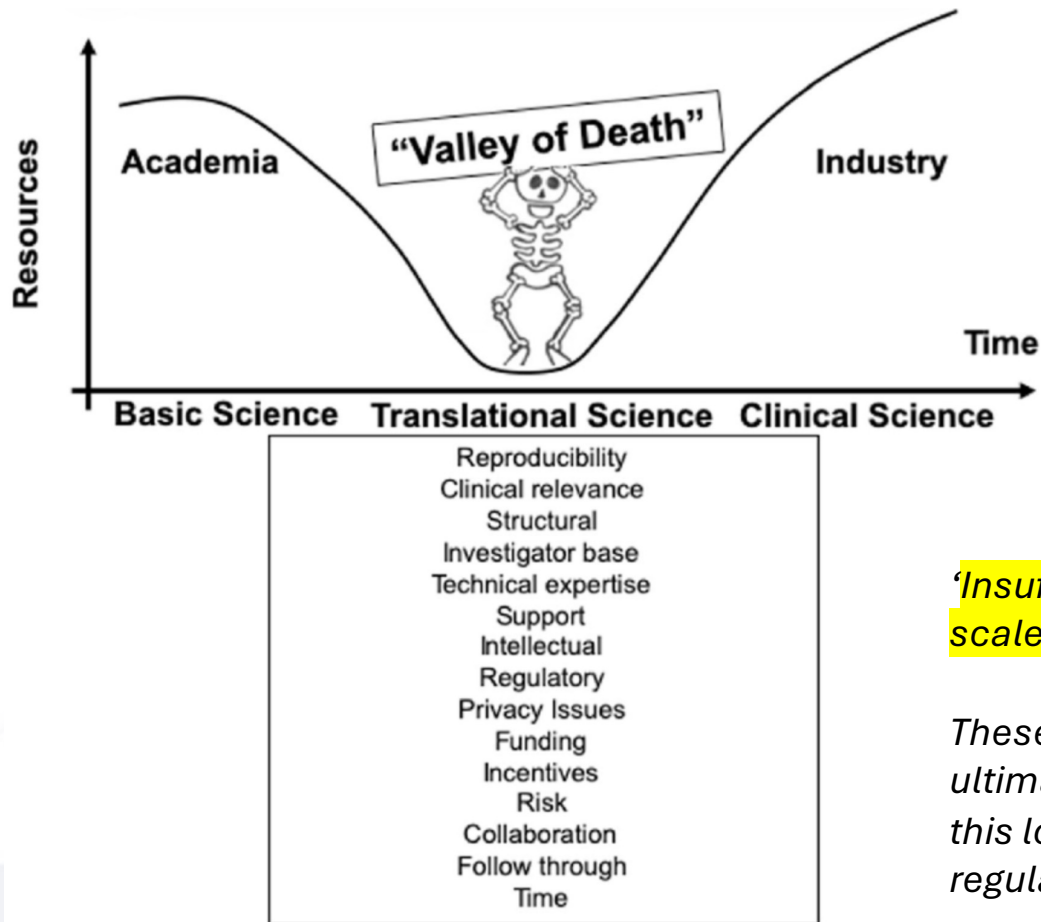


Project overview

Biologicals such as vaccines, cytokines, enzymes, and hormones are tested extensively post-licensure as part of routine quality control and batch release testing to ensure the safety and potency of products. The World Health Organization (WHO) is mandated to establish international standards for this purpose and as such their guidelines and recommendations carry significant influence, being adopted by most global regulatory authorities. However, a review of the animal testing requirements within these guidelines had never been conducted and there may have been opportunities to adopt the latest non-animal technologies that were being missed as a result.

nc3rs.org.uk/our-portfolio/review-animal-use-requirements-who-biologics-guidelines

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Lost in translation: the valley of death across preclinical and clinical divide – identification of problems and overcoming obstacles

November 2019 · [Translational Medicine Communications](#) 4(1)

DOI: [10.1186/s41231-019-0050-7](#)

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Authors:



Attila Seyhan
Brown University

Insufficient funding available for validation, qualification, scale-up, and regulatory acceptance.

These are the very stages that determine whether innovations ultimately reach patients, regulators and markets. And while this logjam persists, animal testing remains the default in regulatory use.

As a result, drug development continues to suffer from failure rates approaching 90%, despite decades of investment.'

researchgate.net/publication/337333742/figure/fig1/AS:826641618046979@1574098128614/illustration-of-the-valley-of-death-in-biomedical-research-Between-basic-scientific.png

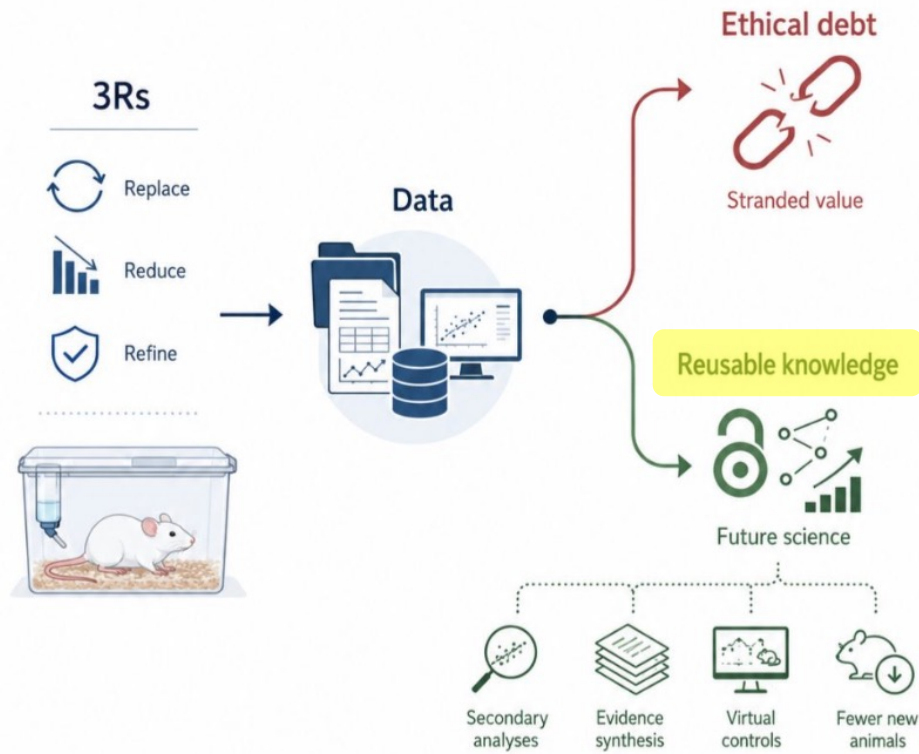
Regulatory guidance

Consult:

- the national competent authority for animal research
- institutional animal ethics committees
- veterinary staff
- 3R centres

These bodies can advise on legal requirements and available alternatives.

What happens to the value of an animal experiment after the experiment ends?



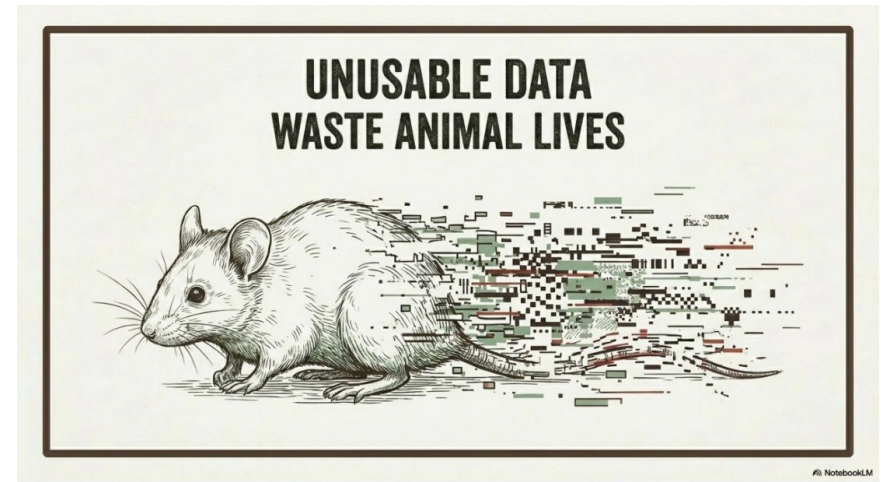
Reuse needs context, provenance, metadata and semantics.



Data welfare is animal welfare.

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Damien Huzard
[linkedin.com/in/dhuzard](https://www.linkedin.com/in/dhuzard)



FAIR data:

Findable, **A**ccessible, **I**nteroperable, **R**eusable
[nature.com/articles/sdata201618](https://www.nature.com/articles/sdata201618)

Selected References:

- Moresis A. et al. A minimal metadata set (MNMS) to repurpose nonclinical in vivo data. Lab Animal, 2024.
- European Medicines Agency. Virtual control groups to help reduce animal use in medicines development, 2026.
- Petit-Demoulière B., Huzard D. Data welfare is animal welfare: Building a WellFAIR research ecosystem. Neuroscience Applied, 2026.







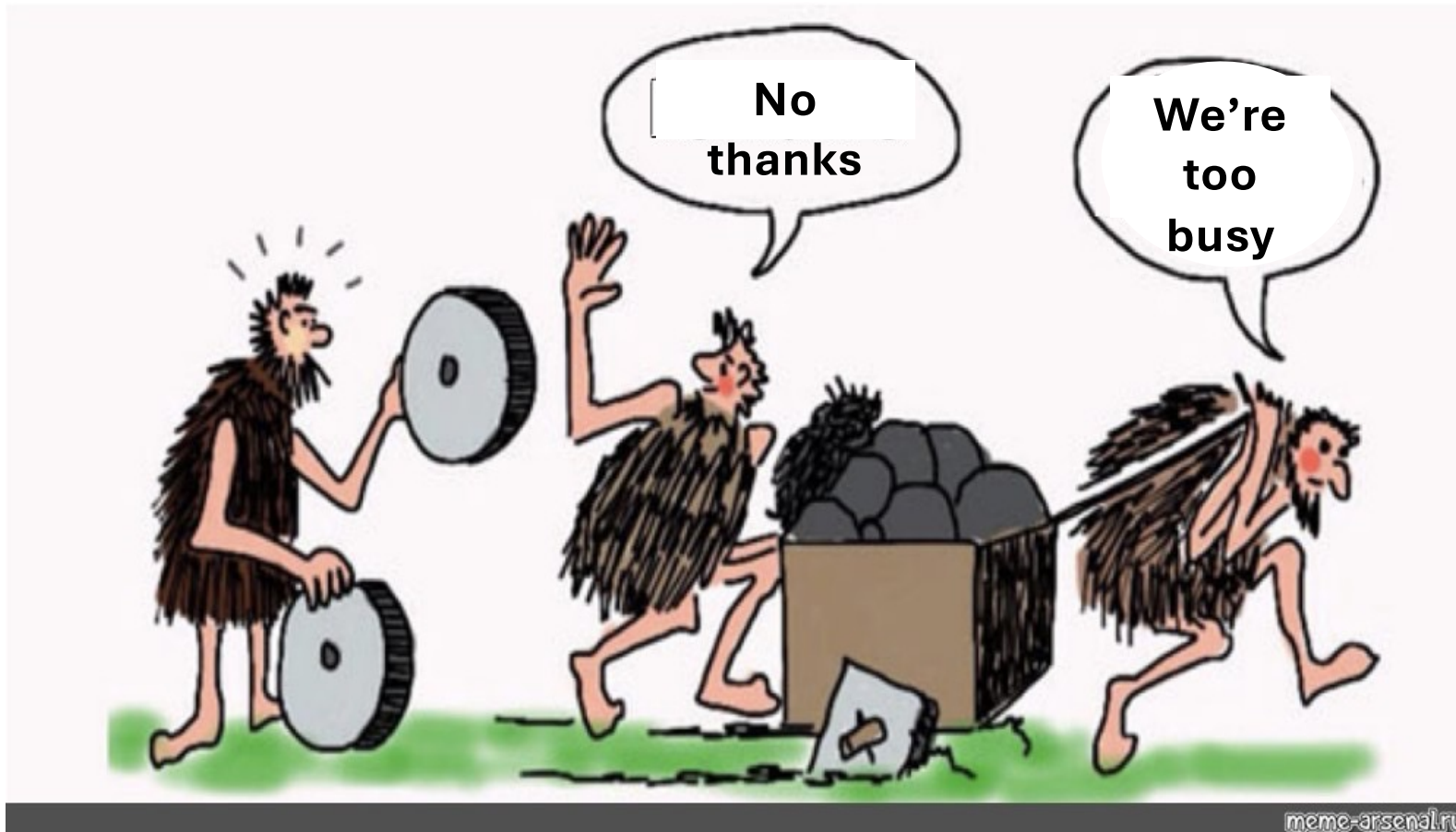
The difficulty is, that changing a university is like moving a graveyard, you get no help from the people inside!

Geoffrey Boulton, University of Edinburgh

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eher.org/changing-a-university-is-like-moving-a-graveyard

weedonbucks.org.uk/index.php/parish-council/weedon-chapel-graveyard



***My project has been funded, and the method has been published before,
so why should I change the protocol?***

There is a real risk that guidelines are treated as a compliance ritual, rather than tools to improve science.

The 'lip service' problem is driven by

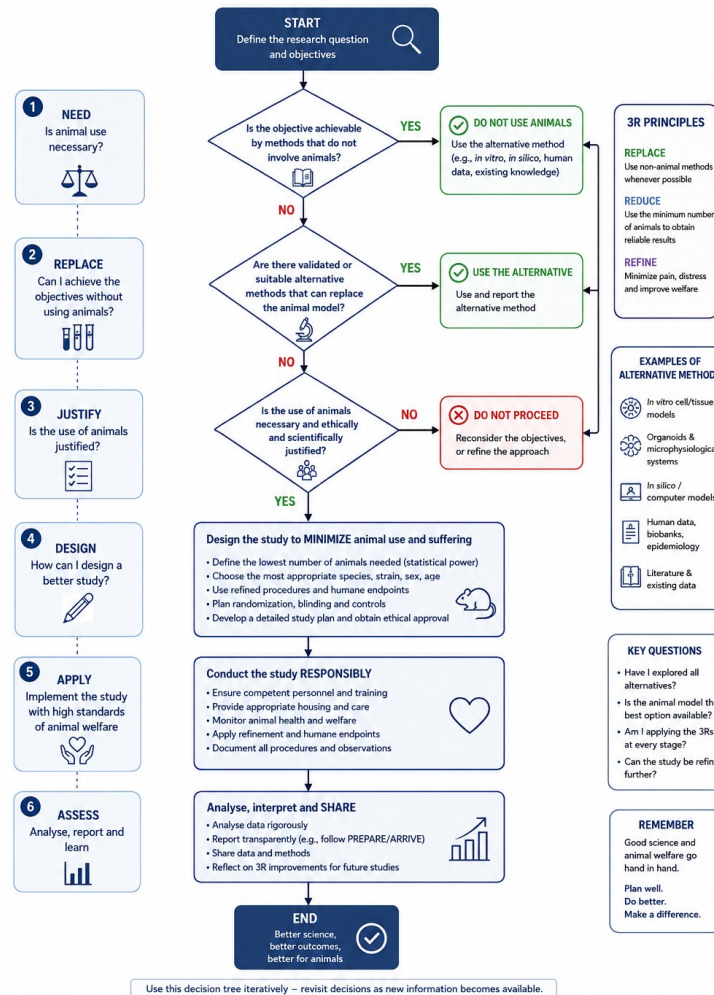
- incentives for novelty, speed and positive results, rather than for rigour, reproducibility and transparency
- checklist fatigue (multiple overlapping requirements from funders, institutional review boards, regulators and journals)
- late-stage engagement (at manuscript submission)
- insufficient training in how to use study design to improve validity and translatability
- cultural separation: is LAS seen as regulatory support rather than an intellectual partner?

Replacement is part of a decision tree that involves all the three Rs

Revisit decisions as new information becomes available

DECISION TREE TO PLAN AND CONDUCT ANIMAL EXPERIMENTS

Make the right decisions at every step – 3R principles in action



ChatGPT

PHASING OUT LAB ANIMALS



10 things that need to happen

1. **Commitment to the principle** that 'phasing out' the use of animals in science is a desirable goal
2. **Leadership** from government, industry and scientists, including clear **strategies** for replacing animals with alternative technologies and new approaches
3. A **culture at every laboratory** that strives to replace animals, supported by senior management and championed by local animal ethics committees
4. **More funding** and other incentives to encourage the development of non-animal technologies, and to support their use
5. **Greater collaboration** between people with different expertise (such as scientists, engineers and mathematicians) to advance the capabilities of technologies and approaches that do not involve animals
6. **Increased awareness** and sharing of knowledge between scientists, regulators and funders about 'alternatives' that are already available
7. **Training and support for scientists** in the new skills and equipment needed to move to non-animal approaches and methods
8. **Critical analysis** of the actual benefits arising from **current animal experiments**
9. **Rethink** about the types of tests and information currently **required by law** to inform decisions around the safety of medicines and chemicals
10. **Faster process of validating 'alternatives'** to ensure they are effective, and clear guidance on what is needed for them to be accepted by the regulators of medicines and chemicals



norecopa
PREPARE for better Science

norecopa.no/media/3xzc2ac/phasing-out-lab-animals-10-things-that-need-to-happen.pdf

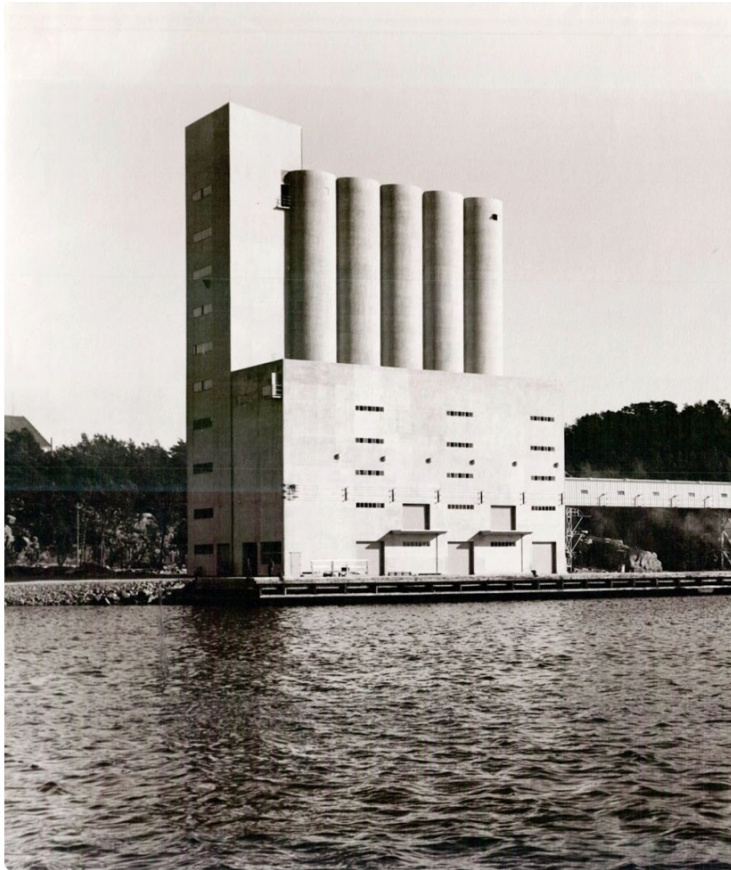
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The problem of “oversell” on both sides



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ChatGPT



Breaking down the knowledge silos ...

**Best practice in non-animal
research methods**

26-27 March 2025, York UK

Proudly presented by:

**Replacing
Animal
Research**



**The Humane
Research Trust
CIO**

**CENTRE FOR
HUMAN
SPECIFIC
RESEARCH**

FELASA, Athens (June 2025)

**Session 2E3: You All Shouldn't Be Here! How to Burst the 3R
Bubble**

The challenge of leaving our comfort zone



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Kunstsilo mottok både DOGA-merket i 2025 og stakk av med Hedersmerket under samme prisutdeling. Foto: Allan Williams



kunstsilo.no

gemsofnorway.no

doga.no/forbilder-og-eksempler/kunstsilo-monumental-transformasjon-med-rom-for-alle

'Desirable as replacement is, it would be a mistake to put all our humanitarian eggs in this basket alone.'

The progress of replacement is gradual, nor is it ever likely to absorb the whole of experimental biology.

Refinement may reach such a pitch that a given procedure employing animals is absolutely humane, but in any given field, there is bound to be a latent period before such success is attained.

Moreover, we have suggested that reduction is desirable in any procedure, however directly humane, which employs large numbers of animals in one laboratory.

For all these reasons, reduction remains of great importance, and of all the modes of progress, it is the one most obviously, immediately, and universally advantageous in terms of efficiency'.



Rex Burch & William Russell at a workshop in Sheringham, UK, in 1995 organised by ECVAM, CAAT and FRAME

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- [Aurora Brønstad wins Norecopa's 3R Prize](#)
- [UFAW Handbook - new edition published](#)
- [Website of the Nordic Zebrafish Network](#)
- [Refinement of oral administration](#)
- [European Network of National Networks of Animal Welfare Bodies](#)
- [Mouse tail simulator for i.v. injection](#)
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Aurora Brønstad wins Norecopa's 3R Prize

We congratulate Aurora Brønstad, laboratory animal veterinarian at the University of Bergen, who was awarded [Norecopa's annual 3R Prize](#) on 4 June, after the annual meeting.

There were two nominees for this year's prize in addition to Aurora Brønstad:

- [Cesilie Røtnes Amundsen](#) at Nord University was nominated for her contributions to fish welfare, teaching and implementation of the 3Rs, including the initiative to start a [Nordic Zebrafish Network](#), of which she is the leader.



Website of the Nordic Zebrafish Network

In a previous newsletter we informed of the creation of a Nordic Zebrafish Network, founded in November 2023.

The Network has [started to build its website](#), which is hosted by the Karolinska Institutet in Stockholm.

The Network will arrange its second course on the husbandry and use of zebrafish in November, followed (like last year) by a Network meeting to discuss the way ahead.

Suggestions for resources to add to the website are very welcome.

The Nordic zebrafish network

The Nordic Zebrafish Network (NZN) was established as a result of a workshop meeting in Stockholm, with the aim to bring together scientists and animal caretaker staff to improve the quality of husbandry and science.

In November 2023, almost all zebrafish facilities from the Nordic countries met in Stockholm. For two days, animal caretakers, facility heads and scientists discussed how research in zebrafish and husbandry of this laboratory animal can be optimized and harmonized to facilitate animal welfare and improve the significance and reproducibility of scientific data.



Photo: Getty Images



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norecopa.no/R3FINED



Speaker

Joseph Garner, D.Phil., is Professor in the Department of Comparative Medicine at Stanford University and an internationally recognized expert in laboratory mouse behavior and welfare. Trained at University of Oxford and University of California, Davis, his work focuses on why animal research often fails to translate to human outcomes and how improving animal welfare can strengthen scientific validity. Dr. Garner leads innovative 3Rs services supporting better experimental design and methodology. He has authored over 190 peer-reviewed papers and received multiple international awards for advancing animal welfare and translational science.

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September 2026

- › [Building a 3Rs Framework for Inclusive Animal Research](#), webinar (Fernando Gonzales Uarquin), 1 September 2026
- › [Recognition of pain, suffering and distress](#), online course, 1-3 September 2026
- › [Enhancing Biosafety Training with Generative AI: Multimedia Tools, Workflows, and Best Practices](#), ABSA webinar (Alisha Diego Klatt & Imke Schroeder), 2 September 2026
- › [Beyond the Checkbox: What Sex-Inclusive Research Really Requires](#), webinar (Ivana Jaric), 2 September 2026
- › [Communicating Research Using Animals](#), LERU workshop, Paris, 2-4 September 2026
- › [Species-Specific Laboratory Animal Science Course: Poultry and other birds](#), Utrecht, 7-18 September 2026
- › [Animals in Scientific Research: When and where? IX National Conference of PoILASA](#), Warsaw, 7-9 September 2026
- › [Galleria Mellonella Workshop](#), Exeter, 8-9 September 2026
- › [Nordic Life Science Days](#), Stockholm, 8-9 September 2026
- › [Genetics for Laboratory Animal Research](#), hybrid course, 8, 15 & 22 September 2026
- › [Prevalence, causes, and consequences of image manipulation within published animal studies](#)
- › [3RsC Bone Marrow MPS webinar](#), 9 September 2026
- › [Laboratory skills](#), hybrid course, 9 & 16 September 2026
- › [EUROTOX congress](#), Vienna, 13-16 September 2026
- › [Advanced anaesthesia for surgical or prolonged procedures](#), online, 14-16 September 2026
- › [New Approaches in Science Workshop \(details and registration\)](#), Pretoria, 15-16 September 2026
- › [TT2026: 20th Transgenic Technology Meeting](#), Leiden, 15-18 September 2026
- › [Practical Laboratory Skills](#), Harwell, 16 September 2026
- › [Practical ethics for CAREs](#), webinar (Penny Hawkins), 16 September 2026
- › [Insects and the 3Rs: progress and challenges for research](#), EC3R webinar
- › [10th Annual Meeting of AWRPN \(Animal Welfare Research Network\)](#)



norecopa.no/calendar

+ webpages for recorded meetings, sorted by PREPARE topics

- › [Animal welfare assessment](#), EALAS webinar, 21 September 2026
- › [Conference: Enhancing Laboratory Animal Welfare: Pushing the boundaries to build capacity for responsible Research in Africa, we must succeed](#), Mbarara, 21-26 September 2026
- › [Establishing a culture of care in research animal facilities](#), online course, 24 September and 1, 8 & 15 October 2026
- › [Cell Culture Days](#), Graz, 23-24 September 2026
- › [New Approach Methodologies in Research and Drug Development](#), Stockholm, 24 September 2026
- › [Tillit til dyrevelferd i fiskeoppdrett – kva kan vi stole på?](#), Trondheim, 24 September 2026
- › [IACUC Training Workshop](#), Cincinnati, 25 September 2026
- › [Advanced animal husbandry, care and enrichment practices](#), hybrid course, 25 September, 12 & 26 October and 13 & 27 November 2026
- › [Mouse colony management: GA strain creation, validation, welfare and breeding](#), London, 28-30 September 2026
- › [AWERB-UK Action Point Workshop: Lack of recognition and reward for AWERB members](#), RSPCA workshop, 29 September 2026
- › [Fun with Ferrets](#), AALAE webinar, 30 September 2026
- › [Multidisciplinary approaches for human relevant modelling](#), Training School, Pisa, 30 September - 1 October 2026
- › [Final Conference of the COST Action IMPROVE](#), Pisa, 30 September - 2 October 2026

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We are actively looking at ways of interrogating Norecopa's 11,000 webpages using AI

- *to provide more comprehensive search results from norecopa.no*
- *to produce a heatmap for a study plan's compliance with the PREPARE guidelines*

without hallucinations or fake data

- *A heatmap for a study plan's compliance with ARRIVE is coming soon*
nc3rs.org.uk/news/developing-ai-tool-check-arrive-compliance

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The near future... as ChatGPT sees it 🤖



On 30 June 2026, Anthropic launched Claude Science, a workbench that connects more than sixty scientific databases, coding tools, and compute into one workspace for genomics, proteomics, structural biology, and cheminformatics

anthropic.com/news/claude-science-ai-workbench

Challenges as I see it:

Cost of the AI tokens (academics are used to free resources)
Security of their study protocols & data
Hallucination

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Contact oss
+47 41 22 09 49
post@norecopa.no

 Norecopa on Facebook
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Street address
Arboretveien 57
1433 Ås

Postal address
% Norwegian Veterinary Institute
P.O. Box 64
N-1431 Ås, Norway

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