HPRA
An tÚdarás Rialála Táirgí Sláinte
Health Products Regulatory Authority

# Annual statistical report for animals used in Ireland under scientific animal protection legislation - 2023

**19 DECEMBER 2024**

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# 1 INTRODUCTION

The Health Products Regulatory Authority (HPRA) is the State agency with responsibility for the protection of animals used for scientific purposes, the regulation of human and veterinary clinical trials, and the regulation of human and veterinary medicines, medical devices and other health products, amongst other regulatory functions. The European legislation regulating the use of animals for scientific purposes is Directive 2010/63/EU (hereafter referred to as the Directive), and the HPRA is the competent authority responsible for the Directive's implementation in Ireland.

The Directive is among the world's most advanced pieces of animal welfare legislation. The restrictions and standards set by the Directive aim to enhance animal welfare and ensure that animals are used in studies only when absolutely necessary and following independent assessment. The Directive firmly anchors in EU Legislation the 3R principles, i.e. Replacement, Reduction, and Refinement:

- **Replacement** involves the acceleration of the development and use of models and tools, based on the latest science and technologies, to address important scientific questions without the use of animals. Examples of alternative methods would include *in vitro* tests such as the use of cell lines, organ-on-a-chip technologies, computer and mathematical simulation and modelling, video material, or the use of invertebrates such as fruit flies or worms.

- **Reduction** refers to methods that minimise the number of animals used per project or study consistent with the scientific aims. It is essential that studies using animals are appropriately designed and analysed to ensure robust and reproducible findings. Reduction also includes methods that allow the information gathered per animal in a study to be maximised in order to reduce the use of additional animals. Examples of this include the use of some imaging modalities which allow repeated measurements in the same animal to be taken over time (rather than, for example, imaging different animals at each time point) or microsampling of blood, where limiting the amount of blood taken each time to small volumes enables repeat sampling in the same animal.

- **Refinement** refers to methods that minimise the pain, suffering, distress or lasting harm that may be experienced by the animals, and which improve their welfare. Refinement means that animals are provided with the best possible care, and this applies to all aspects of animal use from the animals' housing and husbandry to the scientific procedures performed on them. Examples of refinement include ensuring that animals are provided with housing that allows the expression of species-specific behaviours, using appropriate anaesthesia and analgesia to minimise pain, and training animals to cooperate with procedures to minimise any stress.

Although complete replacement of animal studies is the ultimate goal of the Directive, for the moment the use of live animals continues to be necessary in some circumstances, to protect human and animal health and the environment. Where biological processes are not sufficiently understood or are very complex, non-animal research or test methods are often not available. After generating as much information as possible using non-animal alternatives, animal studies can sometimes be necessary to fill knowledge gaps. The Directive plays a vital role in protecting and improving the welfare of those animals that are required to be used for scientific purposes.

The HPRA regulates the sector by means of authorisation at three levels:

1. **Breeder/supplier/user establishments:** Breeders and suppliers of animals as well as establishments where procedures are performed must be authorised, and are subject to HPRA inspections. During 2023, there were 32 inspections completed to monitor animal welfare standards and compliance with legislation, with 22% of these performed as unannounced inspections.

2. **Projects:** Scientific procedures involving animals can only take place following a detailed submission of the planned study/studies and subsequent approval by the HPRA on the basis of a favourable harm/benefit analysis.

3. **Individuals:** Any person wishing to carry out scientific procedures involving animals, as well as project managers and those conducting euthanasia in an authorised establishment, must be adequately trained to do so and hold a HPRA individual authorisation.

The HPRA aims to improve the welfare of animals used for scientific purposes and to promote the principles of the 3Rs. Every application received for a project involving animals is subject to a detailed evaluation process rooted in the 3R principles, and requires robust scientific justification for the research techniques being applied. The HPRA considers whether alternative (non-animal) methods are available or appropriate, as alternatives to the use of live animals must be used where possible. Where non-animal methods to address the specific research question are not available/appropriate, the likely impact on the animals must be minimised in so far as possible by applying the principles of Reduction and Refinement, and any harms experienced by the animals must be outweighed by the expected benefits of the work. In fulfilment of the HPRA's mandate to promote the 3Rs, in 2023 the HPRA continued its ongoing efforts to enhance awareness and utilisation of non-animal alternatives. The HPRA continued to promote the application of the principles of Replacement, Reduction, and Refinement in the conduct of scientific studies in animals through its work, including the regular dissemination of pertinent information to the regulated sector.

The objective of this report is to present statistical data on the number of uses of animals for scientific purposes in Ireland during 2023 in accordance with Article 54(2) of the Directive. This is the eleventh report to be prepared by the HPRA since it became the competent authority for the protection of animals used for scientific purposes.

As in previous years, the data provided are based on self-declarations by the establishments concerned. The data are presented in this report in accordance with the Commission Implementing Decision 2020/569/EU, which sets out a common format for the submission of information to the European Commission. In line with the EU summary reports under Directive 2010/63/EU on the uses of animals for scientific purposes within the EU and Norway, data has been categorised in this report as follows:

- number of animals used in research, testing, routine production, and education and training purposes[1]
- details of all uses (first and any subsequent reuse) of animals for research and testing
- numbers and uses of animals for the creation and maintenance of genetically altered animal lines

[1] Hereafter referred to as 'research and testing'

***Please refer to the Appendix for definitions relating to some of the terminology used in this report.***

## 2 SUMMARY

In 2023, there were a total of 107,873 uses of animals in procedures for research and testing purposes, with reuse representing 1% of this number (1,234 uses). Some 106,639 animals were reported as being used for the first time for research and testing purposes in 2023. Mice were the most commonly used species at 81% of total animal use. In addition, 482 mice and 2,288 zebrafish were reported as having been used to create and maintain colonies of genetically altered animals. These animals are not considered by the European Commission to have been directly used in research and testing.

Of the total number of uses of animals in procedures for research and testing purposes, 70% were used for regulatory purposes, which refers to legal requirements to test the safety, quality, and potency of medicines (e.g. biological medicines such as vaccines). 7,332 (<7%) of the animals used for research and testing purposes in 2023 were reported as carrying a genetic alteration.

The most frequently reported actual severity experienced by animals during their uses in procedures for research and testing purposes was mild at 53%, followed by moderate at 27%. Of the animals reported as being used for the creation of new genetically altered lines, 70% were reported as having experienced an actual severity of moderate. Of the animals reported as being used for the maintenance of genetically altered lines, 95% were reported as having experienced an actual severity of mild.

## 3 DATA ON THE USES OF ANIMALS FOR RESEARCH AND TESTING PURPOSES

### 3.1 Species and numbers of uses of animals for research and testing purposes

**Table 1** shows the number of animals used (by species) for the first time in procedures performed for research and testing purposes. Each use of an animal extends from the time when the first intervention is applied to the animal until the completion of data collection under a project, or when the animal is removed from the project.

Mice (82% of total first uses of animals) were the most commonly used species. The second most commonly used species was rats, followed by sheep. The species reported as being used under the category 'other rodents' (0.01%) were red squirrels being studied as part of a conservation project aiming to protect their population numbers and habitats. The species reported under the category 'other birds' (0.01%) were Eurasian curlews also being studied in a conservation project aimed at protecting their population numbers. The species reported under the category 'other fish' (0.05%) were wild fish species such as bluefin tuna and blue sharks being studied for conservation projects aimed at improving the survival of these species.

It should be noted that the following species have been excluded from this table as they were not reported as being used for the first time for research and testing purposes in 2023; hamsters (Chinese), Mongolian gerbils, other carnivores, other mammals, reptiles, *Rana*, other amphibians, zebrafish, sea bass, guppy, swordtail, molly, platy, cephalopods, and non-human primates.

*Table 1: Numbers animals used for the first time by species*

| Animal species | Number of uses | Percentage |
|---|---|---|
| Mice | 86,871 | 81.46% |
| Rats | 8,440 | 7.91% |
| Guinea pigs | 1,188 | 1.11% |
| Hamsters (Syrian) | 24 | 0.02% |
| Other rodents | 11 | 0.01% |
| Rabbits | 1,852 | 1.74% |
| Cats | 8 | 0.01% |
| Dogs | 54 | 0.05% |
| Ferrets | 175 | 0.16% |
| Horses, donkeys and cross-breeds | 5 | <0.01% |
| Pigs | 752 | 0.71% |
| Goats | 26 | 0.02% |
| Sheep | 3,088 | 2.90% |
| Cattle | 1,892 | 1.77% |
| Domestic fowl | 37 | 0.03% |
| Turkey | 3 | <0.01% |
| Other birds | 6 | <0.01% |
| Xenopus | 4 | <0.01% |
| Salmon, trout, chars and graylings | 2,068 | 1.94% |
| Other fish | 135 | 0.13% |
| **Total uses** | **106,639** | **100.00%** |

## 3.2 Reuse of animals

**Table 2** shows the proportion of reuse (see Appendix for definition), which represents 1% of total animal use. Under the legislation, animals are only permitted to be reused on second or subsequent projects if the severity they have experienced to date is mild or moderate (see Appendix for definition of severity categories), and they have been assessed as having returned to full general health between studies.

It should be noted that the true number of animals that are reused cannot be deduced from this data as some animals may be reused more than once (i.e. the figure 1,234 represents the total *reuses of animals,* not actual numbers of animals reused). Cattle, sheep, Xenopus, cats, dogs and horses were the species reused during 2023. Cattle are the species most commonly reused in Ireland. The reuse of cattle was in agricultural research studies investigating, for example, ways to protect the environment through the reduction of methane emissions. The majority of sheep reused were also enrolled in studies investigating strategies to reduce methane emissions and the environmental footprint of sheep production. The horses that were reused were used for the purposes of training veterinary students, and the severity of the procedures did not exceed mild. In Ireland, cats and dogs are used exclusively for the development and testing of veterinary medicines to treat diseases and disorders of companion animal species.

**Table 2** shows the total numbers of all uses of animals (first time and reuse) in procedures performed for research and testing purposes, broken down by species.

*Table 2: Numbers animals used (first time and reuse) by species*

| Animal species | First uses | Reuses | Percentage of reuses | Total uses (first use + reuse) |
|---|---|---|---|---|
| Mice | 86,871 | 0 | 0.00% | 86,871 |
| Rats | 8,440 | 0 | 0.00% | 8,440 |
| Guinea pigs | 1,188 | 0 | 0.00% | 1,188 |
| Hamsters (Syrian) | 24 | 0 | 0.00% | 24 |
| Other rodents | 11 | 0 | 0.00% | 11 |
| Rabbits | 1,852 | 0 | 0.00% | 1,852 |
| Cats | 8 | 16 | 1.30% | 24 |
| Dogs | 54 | 12 | 0.97% | 66 |
| Ferrets | 175 | 0 | 0.00% | 175 |
| Horses, donkeys and cross-breeds | 5 | 5 | 0.41% | 10 |
| Pigs | 752 | 0 | 0.00% | 752 |
| Goats | 26 | 0 | 0.00% | 26 |
| Sheep | 3,088 | 192 | 15.56% | 3,280 |
| Cattle | 1,892 | 963 | 78.04% | 2,855 |
| Domestic fowl | 37 | 0 | 0.00% | 37 |
| Turkey | 3 | 0 | 0.00% | 3 |
| Other birds | 6 | 0 | 0.00% | 6 |
| Xenopus | 4 | 46 | 3.73% | 50 |
| Salmon, trout, chars and graylings | 2,068 | 0 | 0.00% | 2,068 |
| Other fish | 135 | 0 | 0.00% | 135 |
| **Total uses** | **106,639** | **1,234** | **100.00%** | **107,873** |

### 3.3 Origin of animals at the first use

**Table 3** shows the number of animals used according to their place of birth, but only includes animals used for the first time as the place of birth is not recorded for animals on their second (or subsequent) use(s). The majority (91%) of animals were born in the EU at a registered breeder, which means that they were born at breeding establishments authorised under the Directive. Animals born in the EU but not at a registered breeder (4%) includes wild animals and farm animals. Animals born in the rest of Europe (5%) represents rats and mice sourced from establishments authorised in the UK (since the UK is no longer an EU Member State). Animals born in the rest of the world (<1%) represents animals that have been obtained from breeding establishments outside of Europe (e.g. specific strains of mice not available in Europe).

*Table 3: Origin of animals at the first use*

| Place of Birth | Number of uses | Percentage |
|---|---|---|
| Animals born in the EU at a registered breeder | 96,504 | 90.50% |
| Animals born in the EU not at a registered breeder | 4,592 | 4.31% |
| Animals born in rest of Europe | 5,302 | 4.97% |
| Animals born in rest of world | 241 | 0.23% |
| **Total uses** | **106,639** | **100.00%** |

## 3.4 Project purposes

**Table 4** shows the primary purposes for which animals were used in research and testing. The most common primary purpose at 70% was 'Regulatory use and Routine production'. This is defined as the 'use of animals in procedures with a view to satisfying legal requirements for producing, placing and maintaining products/substances on the market, including safety and risk assessment for food and feed'.

The primary purposes are further sub-divided in **Tables 5-11**. It should be noted that the primary purposes 'Higher education' and 'Forensic enquiries' are excluded from this table as no uses were reported under these purposes for 2023.

*Table 4: Primary purpose for which animals are used*

| Primary purpose | Number of uses | Percentage |
|---|---|---|
| Basic research | 14,105 | 13.08% |
| Translational and applied research | 17,527 | 16.25% |
| Regulatory use and routine production | 75,109 | 69.63% |
| Protection of the natural environment in the interests of the health or welfare of human beings or animals | 650 | 0.60% |
| Preservation of the species | 195 | 0.18% |
| Training for the acquisition, maintenance or improvement of vocational skills | 287 | 0.27% |
| **Total uses** | **107,873** | **100.00%** |

**Table 5** shows the number of uses of animals in more specific categories of 'Basic research'. 'Basic research' refers to studies of a fundamental nature, which are designed to add knowledge about the structure, functioning, or behaviour of organisms. It should be noted that the sub-fields of 'respiratory system', 'musculoskeletal system', 'urogenital/reproductive system', 'developmental biology, and 'other basic research' were excluded from this table as no uses under these sub-fields were reported for 2023.

The most common sub-field of 'Basic research' at 29% was 'immune system', which relates to research investigating the functioning and activities of the immune system in health and disease. The next most common sub-field at 28% was 'nervous system'. Nervous system research involves studies investigating the physiology and functionality of the brain, spinal cord, and nerves (e.g. studies into behaviour and memory function). These types of studies most commonly use mice and rats.

The third most common sub-field was 'ethology/animal behaviour/animal biology', representing 27% of all basic research performed. In Ireland, this is mainly accounted for by agricultural research into farm animal biology, for example research into genetic factors that impact methane production by sheep and cattle.

*Table 5: Uses of animals for basic research*

| Basic Research | Number of uses | Percentage |
|---|---|---|
| Oncology | 437 | 3.10% |
| Cardiovascular, blood and lymphatic system | 35 | 0.25% |
| Nervous system | 3,990 | 28.29% |
| Gastrointestinal system including liver | 233 | 1.65% |
| Immune system | 4,111 | 29.15% |
| Sensory organs (skin, eyes and ears) | 421 | 2.98% |
| Endocrine system/metabolism | 300 | 2.13% |
| Multisystemic | 786 | 5.57% |
| Ethology / animal behaviour /animal biology | 3,792 | 26.88% |
| **Total uses** | **14,105** | **100.00%** |

**Table 6** shows the number of uses of animals in more specific categories of 'Translational and applied research', which refers to studies which aim to prevent, diagnose, detect or treat disease in animals or humans, as well as studies which aim to improve animal nutrition and welfare. It should be noted that the sub-fields of 'human urogenital/reproductive disorders', 'other human disorders', 'diagnosis of diseases', 'plant diseases' and 'non-regulatory toxicology and ecotoxicology' were excluded from this table, as no uses under these sub-fields were reported for 2023.

The most common sub-field of 'Translational and applied research' at 35% was research into 'human nervous and mental disorders'. This includes research into diagnostics and treatments for diseases such as epilepsy, autism and depression, using mice and rats. The next most common sub-field at 14% was 'animal diseases and disorders'. Studies conducted under this project purpose sub-field in 2023 included research into treatments for parasitic gill disease in salmon and research into vaccination strategies to protect sheep from parasitic liver fluke infection. The third most common sub-field at 10% was research into 'human immune disorders'. Studies performed under this sub-field included research into the development of vaccines to prevent infections and certain types of cancers.

*Table 6: Uses of animals for translational and applied research*

| Translational and applied research | Number of uses | Percentage |
|---|---|---|
| Human cancer | 822 | 4.69% |
| Human infectious disorders | 874 | 4.99% |
| Human cardiovascular disorders | 762 | 4.35% |
| Human nervous and mental disorders | 6,149 | 35.08% |
| Human respiratory disorders | 569 | 3.25% |
| Human gastrointestinal disorders including liver | 726 | 4.14% |
| Human musculoskeletal disorders | 687 | 3.92% |
| Human immune disorders | 1,694 | 9.67% |

| Translational and applied research | Number of uses | Percentage |
|---|---|---|
| Human sensory organ disorders (skin, eyes and ears) | 755 | 4.31% |
| Human endocrine/metabolism disorders | 199 | 1.14% |
| Animal diseases and disorders | 2,421 | 13.81% |
| Animal nutrition | 419 | 2.39% |
| Animal welfare | 1,450 | 8.27% |
| **Total uses** | **17,527** | **100.00%** |

**Table 7** shows the breakdown of animal uses for 'Routine production'. Routine production refers to the use of animals for the production of biological material, for example blood required in the development of diagnostic assays for the identification and treatment of diseases. The sub-fields 'monoclonal antibody by mouse ascites method only', 'monoclonal and polyclonal antibodies (excluding ascites method), and 'other products' were excluded from this table as no uses under these sub-fields were reported in 2023.

*Table 7: Uses of animals for routine production*

| Routine production uses | Number of uses | Percentage |
|---|---|---|
| Blood based products | 25 | 100.00% |
| **Total uses** | **25** | **100.00%** |

**Table 8** shows the breakdown of animal uses for 'Regulatory testing'. The majority of reported uses (>99%) can be attributed to quality control testing. The animals used for 'Other efficacy and tolerance testing' were cattle used to test an intramammary veterinary medicinal product and the animals used for 'Toxicity and other safety testing' were pigs used to test the safety of a medical device.

*Table 8: Uses of animals for regulatory testing*

| Regulatory use | Number of uses | Percentage |
|---|---|---|
| Quality control (including batch safety and potency testing) | 75,072 | 99.98% |
| Other efficacy and tolerance testing | 9 | 0.01% |
| Toxicity and other safety testing including pharmacology | 3 | <0.01% |
| **Total uses** | **75,084** | **100.00%** |

**Table 9** shows a further breakdown of animal use for 'Quality control' tests. Quality control refers to animals used in the testing of purity, stability, efficacy, and potency parameters of a final medicinal product, in order to satisfy regulatory requirements. The majority of quality control tests were for batch potency (91%), and of these tests, 92% were performed on mice. It should be noted that the sub-field of 'other quality controls' was excluded from this table as no uses under this sub-field were reported for 2023.

Batch potency testing is required for biological products, which are products made in a living system such as a microorganism, or plant or animal cells, as opposed to being manufactured through chemical synthesis. The nature of biological products is that they can be inherently variable, and therefore it is necessary to perform batch potency testing to ensure that each manufactured batch of product is of a consistent strength, and therefore both safe and effective

for patients. It is also required as a safety/efficacy test for certain types of vaccine. In relation to pyrogenicity testing (2%), non-animal alternatives have been developed to replace this type of testing for certain medicines. However, for some human medicinal products that still do not have a validated non-animal alternative test that has been accepted and approved by medicines regulators, the requirement remained to employ animal-based tests to test for pyrogenicity during 2023.

*Table 9: Uses of animals for regulatory testing - quality control*

| Quality control | Number of uses | Percentage |
|---|---|---|
| Batch safety testing | 4,699 | 6.26% |
| Pyrogenicity testing | 1,834 | 2.44% |
| Batch potency testing | 68,539 | 91.30% |
| **Total uses** | **75,072** | **100.00%** |

**Table 10** relates to the use of animals for regulatory testing under the sub-field 'Toxicity and other safety testing including pharmacology'. Animals reported under this sub-field in 2023 were used to test the safety of medical devices. Since there were no animals reported under any other sub-fields of 'Toxicity and other safety testing including pharmacology' in 2023 these have been excluded from this table.

*Table 10: Uses of animals for regulatory testing - toxicity and other safety testing including pharmacology*

| Toxicity and other safety testing including pharmacology | Number of uses | Percentage |
|---|---|---|
| Other toxicity/safety testing | 3 | 100.00% |
| **Total uses** | **3** | **100.00%** |

## 3.5 Use of animals to meet legislative requirements

**Table 11** shows which type of legislation is being satisfied in the performance of the regulatory tests for which animals were used. Only categories of legislation under which animal use was reported are included in this table. The vast majority (>99%) were performed on medicinal products manufactured for use in humans. <1% of uses were to satisfy legislation on medicinal products for veterinary use and their residues or medical devices legislation.

*Table 11: Regulatory testing by type of legislation*

| Testing by Legislation | Number of uses | Percentage |
|---|---|---|
| Legislation on medicinal products for human use | 75,072 | 99.98% |
| Legislation on medicinal products for veterinary use and their residues | 9 | 0.01% |
| Medical devices legislation | 3 | <0.01% |
| **Total uses** | **75,084** | **100.00%** |

**Table 12** shows the geographical origin of the legal requirement. All tests were performed to satisfy EU legislative requirements.

*Table 12: Origin of legislative requirement*

| Legislative Requirement | Number of uses | Percentage |
|---|---|---|
| Legislation satisfying EU requirements | 75,084 | 100.00% |
| Legislation satisfying national requirements only [within EU] | 0 | 0.00% |
| Legislation satisfying non-EU requirements only | 0 | 0.00% |
| **Total uses** | **75,084** | **100.00%** |

## 3.6 Use by genetic status for research and testing purposes

**Table 13** shows the number of uses of animals for research and testing purposes that had a genetic alteration, broken down by whether the animal exhibited a harmful phenotype at the time of the study or not. The majority of animals (93%) were not genetically altered, with 2% of all uses involving animals with harmful phenotypes (see Appendix for definitions).

*Table 13: Genetic status*

| Genetic Status | Number of uses | Percentage |
|---|---|---|
| Not genetically altered | 100,541 | 93.20% |
| Genetically altered without a harmful phenotype | 4,678 | 4.34% |
| Genetically altered with a harmful phenotype | 2,654 | 2.46% |
| **Total uses** | **107,873** | **100.00%** |

## 3.7 Actual severity of uses of animals for research and testing purposes

**Table 14** shows the reported actual severity experienced by the animals during their uses for research and testing purposes. Overall, <2% of uses were classified as non-recovery, 53% were classified as mild, 27% were classified as moderate and 18% were classified as severe (see Appendix for definitions). Of the animals that were reported as experiencing severe severity in 2023, >99% were mice. It should be noted that there were no reports received of the severe classification being exceeded, nor did the HPRA grant any exemptions for the severe classification to be exceeded.

*Table 14: Classification of actual severity*

| Severity | Number of uses | Percentage |
|---|---|---|
| Non-recovery | 1,576 | 1.46% |
| Mild [up to and including] | 57,152 | 52.98% |
| Moderate | 29,329 | 27.19% |
| Severe | 19,816 | 18.37% |
| **Total uses** | **107,873** | **100.00%** |

## 4 DATA ON THE USES OF ANIMALS FOR THE CREATION AND MAINTENANCE OF GENETICALLY ALTERED ANIMAL LINES

**Table 15** shows the number of animals (by species) used for the creation of new genetically altered animal lines for the first time. There was no reuse of animals reported for the creation of new genetically altered animal lines in 2023.

*Table 15: Number of animals (by species) used for the creation of new genetically altered animal lines for the first time*

| Animal species | Number of uses | Percentage |
|---|---|---|
| Mice | 203 | 8.97% |
| Zebrafish | 2,059 | 91.03% |
| **Total uses** | **2,262** | **100.00%** |

**Table 16** shows the uses of animals for the creation of new genetically altered lines by severity.

*Table 16: Uses of animals for the creation of new genetically altered animal lines by severity*

| Severity | Number of uses | Percentage |
|---|---|---|
| Non-recovery | 0 | 0.00% |
| Mild [up to and including] | 671 | 29.66% |
| Moderate | 1,591 | 70.34% |
| Severe | 0 | 0.00% |
| **Total uses** | **2,262** | **100.00%** |

**Table 17** shows the number of animals used for the creation of new genetically altered lines by genetic status of the animals. <1% of animals used in 2023 for the creation of a new genetically altered line were reported as not genetically altered. 10% were reported as genetically altered without a harmful phenotype, with 90% reported as genetically altered with a harmful phenotype.

*Table 17: Uses of animals for the creation of new genetically altered animal lines by genetic status*

| Genetic status | Number of uses | Percentage |
|---|---|---|
| Not genetically altered | 16 | 0.71% |
| Genetically altered without a harmful phenotype | 215 | 9.50% |
| Genetically altered with a harmful phenotype | 2,031 | 89.79% |
| **Total uses** | **2,262** | **100.00%** |

**Table 18** shows the uses of animals for the creation of new genetically altered lines by type of 'Basic research' purposes. 42% of animals used for the creation of a new genetically altered line were reported under the 'Basic research' sub-field 'multisystemic', which relates to research looking at multiple organ systems, with the remaining uses reported under the sub-fields of 'oncology' or 'immune system'. Since the remaining 'Basic research' sub-fields had no animals reported, they are excluded from this table.

*Table 18: Uses of animals for the creation of new genetically altered animal lines by type of basic research purposes*

| Basic research | Number of uses | Percentage |
|---|---|---|
| Oncology | 61 | 26.41% |
| Immune system | 72 | 31.17% |
| Multisystemic | 98 | 42.42% |
| **Total uses** | **231** | **100.00%** |

**Table 19** shows the uses of animals for the creation of new genetically altered lines by type of 'Translational and applied research' purposes. The majority of animals (98%) were reported as used under the 'Translational and applied research' sub-field 'human sensory organ disorders (skin, eyes and ears)', with small percentages of animals reported under the sub-fields 'human cancer' and 'human immune disorders'. Since the remaining 'Translational and applied research' sub-fields had no animals reported, they are excluded from this table.

*Table 19: Uses of animals for the creation of new genetically altered animal lines by type of translational and applied research purposes*

| Translational and applied research | Number of uses | Percentage |
|---|---|---|
| Human cancer | 7 | 0.34% |
| Human immune disorders | 26 | 1.28% |
| Human sensory organ disorders (skin, eyes and ears) | 1,998 | 98.38% |
| **Total uses** | **2,031** | **100.00%** |

**Table 20** shows the number of animals used (by species) for the maintenance of established genetically altered lines for the first time. Mice and zebrafish were the only species of animal reported as being used for the maintenance of established genetically altered lines during 2023. There was no reuse of animals reported for the maintenance of established genetically altered lines in 2023.

*Table 20: Number of animals used for the maintenance of established genetically altered animal lines by species*

| Animal species | Number of uses | Percentage |
|---|---|---|
| Mice | 279 | 54.92% |
| Zebrafish | 229 | 45.08% |
| **Total uses** | **508** | **100.00%** |

**Table 21** shows the uses of animals for the maintenance of established genetically altered lines by severity. 95% of animals used for the maintenance of established genetically altered lines in 2023 were reported as having experienced mild severity.

*Table 21: Uses of animals for the maintenance of established genetically altered animal lines by severity*

| Severity | Number of uses | Percentage |
|---|---|---|
| Non-recovery | 0 | 0.00% |
| Mild [up to and including] | 481 | 94.69% |
| Moderate | 9 | 1.77% |
| Severe | 18 | 3.54% |
| **Total uses** | **508** | **100.00%** |

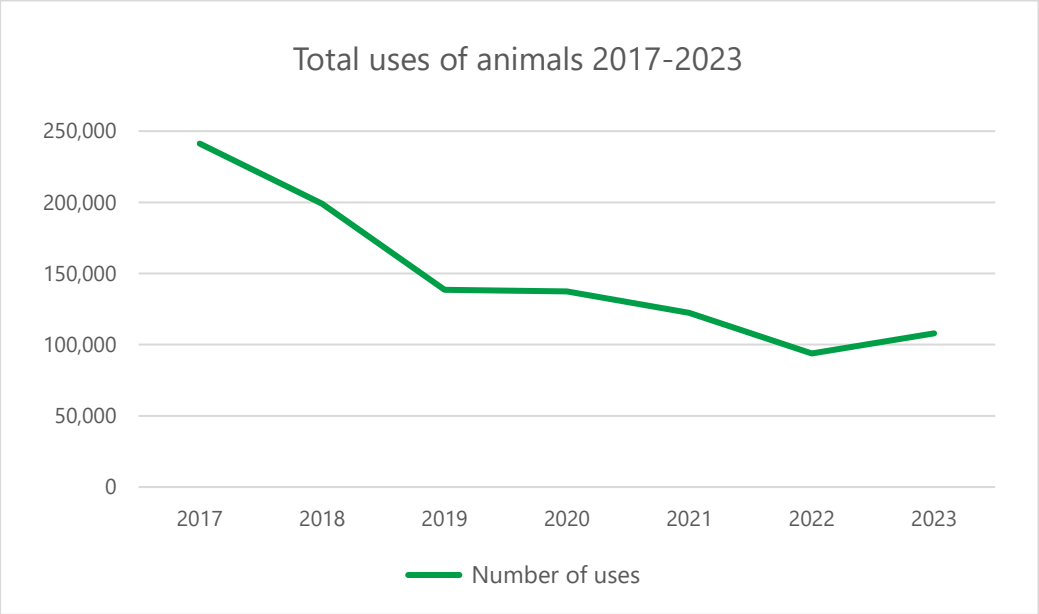
**Table 22** shows the uses of animals for the maintenance of established genetically altered lines by genetic status of the animals. 63% of animals used for the maintenance of established genetically altered lines in 2023 were reported as genetically altered without a harmful phenotype, with 37% reported as genetically altered with a harmful phenotype.

*Table 22: Uses of animals for the maintenance of established genetically altered animal lines by genetic status*

| Genetic status | Number of uses | Percentage |
|---|---|---|
| Not genetically altered | 0 | 0.00% |
| Genetically altered without a harmful phenotype | 318 | 62.60% |
| Genetically altered with a harmful phenotype | 190 | 37.40% |
| **Total uses** | **508** | **100.00%** |

## 5 TRENDS

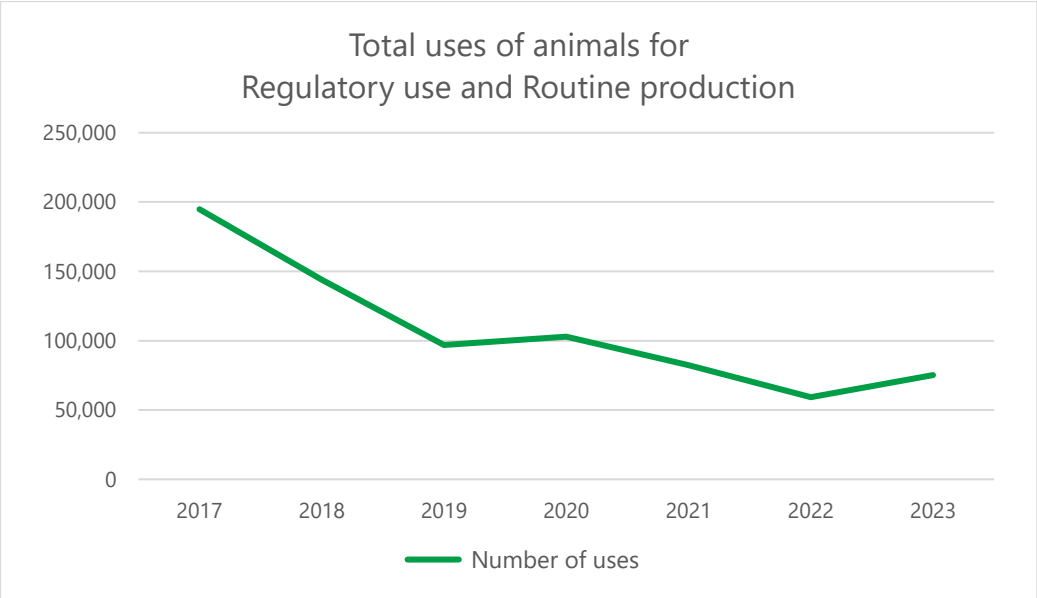
a) In 2023, there were 107,873 uses of animals for research, testing, routine production, and education and training purposes. This represents a 15% increase from the number of uses reported for 2022 (93,825 uses in 2022). This increase was mirrored by a 15% increase in the numbers of animals used for first time in 2023 versus 2022 (106,639 in 2023 versus 92,939 animals in 2022). Overall, the total number of uses of animals in Ireland has decreased significantly over the last number of years, as illustrated by the graph below.




b) There was a 28% increase in the number of animals used for 'Basic research' in 2023 (14,105 animals) versus 2022 (11,042 animals). This increase was primarily driven by a large-scale national study investigating the impacts of sheep genetics on methane emissions.

c) There was an 11% decrease in the uses of animals for 'Translational and applied research' in 2023 (17,527 animals) versus 2022 (19,646 animals).

d) There was a 27% increase in the number of animals used for 'Regulatory Use and Routine production' in 2023 (75,109 animals) versus 2022 (59,245 animals). By way of more long-term comparison however, there has been a significant reduction in the number of animals used for the purpose of 'Regulatory Use and Routine production' in the last number of years, as illustrated by the graph below.




e) The increase in the numbers of animals used for 'Regulatory Use and Routine production' in 2023 is driven by an increase in the number of animals used for the secondary purpose 'Quality Control (including batch safety and potency testing)', with 75,072 animals used for this secondary purpose in 2023 versus 59,224 in 2022. This is primarily due to increases in uses for batch safety and batch potency testing of human medicinal products such as vaccines and snake anti-venom products.

f) There was an almost two-fold increase in the number of rabbits used for pyrogenicity testing (1,834 in 2023 versus 966 in 2022). This is due to sponsor companies requiring increased volumes of rabbit pyrogen testing as part of the process of investigating and validating non-animal alternative tests to detect pyrogenic contaminants, in preparation for the removal of the rabbit pyrogen test as a regulatory requirement from the European Pharmacopoeia in 2025.

g) Mice remain the most commonly used species, accounting for 81% of all animal uses. The total number of mice used increased by 29%, (86,871 in 2023 versus 67,320 in 2022). This increase was primarily due to a 39% rise in the number of mice used for regulatory testing in 2023, e.g. for the batch safety testing of human vaccines and batch potency testing of anti-venom products.

h) The number of rats used decreased by 35% (8,440 in 2023 compared to 13,082 in 2022) This decline was mainly due to a reduction in the use of rats for regulatory testing.

i) The number of guinea pigs used increased by 60% (1,188 in 2023 versus 741 in 2022). This rise was driven by an increase in the use of guinea pigs in quality control and safety testing of human vaccine products.

j) There was a 52% decrease in the number of uses of cats reported (24 uses reported in 2023 versus 50 uses in 2022) and a 75% decrease in the number of uses of dogs reported (66 uses reported in 2023 versus 264 uses in 2022). The factors underlying these reductions are not fully understood, but they may be due to lower volumes of research, development, and regulatory testing of veterinary medicinal products being undertaken during 2023 when compared to 2022.

k) There was a significant decrease in the number of uses of horses reported for 2023 versus 2022 (10 uses of horses reported in 2023 compared to 259 uses reported for 2022). This was due to a large-scale study on equine metabolic disease concluding during 2022.

l) The number of reported uses of pigs decreased by 69% in 2023, with 752 uses compared to 2,460 uses in 2022. This decline was due to the conclusion of several large-scale studies on porcine nutrition and antimicrobial resistance in 2022.

m) The number of reported uses of fish in the species category 'salmon, trout, chars, and graylings' increased by 52%, rising to 2,068 in 2023 from 1,364 in 2022. This increase was driven by studies conducted in 2023 aimed at conserving Irish salmon populations.

n) The percentage distribution of uses across the four severity categories in 2023 remains broadly similar to that reported in 2022.

**To Note:** In addition to routine year-on-year variation in the number and nature of projects authorised, annual trend data can be impacted by a range of other factors which can lead to variation in the overall number of animals used. Decreases, for example, may arise as a result of the ongoing application of the 3Rs principles while certain extraneous developments may result in increases in the levels of animal use. Among the factors that should be considered when assessing annual trend data include:

- The relocation of existing regulatory testing either to or from Ireland.
- The regulatory requirement for the use of animal tests to determine the safety and effectiveness of new human medicines and vaccines developed in response to emerging and significant public health developments.
- The adoption, following regulatory approval, of alternative testing methods including *in vitro* tests.

## 6 CONCLUSION

In 2023 there were 107,873 reported uses of animals for research, testing, routine production, and education and training purposes in Ireland. Furthermore, 2,262 animals were reported as being used for the creation of new genetically altered animal lines, with 508 animals reported as being used for the maintenance of genetically altered animal lines.

The HPRA's focus will continue to be on promoting the replacement of animal tests using with suitable non-animal alternatives, ensuring that the principle of Reduction is applied appropriately when it is necessary to use animals, and refining the husbandry, care and use of animals in procedures. In addition, the HPRA will ensure that animals are used only when there is no equivalent alternative (non-animal) technique available, and the harm-benefit analysis of the proposed use is favourable.

## 7 APPENDIX: DEFINITIONS

### Procedures

The Directive defines a procedure as: "any use of an animal for scientific or educational purposes, which may cause the animal a level of pain, suffering, distress or lasting harm equivalent to, or higher than, that caused by the introduction of a needle in accordance with good veterinary practice". This includes the creation and maintenance of any genetically altered animal lines that may result in pain or distress as per the above definition. Each procedure may consist of several stages or techniques for a single scientific purpose, which is then counted as *one* procedure and reported in the year it was completed.

### Reuse

Reuse means that following a full recovery from a completed procedure and having been certified by a veterinarian as being returned to full health, that animal can then be enrolled on another project.

### Genetically altered animals

Genetically altered animals are those that have been genetically modified, for example, by the introduction (into an animal) of genetic material from another animal, or by 'knocking out' or disrupting an existing gene. Statistics are only collected on genetically altered animals that have an impairment to their well-being from the genetic alteration (a harmful phenotype), or when a new genetic line of animals is being created and the effect on the animals is not yet known.

### Actual severity

At the end of the use of an animal on a procedure, the impact of the procedure must be determined and reported as 'actual severity'. This means that the *highest severity* that an animal may have experienced throughout the course of their time on procedure (rather than the severity at the end or the average severity throughout) must be recorded. Therefore, it is based on the real impact of the procedure, rather than any predicted

impact. The legislation defines four categories of actual severity, in order of least to most harmful, as: non-recovery, mild, moderate, and severe.

**Non-recovery:** This means the entire procedure is carried out under general anaesthesia and, at the end, the animal is humanely euthanised rather than being allowed to wake up.

**Mild:** Any pain or suffering experienced by the animal is only slight, minor, or temporary and so the animal recovers in a short period of time. This would include an injection, a short period of social isolation, or non-invasive imaging under sedation or anaesthesia (e.g. MRI scanning).

**Moderate:** Any suffering experienced by the animal is short-term moderate pain, suffering, or distress; long-lasting mild pain, suffering, or distress; or involves a moderate impairment to their well-being. This would include surgery performed under general anaesthesia, repeated injections or blood tests, or the induction of tumours that cause moderate impairment to well-being.

**Severe:** Severe procedures indicate a major departure from the animal's usual state of health or well-being, and cause long-lasting moderate pain, suffering or distress, or short-term severe pain. This might include toxicity testing under legislation where fatalities may occur, surgical procedures that cause severe post-operative pain, or the breeding of animals with serious genetic disorders.

It should be noted that procedures that involve severe pain, suffering, or distress that are *long-lasting* are prohibited under the legislation.