

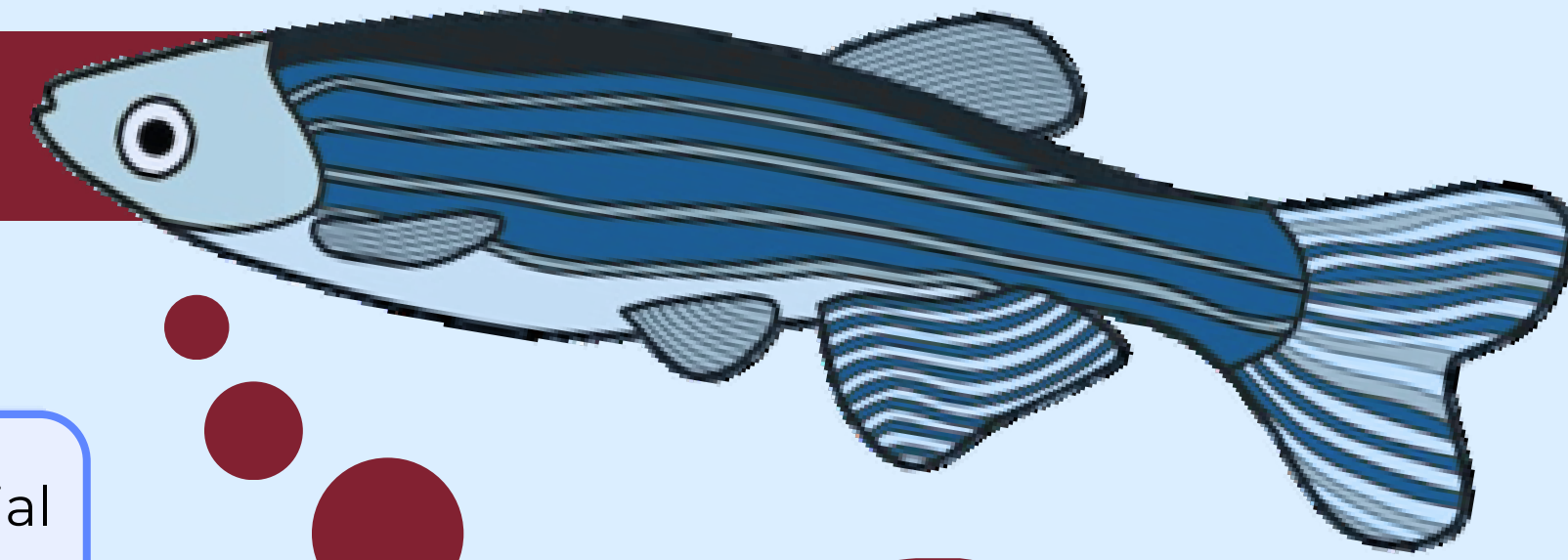


From Mice to NAMs: The rise of the 3Rs

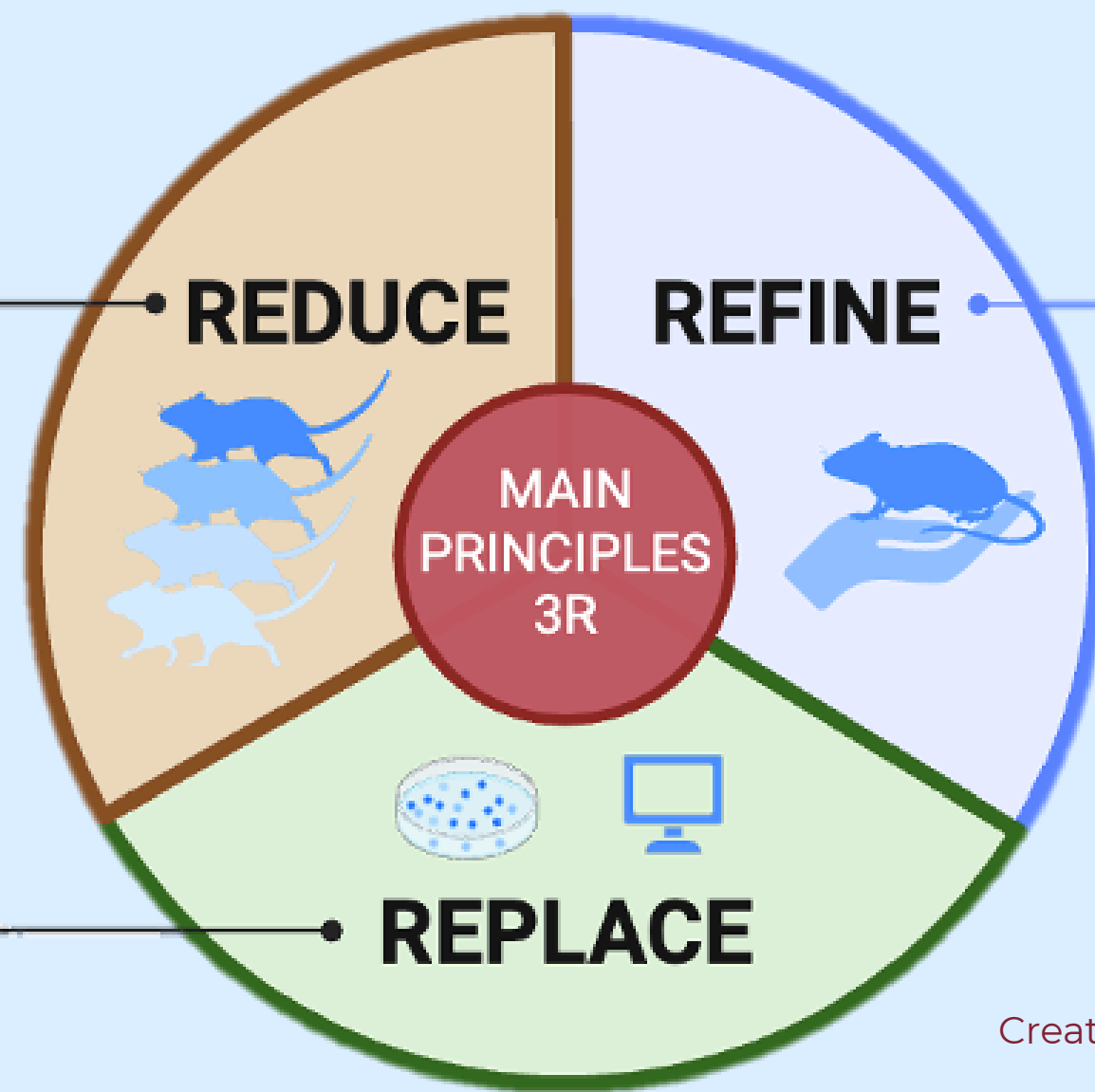
Maria Eleni Vogiatzi and Anna Vedelden Robberstad
Department of Biological Sciences, University of Bergen



WHAT ARE THE 3RS?



Minimize the **number** of animals used in experimentation



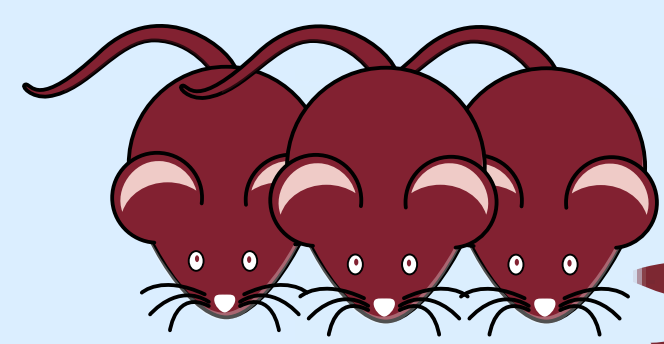
Minimize the potential **suffering and distress** for the animals during testing

Perform **new ways** to perform tests **without** the need for animal models

Did you know?
~8 million animals were used in research in EU and Norway (2023)¹. In Norway, the total number was 1.5 million and ~95% of these animals were **fish**².

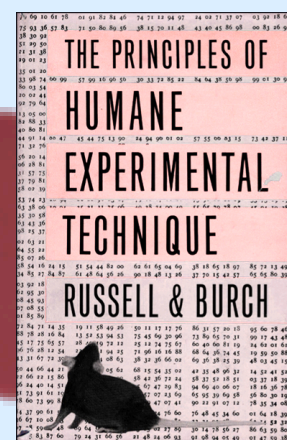
Created in BioRender.com

HOW DID THEY EVOLVE?³



Pre-regulatory era

Widespread **use of animals** in research.
Limited welfare regulations.
Toxicity testing for human products conducted ***in vivo***.



1959

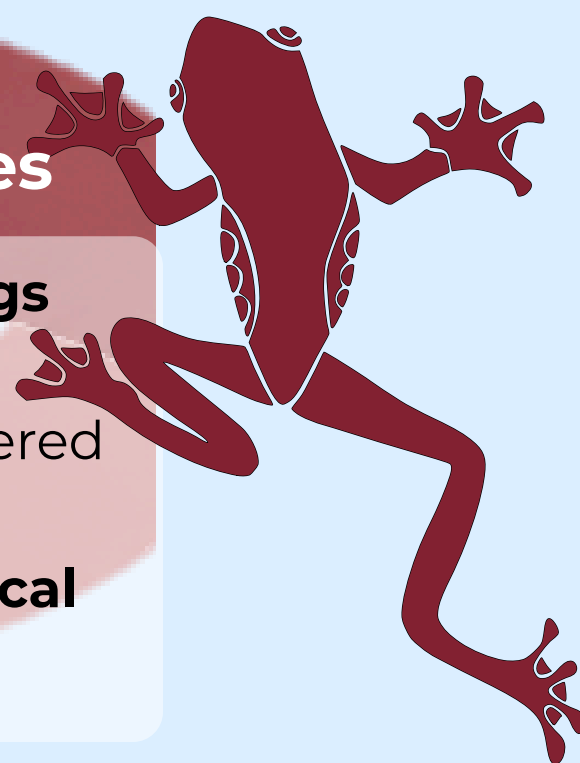
Introduction of the 3Rs

Proposed by **William Russell** and **Rex Burch**.
Established **ethical framework** for animal research.

1960s

Early alternatives

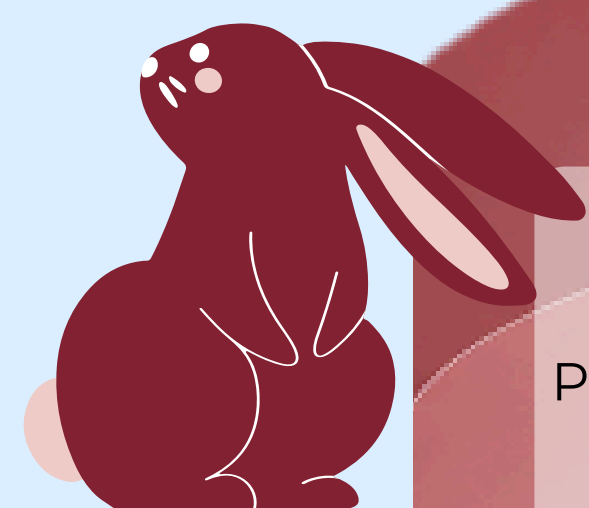
Pregnancy testing using frogs (Hogben test).
Injection of human urine triggered egg-laying if pregnant.
Was replaced by **immunological laboratory tests**.



2013

EU cosmetics ban

European Union bans animal testing for cosmetics.
Phase-out of **Draize rabbit eye test**, used to test skin irritation.
Shift toward non-animal (*in vitro*) methods.



2021

EU Parliament resolution

Voted in **favour** of long-term **phase-out** of animal testing⁴.
Animal use in research **decreased ~8%** in the EU (2022→2023)¹.



Today

Regulation in Norway

Animal research requires **approval** from the **Norwegian Food Safety Authority**.
Strict regulatory oversight with **mandatory** implementation of the 3Rs principle.



Future directions

Expansion of ***in vitro*** and ***in silico*** methods under the term New Approach Methodologies (**NAMs**)⁵.
Increased data and **knowledge sharing**.
Development of **next-generation** NAM models, such as **3D-bioprinted organs**.



ARE ANIMAL MODELS STILL NEEDED?

They remain important where alternatives are **insufficient**. Used to study diseases such as cancer⁶, Parkinson's disease⁷, and Alzheimer's disease⁸. Enable **safety testing** before human trials.

References

1. European Animal Research Association (2024). The 2023 EU figures on animals used in research. <https://www.eara.eu/>.
 2. Norwegian Institute for Nature Research (NINA). (2026). *Use of animals in research in Norway*. <https://www.nina.no/Portals>.
 3. Balls, M. (2024). PubMed Central. <https://pubmed.ncbi.nlm.nih.gov/articles/PMC12097330/>
 4. Naujokaitytė, G. (2021, September 16). Science|Business. <https://sciencebusiness.net/news>
 5. European Medicines Agency (EMA). 2024. <https://www.ema.europa.eu>.
 6. Mak IW, Evaniev N, Ghert M. Am J Transl Res. 2014 Jan 15;6(2):114-8. PMID: 24489990; PMCID: PMC3902221.
 7. Solheim, N., Pinho, B.R., Oliveira, N.A.S. et al. Sci Rep 16, 9525 (2026). <https://doi.org/10.1038/s41598-026-39692-0>
 8. Chia K, Klingseisen A, Sieger D and Priller J (2022) Front. Mol. Neurosci. 15:940484. doi: 10.3389/fnmol.2022.940484
- Poster and figures from canva.com, unless stated otherwise.

