

Science Report

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Declining numbers of laboratory animals in Germany

Possible reasons for the reduction and its impact on Germany as a research hub

In 2025, the German Centre for the Protection of Laboratory Animals published the reported figures on laboratory animals used in Germany in 2024. According to these official statistics, the numbers fell for the fifth consecutive year and, for the first time, dropped below two million animals used or killed for scientific purposes in Germany.

From the BfR's perspective, more reliable data is needed to specifically identify and understand the reasons for the steadily declining numbers of laboratory animals. Against this background, the BfR has used various conceptual approaches to investigate in greater depth the reasons for the decline and, in doing so, the potential implications for basic life sciences research as well as translational and applied research.

The following methods were used in the investigation:

- Detailed analysis of German laboratory animal statistics up to the reporting year 2024
- Evaluation of the contribution of individual research areas to the downward trend, as well as a comparison of German laboratory animal statistics with figures from France and the United Kingdom
- Impact of the downward trend on national publication output in the biomedical research domain in a global and European comparison
- Impact of the downward trend on pharmaceutical companies' satisfaction with Germany as a research and development location
- Investigation of the possible reasons for the reduction in the number of laboratory animals.

The cause of the reduction in the number of laboratory animals cannot be attributed to a single factor, but has a very high probability of being multifactorial.

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1 Subject of the assessment

In 2025, the German Centre for the Protection of Laboratory Animals (Bf3R), which forms part of the German Federal Institute for Risk Assessment (BfR), published the reported data on laboratory animals used in Germany in 2024.¹ According to these official statistics, the figures had fallen for the fifth consecutive year and, for the first time, dropped below two million animals used or killed for scientific purposes in Germany.²

Whilst organisations campaigning for a complete phase-out of animal experiments called for an even sharper decline in 2025³, the science-oriented organisation ‘Tierversuche Verstehen’ had already expressed concerns about the rapid decline a year earlier. According to the organisation, this decline is primarily attributable to increasingly difficult conditions for research in Germany. This is said to affect the country’s appeal as a location for early-career researchers and is clearly felt in the context of international competition.⁴

The German Research Foundation (DFG) also considers refinements to the framework conditions for research involving animal experimentation to be urgently needed and calls on the relevant ministries and authorities at federal and state level to take measures to speed up and harmonise approval procedures, reduce bureaucratic burdens and eliminate legal uncertainties.⁵ In this regard, it refers to an opinion by the DFG’s Senate Commission on Animal Experimentation, which criticises in particular what researchers perceive as excessively long processing times for applications for animal experimentation projects. The opinion identifies “significant impairments to research work”, which could potentially pose a hazard to Germany’s position as a centre for research.⁶ These concerns have also been raised with the BfR by the scientific community, although the declining numbers of laboratory animals could also reflect a shift of experiments abroad. Once again, the criticism is directed at the duration and complexity of the authorisation process. However, particularly with regard to the duration of the authorisation process, the data collected by the EU⁷ on authorisation times in Germany – which appear unremarkable in an EU-wide comparison⁸ – contradict the data collected in a pilot study by the DFG Senate Commission⁹.

From the BfR’s perspective, this is one of the key reasons why more reliable data is needed to specifically identify and understand the reasons for the steadily declining numbers of laboratory animals. Against this background, the BfR has used various conceptual

¹ <https://www.bf3r.de/en/offers/test-animal-numbers/test-animal-numbers-2024/>, last accessed on 9 June 2026

² <https://www.bfr.bund.de/en/press-release/less-than-two-million-laboratory-animals-for-the-first-time/>, last accessed on 9 June 2026

³ For example, <https://www.peta.de/themen/tierversuche-deutschland/> last accessed on 9 June 2026; <https://www.tierrechte.de/2025/12/10/10-12-25-versuchstierzahlen-trotz-rueckgang-brauchen-wir-eine-ausstiegstrategie/>, last accessed on 9 June 2026

⁴ <https://www.tierversuche-verstehen.de/versuchstierzahlen-2023/> last accessed on 3 June 2026

⁵ <https://www.dfg.de/de/aktuelles/neuigkeiten-themen/info-wissenschaft/2025/ifw-25-77> last accessed on 9 June 2026

⁶ Deutsche Forschungsgemeinschaft | Ständige Senatskommission für tierexperimentelle Forschung. (2025).

Genehmigungsverfahren für Tierversuche – aktuelle Bestandsaufnahme und Handlungsbedarfe. Deutsche Forschungsgemeinschaft (DFG) <https://doi.org/10.5281/zenodo.17647767>

⁷ Article 54(1) Member State Implementation Report for Germany, available at <https://circabc.europa.eu/ui/group/8ee3c69a-bccb-4f22-89ca-277e35de7c63/library/e2f2be2e-0bb1-434e-b830-72d11a6c9b59/details>

⁸ COMMISSION STAFF WORKING DOCUMENT: Union overview on the implementation of Directive 2010/63/EU on the protection of animals used for scientific purposes in the Member States of the European Union in 2018–2022, p. 65, available at: <https://circabc.europa.eu/ui/group/8ee3c69a-bccb-4f22-89ca-277e35de7c63/library/16a0a839-8f80-4aef-951b-d49cfe21935e/details>

⁹ Deutsche Forschungsgemeinschaft | Ständige Senatskommission für tierexperimentelle Forschung, & Stephan, V. M. (2025). Pilotstudie zur Praxis der Genehmigungsverfahren für Tierversuche in Deutschland – eine kritische Analyse. Deutsche Forschungsgemeinschaft (DFG). <https://doi.org/10.5281/zenodo.17647698>

approaches to investigate in greater depth the reasons for the decline and, in doing so, the potential implications for basic life sciences research as well as translational and applied research.

The following methods were used to investigate the reasons behind the reduction in the number of laboratory animals and its implications:

1. **A detailed analysis of German laboratory animal statistics** up to the 2024 reporting year, an evaluation of the contribution of individual research areas to the downward trend, and a comparison of German laboratory animal statistics with figures from France and the United Kingdom.
2. **Impact of the downward trend on national publication output** in the biomedical research domain in a global and European comparison, based on an analysis of publication figures in PubMed.
3. **Impact of the downward trend on pharmaceutical companies' satisfaction** with Germany as a research and development location, based on a separate evaluation of the 2023 data collection by the Expert Commission for Development and Innovation (EFI).
4. **Investigation into the possible reasons** for the reduction in the number of laboratory animals.
 - 4.1. Analysis of **the funding** of university and non-university research in the life sciences domain.
 - 4.2. Investigation of **the use of alternative methods** in biomedical research through AI-based analysis of publication figures from Germany.
 - 4.3. Investigation of a possible **shift of animal experiments abroad** through a systematic analysis, using specific examples, of the locations where animal experiments on rats were carried out, as cited in publications from Germany over the last ten years.
 - 4.4. Assessment of the impact of a potentially more onerous **authorisation procedure** in Germany through an analysis of authorised animal testing projects since 2019.

On the basis of these surveys, the BfR recommends measures to address the identified problems appropriately.

2 Overview of the individual studies

2.1 Trend analysis of German laboratory animal statistics compared with those of France and the United Kingdom

Research question

The significant decline in the number of laboratory animals has been interpreted by the scientific community, at least since the publication of the German laboratory animal statistics for the 2023 reporting year, as a sign of the increasingly difficult operating conditions for research involving animal experimentation.¹⁰

The initial aim of this work package was to present the trend in laboratory animal numbers from 2015 to 2024, including an analysis of the contribution of individual experimental purposes to the downward trend. Furthermore, the trend in German laboratory animal statistics was placed in a European context and compared with figures from France and the United Kingdom.

Method

The data analysis was based on the published laboratory animal statistics for Germany from the BfR¹¹ and the Federal Ministry of Agriculture, Food and Home Affairs (BMLEH)¹². These figures were compared with the reported data from France¹³ and the United Kingdom¹⁴.

As reporting on laboratory animals in Germany in accordance with the requirements of European Directive 2010/63/EU only began in the 2014 reporting year, and as there was still some legal uncertainty in that year regarding the interpretation of the version of the National Laboratory Animal Reporting Ordinance that had been in force since 18 December 2013, the 2014 reporting year was excluded from all analyses. Accordingly, the trend in the number of laboratory animals is examined over a ten-year period (2015–2024). The numbers of laboratory animals were analysed according to the following purposes of experimentation, as specified in the reports: basic research, translational and applied research, regulatory purposes and routine production, as well as other purposes, which largely also include the breeding of genetically modified laboratory animals. The figures for animals used for the first time and those reused were included in the analysis. For the European comparison, data on the number of laboratory animals from France and the United Kingdom were selected, as these countries have similarly high numbers of laboratory animals and the data are publicly available.

In order to ensure the greatest possible comparability between Germany, France and the United Kingdom, only the figures for animals used in animal experiments (which, in Germany, corresponds to uses in accordance with Section 7(2) of the Animal Welfare Act (TierSchG)) were analysed, as data on animals killed for scientific purposes were either

¹⁰ <https://www.tierversuche-verstehen.de/versuchstierzahlen-2023/> last accessed on 3 June 2026

¹¹ <https://www.bfr.de/en/offers/laboratory-animal-numbers/>

¹² <https://www.bmleh.de/DE/themen/tiere/versuchstiere/Versuchstierstatistik.html>

¹³ <https://www.enseignementsup-recherche.gouv.fr/fr/enquete-statistique-sur-l-utilisation-des-animaux-des-fins-scientifiques-46270>

¹⁴ <https://www.gov.uk/government/collections/statistics-of-scientific-procedures-on-living-animals>

unavailable or incomplete for the other countries. To further enhance comparability between the three countries, the total number of animals used for the breeding of genetically modified lines in the United Kingdom was also reduced by the number of animals which, according to the reports, did not undergo any stress. Under the EU reporting procedure, these animals do not have to be recorded annually and are therefore not included in either the German or French data.

Figure 1 to Figure 5 show the respective total numbers and the breakdown by purpose of the experiments of the animals used in animal experiments per country and year. To identify a statistical trend, the data for each country were analysed using a two-sided Mann–Kendall test. A statistically significant trend (rising or falling) was assumed from a p-value of 0.05 onwards.

Results

From 2015 to 2019, the total number of animals used in animal experiments in Germany remained stable at just over two million animals per year (Figure 1). Overall, it can be observed that the number of animals used in animal experiments in Germany has fallen significantly over the last ten years ($p=0.02$). A similar decline is also evident in the reporting data from the United Kingdom ($p=0.0003$). For France, however, no statistically significant trend is apparent ($p=0.5915$).

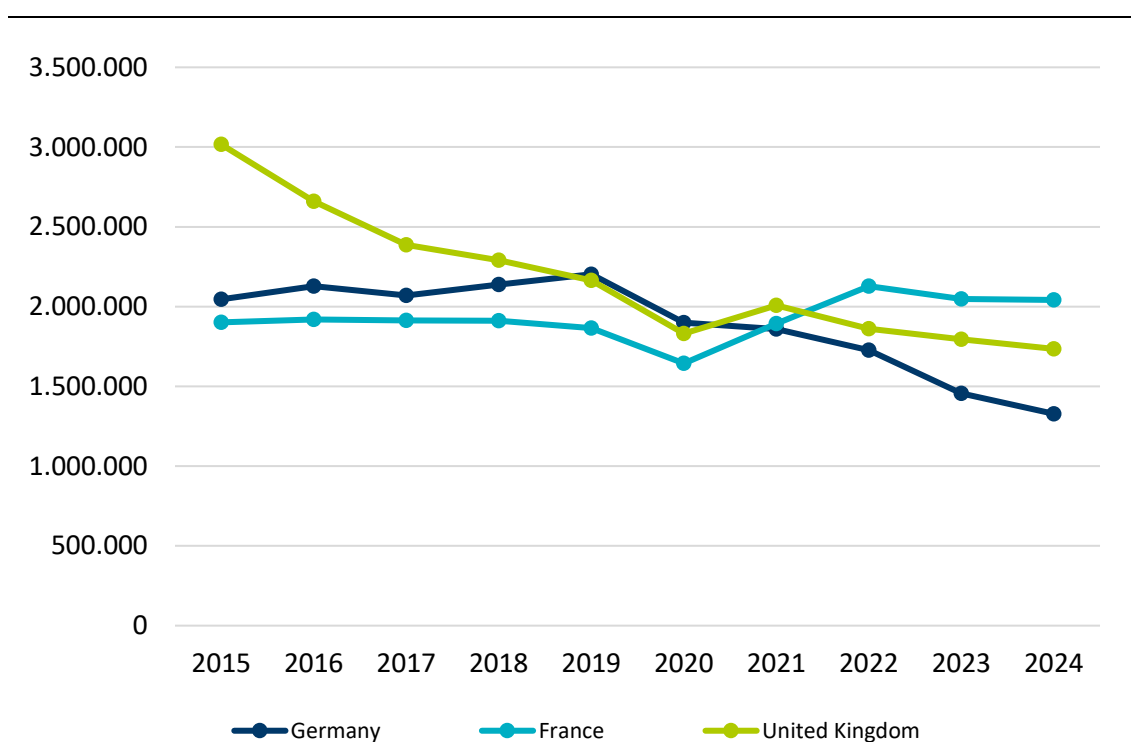


Figure 1: Total number of animals used for experimental purposes in Germany (DE), France (FR) and the United Kingdom (UK). The figure shows the number of animals used per German federal state and year. Statistical trends were calculated using a two-sided Mann–Kendall test; Germany: $p=0.02$; France: $p=0.5915$; United Kingdom: $p=0.0003$.

In 2020, the number of animals in Germany fell significantly by around 14 per cent compared with the previous year. As there were extensive restrictions on public life in Germany from March to May 2020 due to COVID-19 measures, which are likely to have affected the conduct of animal experiments, this decline in the number of laboratory animals may be attributable, at least in part, to this particular situation.

Unlike in France and the United Kingdom, however, the numbers in Germany did not rise again after 2020 (Figure 1). In France, a significant increase in the number of laboratory animals has been recorded since 2021, with figures in the 2024 reporting year remaining at a higher level than before the pandemic. In the United Kingdom, too, there was initially an increase in the number of laboratory animals after 2020; however, this was already offset by 2023 due to the long-standing decline in numbers (Figure 1). It is also noteworthy that in Germany, the decline in the 2024 reporting year was significant, as it had been the previous year, meaning that the number of laboratory animals used for scientific purposes in Germany reached a new low. Consequently, for the second year running, the decline in Germany was greater than that in the United Kingdom.

Animal experiments carried out in the domain of basic research show that the annual numbers of laboratory animals are on a downward trend in all three countries (Figure 2). However, this trend is statistically significant only for the United Kingdom ($p=0.0024$). In Germany, the number of animals used for basic research has been falling since the 2021 reporting year, having peaked in the 2020 reporting year. Over the ten-year period analysed, however, this trend falls just short of statistical significance ($p=0.0736$) and is therefore less pronounced for the selected period than the decline in the United Kingdom. It is also striking that, in the domain of basic research, Germany continues to report the highest numbers of animals in 2024 compared with the other two countries, particularly France. Relatively few animal experiments take place in France in this domain. There, too, there is no statistically significant decline ($p=0.1074$).

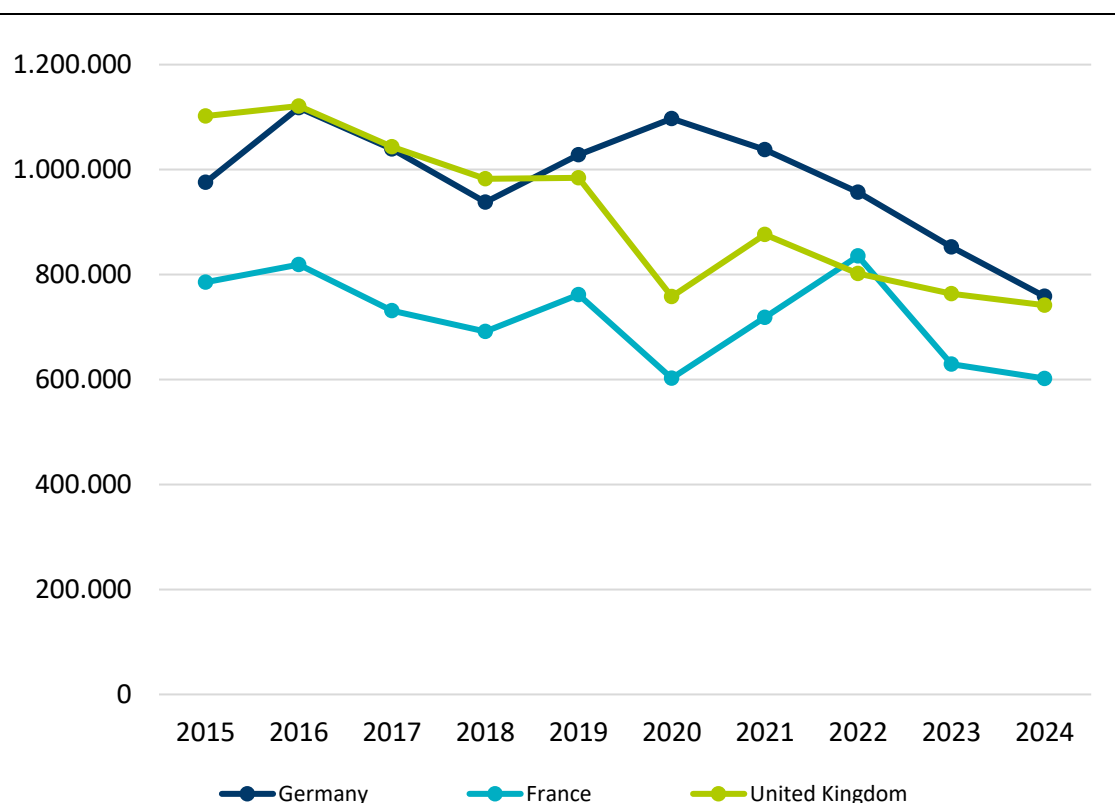


Figure 2: Numbers of laboratory animals used in the 'basic research' domain in Germany (DE), France (FR) and the United Kingdom (UK). The figure shows the number of animals used per German federal state and year. Statistical trends were calculated using a two-sided Mann–Kendall test; Germany: $p=0.0736$; France: $p=0.1074$; United Kingdom: $p=0.0024$.

In the domain of translational and applied research, a statistically significant decline in the number of laboratory animals in Germany can be observed over the last 10 years ($p=0.0013$) (Figure3 3). In France and, in particular, in the United Kingdom, the numbers in the domain of translational and applied research rose during the coronavirus pandemic, only to fall again from 2022 onwards. Consequently, no statistically significant trend was observed over the last 10 years for either the United Kingdom ($p=0.5915$) or France ($p=0.3711$) (Figure3 3).

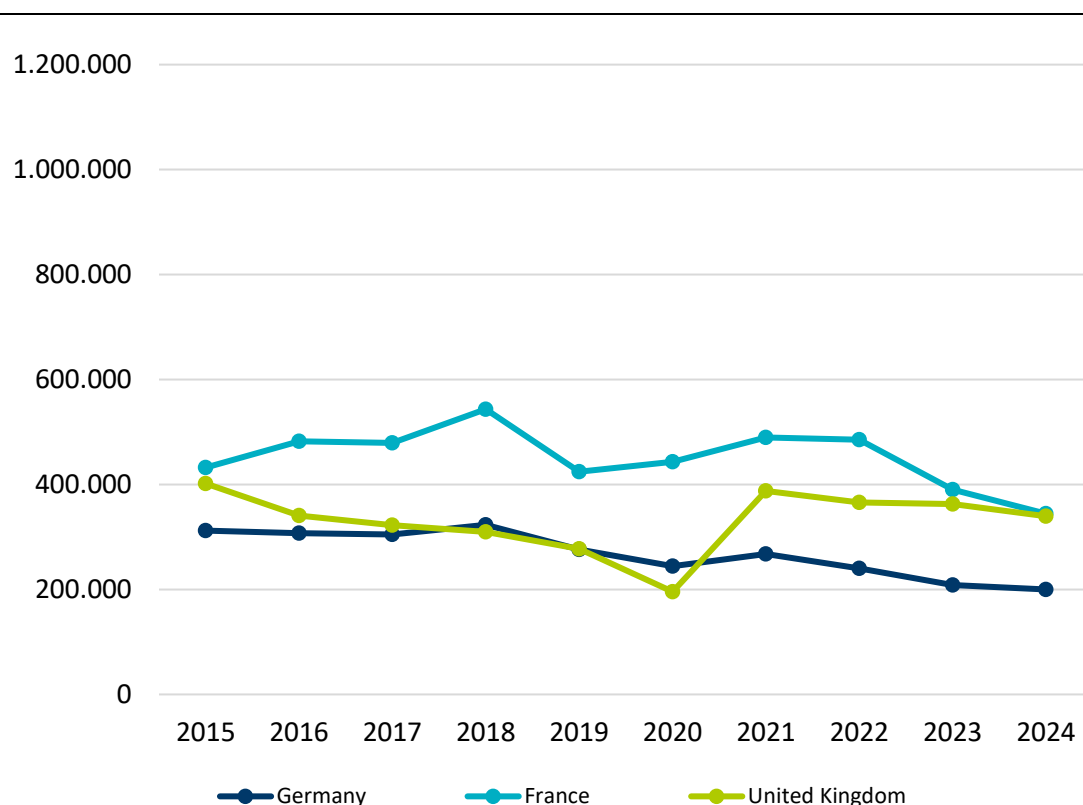


Figure3: Numbers of laboratory animals used in the 'translational and applied research' domain in Germany (DE), France (FR) and the United Kingdom (UK). The figure shows the number of animals used per German federal state and year. Statistical trends were calculated using a two-sided Mann–Kendall test; Germany: $p=0.0013$; France: $p=0.3711$; United Kingdom: $p=0.5915$.

The most marked reduction in the number of laboratory animals used annually for animal experiments in Germany is observed in the domain of regulatory purposes and routine production. Over the ten-year period analysed, the German figures fell significantly ($p=0.0002$); in particular, there was a comparatively sharp decline in 2020 (Figure4 4). The trend in the United Kingdom is similarly downward, albeit less pronounced ($p=0.0003$). In France, too, the number of animals used in the regulatory domain fell by a statistically significant amount ($p=0.02$). Figure4 4 illustrates, however, that the decline in France was smaller than in Germany and the United Kingdom.

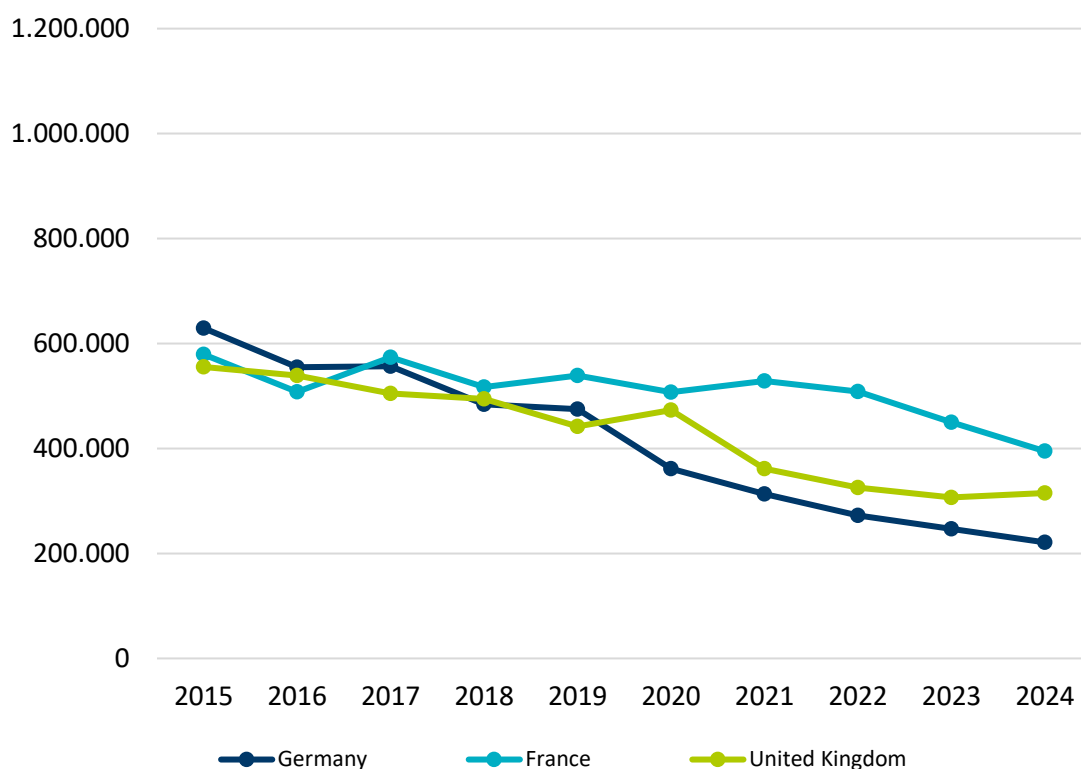


Figure4: Numbers of laboratory animals used for the ‘regulatory’ and ‘routine production’ domains in Germany (DE), France (FR) and the United Kingdom (UK). The figure shows the number of animals used per German federal state and year. Statistical trends were calculated using a two-sided Mann-Kendall test; Germany: $p=0.0002$; United Kingdom: $p=0.0003$; France: $p=0.02$.

Other purposes for which laboratory animals are used include animal experiments for species conservation, environmental protection and training purposes, for example at universities or for vocational skills, as well as forensic investigations. The maintenance of colonies of genetically modified animals, provided that the animals were not used in further animal experiments, for example in the context of basic research, also falls under these other purposes. The proportion of genetically modified animals bred for conservation within the ‘other purposes’ category has amounted to approximately 50–65 per cent in Germany over recent years.

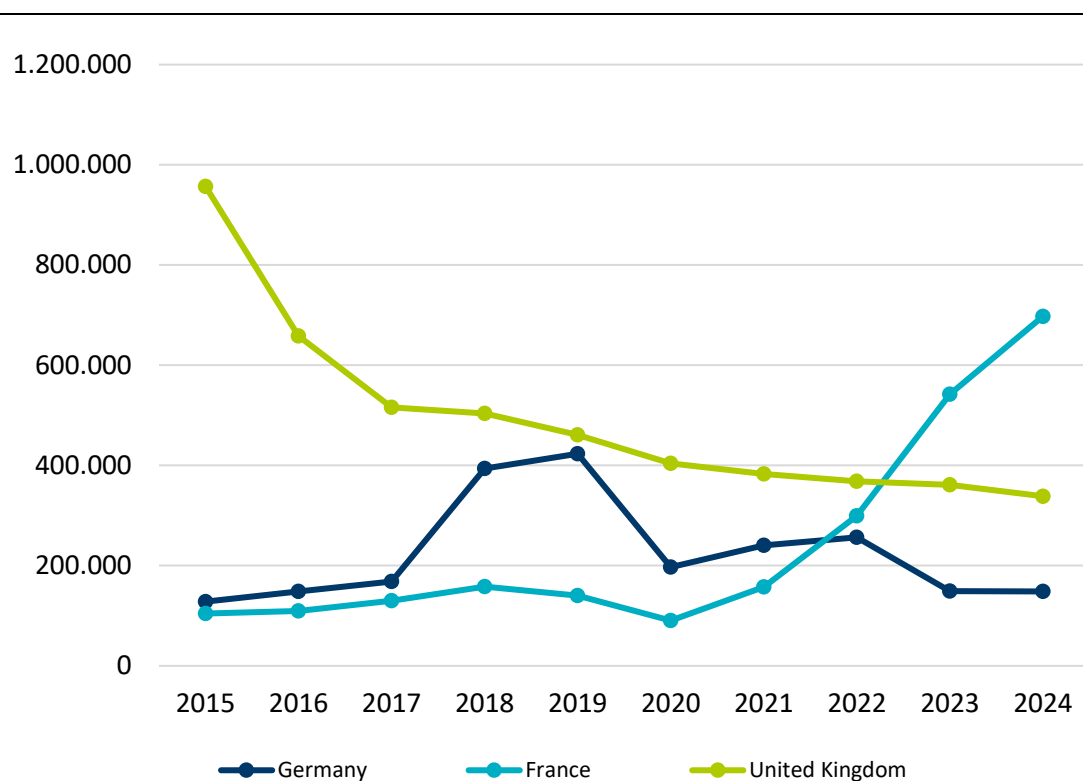


Figure5: Numbers of laboratory animals for the domain ‘Other purposes, including the maintenance of genetically modified animal colonies (GMO)’ in Germany (DE), France (FR) and the United Kingdom (UK). The figure shows the number of animals used per German federal state and year. Statistical trends were calculated using a two-sided Mann–Kendall test; Germany: $p=0.5915$; United Kingdom: $p=0.0001$; France: $p=0.0073$.

For the domain ‘other purposes’, no statistically significant trend was found for Germany over the period tested ($p=0.5915$) (Figure5 5). In 2018 and 2019, a comparatively large number of laboratory animals were reported for ‘other purposes’; for 2019, this was mainly attributable to a series of projects investigating the effects of fish ladders on wild fish populations. The decline in the total number of laboratory animals from 2019 to 2020 can therefore be explained not only by the fall in the number of laboratory animals used for regulatory purposes but also, and above all, by the decline in the number of laboratory animals used for ‘other domains’.

Unlike in Germany, statistically significant effects are found in the ‘other purposes’ domain in the United Kingdom ($p=0.0001$) and France ($p=0.0073$). Whilst the figures for ‘other purposes’ in the United Kingdom fell sharply, particularly between 2015 and 2017, France has seen a significant increase in the number of laboratory animals reported annually since 2021. According to French statistics¹⁵, this increase is almost entirely attributable to rising numbers of laboratory animals used in the breeding of genetically modified lines in the domain of genetic modification.¹⁶

¹⁵ <https://www.enseignementsup-recherche.gouv.fr/fr/enquete-statistique-sur-l-utilisation-des-animaux-des-fins-scientifiques-46270>

¹⁶ Furthermore, the Bf3R has learnt, through direct communication with the Ministry of Research responsible for French reporting, that since the 2021 reporting year, there has been an amended recommendation in France regarding the reporting

Interim conclusion

The number of laboratory animals used in Germany is declining at a statistically significant rate, reaching a low point in 2024. This decline has been particularly pronounced since the 2020 reporting year and is evident from that point onwards across all purposes for which animal experiments are carried out. The decline is particularly marked in regulatory applications and routine production; however, the number of animals used in basic research has also been falling since then, although, by European standards, Germany reports the highest numbers of animals used in the basic research domain as of 2024.

In other domains, particularly translational research and the regulatory use of laboratory animals, the figures in Germany appear to be falling more sharply than in France or the United Kingdom. Overall, however, the differences are minor. Nevertheless, the BfR believes that these developments should continue to be monitored closely.

However, the analysis of the reported numbers of laboratory animals and the conclusions drawn from this regarding the research sector are subject to significant limitations. For instance, a glance at the other purposes of experimentation (Figure 5) makes it clear that, even in a research sector as large as Germany's, individual projects can lead to significant fluctuations in the number of laboratory animals reported annually. Furthermore, a look at the French figures makes it clear that changes in individual purposes of use – in this case, the breeding of genetically modified animals – can also have a significant impact on the overall figures. For example, according to informal communication between representatives of the BfR and the French Ministry of Higher Education, Research and Space¹⁷, the increase in the number of animals used for breeding purposes since 2021 is mainly attributable to a change in national reporting rules¹⁸. It is therefore not possible to derive from the data analysed here whether this effect is also linked to a partial relocation of breeding operations from Germany to France.

Limitations

The following limitations and uncertainties should be borne in mind when conducting the assessment of the data.

- The collection of national figures on laboratory animals is a complex process, which is subject to some uncertainties regarding the validity of the reported data and also depends on authorisation practices. The latter may have changed over the years. The BfR can only carry out a plausibility check on the data reported by the competent authorities.
- Since Brexit, the United Kingdom may have deviated from the reporting system prescribed by Directive 2010/63/EU and Implementing Decision (EU) 2020/569. To our knowledge, however, no such deviation has occurred to date, so the data should remain comparable.

of genotyping subject to authorisation. It is therefore possible that the observed increase is attributable to a change in the reporting system rather than to an actual rise in the number of animals.

¹⁷ Ministère de l'Enseignement supérieur, de la Recherche et de l'Espace; see also *ibid.*, footnote 15.

¹⁸ *ibid.*, footnote 16.

- In the 2021 reporting year, the reporting system underwent minor changes following an amendment to Implementing Decision (EU) 2020/569. For example, new subcategories for purposes of use and new animal species categories were introduced. Although the evaluation of these categories was not conducted in the present study, it cannot be ruled out that the revision of the Implementing Decision may also have led to amendments to national regulations, resulting in changes to how data is recorded. No such effects are known for Germany.
- In principle, an analysis of the reported numbers of laboratory animals can only ever provide a glimpse into the past.

2.2 Analysis of publication output in comparison with France and the United Kingdom

Research question

The aim of the following analyses was to determine how the publication output of researchers affiliated with German institutions in the biomedical research domain developed between 2013 and 2025. Analysing the number of scientific publications per year could provide an indirect measure of the increase or decrease in research activity in Germany. However, the publication output of researchers affiliated with German institutions is only one indication of research activity in Germany, as, amongst other things, not all research activities always result in a publication and, furthermore, researchers affiliated with German institutions also conduct research abroad or in collaborative projects.

Method

Pilot experiments were carried out in the PubMed database using publications from 2013 to 2025. This database focuses on the biomedical field (see <https://pubmed.ncbi.nlm.nih.gov/about/>). The trends in 'global' figures (i.e. without a breakdown by the researchers' country of affiliation) were compared with the trends in figures for publications by researchers affiliated with German institutions (or French or British ones) (see Figure 6.6). The institutional affiliations of the authors can be identified in PubMed via the 'Affiliation' data field (see <https://pubmed.ncbi.nlm.nih.gov/help/#ad>) and the search can be restricted accordingly. However, it is not possible to determine via a search strategy in PubMed whether the research itself was actually carried out in the respective country.

The search strategies were as follows:

- Global: 01/01/2000:31/12/2025[Date - Publication]
- German institute: 01/01/2000:31/12/2025[Date - Publication] AND "Germany"[Affiliation]
- UK institute: 01/01/2000:31/12/2025[Date - Publication] AND ("united kingdom"[Affiliation] OR "uk"[Affiliation])
- French institute: 1 January 2000: 31 December 2025[Date - Publication] AND "france" [Affiliation]

The search strategies listed above were entered into the PubMed Advanced Search Builder on the page <https://pubmed.ncbi.nlm.nih.gov/advanced/> and the search was launched. The number of publications for each year from 2013 to 2025 was taken from the 'Results by year' chart on the results page and transferred to an Excel spreadsheet.

Results

Figure 6 shows an increase in publication output across the years examined for all researchers. This increase is particularly pronounced among researchers affiliated with German, British or French institutions. Publication output peaks in the years 2020 to 2022.

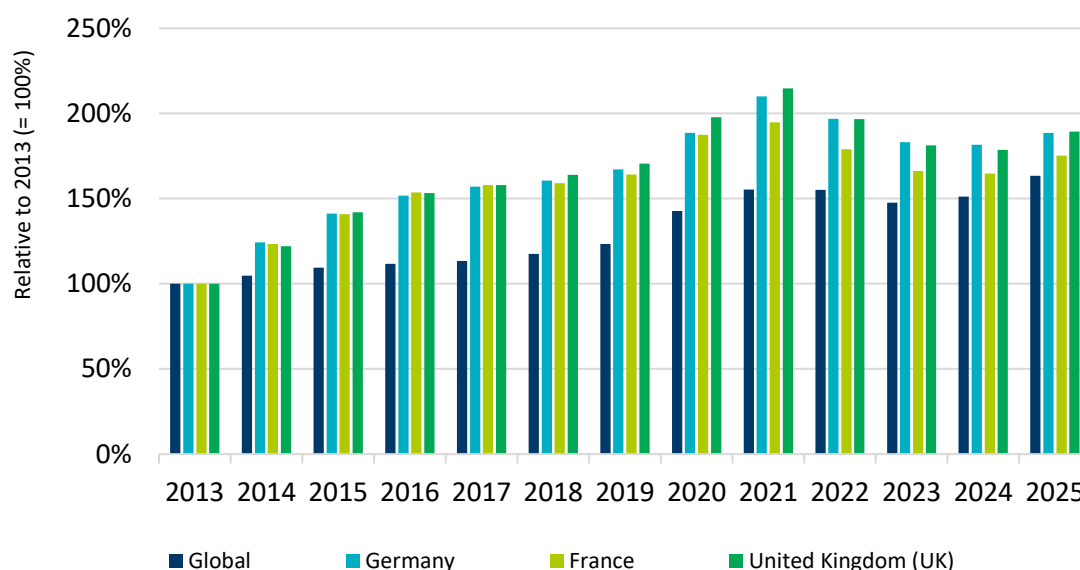


Figure 6: Percentage change in the number of publications cited by researchers in the PubMed database compared with 2013. 'Global': without restriction on institutional affiliation by country; 'Germany', 'France' and 'United Kingdom (UK)': with restriction on institutional affiliation. Absolute number of publications for 2013: Global n=1,150,136, Germany n=48,781, France n=34,359, United Kingdom (UK) n=63,425. Statistical trends were calculated using a two-sided Mann–Kendall test; Global $p < 0.0001$; Germany $p = 0.0008$; France $p = 0.0012$; United Kingdom $p = 0.0012$.

Interim conclusion

The publication output of German researchers has risen steadily over the years examined, with an additional peak occurring between 2020 and 2022, which may be attributable to the effects of the COVID-19 pandemic. A similar trend can also be observed for French and UK researchers. In fact, there was also a sharp rise in the number of review articles between 2020 and 2022: the number of published reviews involving German researchers stood at 236 per cent of the 2013 figure in 2021. This is also very high by global standards, where the figure for 2021 stood at 185 per cent of the 2013 figure. Review articles can be written without conducting one's own experimental work.

Publication figures since 2023 have exceeded pre-pandemic levels, so it cannot be said that there has been a decline in publication output. However, the analysis is subject to certain limitations and must therefore be interpreted with caution. It can, however, provide an indirect indication of research activities in Germany.

Limitations

The following limitations or uncertainties were identified in this pilot project:

- Only one database was used for the analysis.
- A publication was attributed to a German federal state ("Laender") (Germany, France or the United Kingdom) as soon as an author was affiliated with an institution in that Laender. It is therefore possible that, in the case of cross-border projects, a publication was counted more than once. Furthermore, this analysis does not make it possible to determine whether the research contained in the publication was carried out in Germany or in another Laender.
- It was also examined whether the number of publications in PubMed, using keywords or classifications such as MeSH terms, could provide any insight into the development of in vivo and in vitro research. However, this approach had to be discarded because the National Library of Medicine, which also provides PubMed, implemented extensive changes to its classification system (MeSH) between 2022 and 2024 (switch to AI, see https://www.nlm.nih.gov/pubs/techbull/ma24/ma24_mtix.html). These changes have led to a shift in the retrieval rate of publications using classification-based searches. Furthermore, the retrieval rate of publications using keywords is heavily dependent on the authors' choice of words. This can change over the years (e.g. replacement of the term 'in vivo' in the abstract). Other changes to PubMed and the other databases, of which we are unaware, may also influence the retrieval rate.

2.3 Impact of the downward trend on the satisfaction of pharmaceutical companies in the research and development domain with Germany as a research location

Research question

Companies manufacturing pharmaceutical products and medical devices are at the end of the value chain in the life sciences domain. They often conduct animal experiments themselves as part of their research and development activities, or commission such studies. The following therefore examined the impact of the reduction in the number of laboratory animals on companies in this domain and how satisfied they are with Germany as a research location.

Method

Our analysis is based on the report by the Expert Commission for Research and Innovation (EFI) on research, innovation and Germany's technological performance in 2025¹⁹. This report was commissioned by the Federal Ministry of Research, Technology and Space (BMFTR) and contains data from 2023. In order to gain an insight into the situation of German companies involved in research and development for pharmaceutical products and/or medical devices, this data was evaluated separately on behalf of the BfR.

Results

The special analysis incorporated data from 563 companies based in Germany. These comprised 487 small enterprises (up to 249 employees), 34 medium-sized enterprises (250–499 employees) and 42 large enterprises (500 or more employees).

Figure 7, shows the proportion of their expenditure that these companies invested in internal and external research and development (R&D) in 2023, with external R&D further broken down into domestic and foreign activities.

Accordingly, 72 per cent of the funds were spent on internal R&D carried out by the pharmaceutical companies themselves. 12 per cent of R&D expenditure was outsourced to other companies in Germany, and 15 per cent of the funds went towards R&D abroad. When asked to name the five most important German federal states for external R&D, ranked by contract volume in 2023, Germany came top with 50 mentions. Thirty-three companies favoured outsourcing external R&D contracts to the USA. Furthermore, Switzerland (25) and the United Kingdom (19 mentions) also played an important role.

¹⁹ EFI – Expertenkommission Forschung und Innovation (2025): Gutachten zu Forschung, Innovation und technologischer Leistungsfähigkeit Deutschlands 2025, Berlin: EFI.

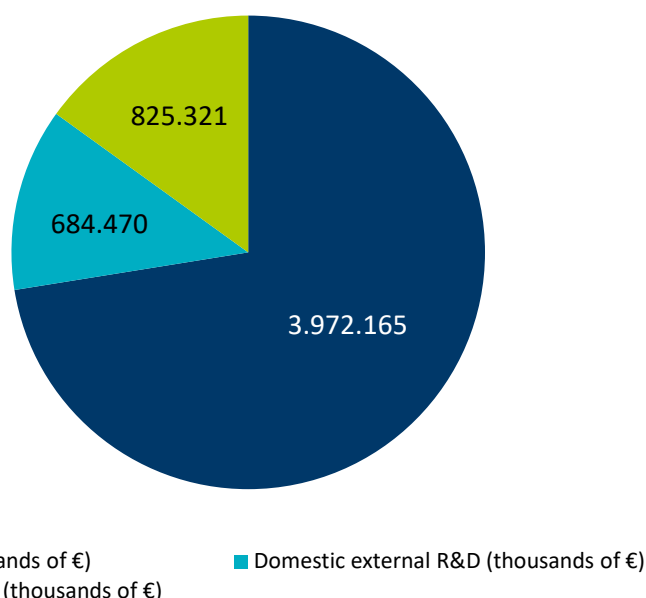


Figure 7: Breakdown of expenditure on research and development (R&D) by the 563 respondents in 2023, stated in thousands of euros. A distinction was made between internal R&D carried out within the company itself and external R&D commissioned from other companies either domestically (in Germany) or abroad.

Table 1 sets out the various reasons for outsourcing R&D abroad, ranked by priority for the respondents. The most important motives are gaining access to specific knowledge (59 per cent), increasing the pace of innovation (57 per cent), accessing and securing markets (54 per cent), and the contractors' specific technical expertise (50 per cent). To a lesser extent, however, cost advantages (46 per cent), a more innovation-friendly regulatory environment (44 per cent), less bureaucracy and regulation (41 per cent) and increased flexibility (44 per cent) are also important reasons for relocating R&D abroad. The acquisition of companies or taking a stake in them plays a minor role (7 per cent).

A total of 337 companies provided feedback on the relocation of external R&D abroad between 2018 and 2023. 14 per cent of firms report that they increased the proportion of contracts awarded abroad during this period. Conversely, 5 per cent of companies state that this proportion has decreased. Overall, this equates to 9 per cent of companies that have increasingly outsourced contracts abroad over the past five years. 45 per cent of pharmaceutical companies state that they do not outsource contracts abroad, whilst 36 per cent have not observed any change.

Looking at the trend for the next two to three years, 40 per cent of 550 companies stated that they do not intend to make any changes to the distribution of internal and external R&D. 14 per cent are expected to increase their share of external R&D, whilst 9 per cent are considering increasing internal R&D. 38 per cent do not expect any changes for the period 2024 to 2026. No data was collected as part of the survey, which was already carried out in 2023, on whether a planned increase in external R&D would also lead to a simultaneous rise in R&D outsourced abroad.

Table1 : Reasons given by companies with research and development expenditure on pharmaceutical products and medical devices for authorising their external R&D abroad. Figures in per cent.

Reason	very important	important	Total	not very important	completely unimportant	Total
Gaining specialist knowledge	30.2	29.1	59.3	24.4	16.3	40.7
Increasing the pace of innovation	29.8	27.4	57.2	23.2	19.6	42.8
Securing or developing markets	31.6	22.2	53.8	23.4	22.8	46.2
Specific techniques used by the contractor	22.9	27.1	50	23.5	26.5	50
Realisation of cost savings	18.9	27.2	46.1	22.5	31.4	53.9
A more innovation-friendly environment	21.3	22.6	43.9	23.8	32.3	56.1
Increased flexibility	14.9	28.6	43.5	29.8	26.8	56.6
Less bureaucracy and regulation	20.5	21.1	41.6	24.1	34.3	58.4
Need to meet requirements	20.5	20.5	41	22.3	36.7	59
Addressing internal bottlenecks	19.2	21	40.2	26.9	32.9	59.8
Risk reduction	8.2	25.3	33.5	30.6	35.9	66.5
Use of funding	11.9	12.5	24.4	30.4	45.2	75.6
Investment in or acquisition of companies	2.4	4.8	7.2	23.4	69.5	92.9

Interim conclusion

As regards the pharmaceutical domain, it can be assumed that these companies have, to a limited extent, relocated their research and development abroad in the past. According to the analysis of the special evaluation of data from the EFI report, approximately 15 per cent of the research and development carried out by German pharmaceutical companies took place abroad in 2023. For around 9 per cent of the respondents, this proportion had increased over the preceding five years. Assuming that this trend has continued since 2023, and bearing in mind that around 5 per cent of companies are considering increasing their share of external R&D, the proportion of research activities carried out abroad is likely to have risen further, albeit to a limited extent.

The main reasons cited by companies for relocating their research abroad are economic (securing markets, speed of innovation, cost advantages). However, less bureaucracy, more innovation-friendly framework conditions and lower costs abroad also play an important role.

Limitations

- When analysing the EFI report, it should be noted that the companies reporting their R&D expenditure on pharmaceutical products and medical devices may belong to different economic sectors. The data show that some of the companies belong to sectors such as the manufacture of data-processing equipment, electronic and optical products, or mechanical engineering. These companies have a low probability of being directly involved in research involving animal experimentation. A more precise classification of the companies into economic sectors with a clear link to preclinical research would have been desirable, but was not possible due to the need to preserve the anonymity of individual companies.
- Although large enterprises accounted for just under 8 per cent of the companies in the survey, they generated 22 per cent of total turnover. A relocation of these companies would therefore have a greater impact, as they contribute more to gross domestic product. However, it was not possible to weight the responses accordingly, again due to the need to protect the anonymity of individual companies.
- The BfR has no data available for other economic sectors regarding the extent to which companies are relocating their R&D abroad. It is therefore difficult to assess whether the 9 per cent figure for relocation abroad should be classified as high or low.
- It cannot be determined whether the companies that provided an assessment of external R&D over the last five years also shared their forecast for the next two to three years. Consequently, no correlation can be inferred here.

2.4 Investigation of possible reasons for the reduction in the number of laboratory animals

The reduction in the number of laboratory animals in Germany may have various causes. The following section examines in more detail the following possible reasons: reduced funding for preclinical research in the life sciences domain, increased use of alternative methods, the relocation of animal experiments abroad, and a decline in the number of approved experimental projects.

2.4.1 Funding: Analysis of funding for (non-)university research in the life sciences domain

Research question

In investigating possible reasons for the reduction in the number of laboratory animals, the question arises as to the extent to which life sciences research involving laboratory animals has been funded in Germany in recent years. If expenditure on this type of research were generally declining, this could have led to a decrease in animal experimentation and thus contributed to a decline in the number of laboratory animals.

Expenditure by the federal and German federal states forms an essential basis for research activities in Germany. The following section therefore examines how the funding of research

in the life sciences – which is often based on animal experimentation – has developed in Germany in recent years.

Method

The data portal of the Federal Ministry of Research, Technology and Space (BMFTR)²⁰ was used to collect data on the funding of German life sciences research. In addition, the annual reports of the German Research Foundation (DFG)²¹ were analysed. All data were collected and analysed for the period from 2014 to 2025.

Mann–Kendall tests were carried out to statistically analyse linear trends in the funding rate for individual DFG applications (Figure 8.9) over time. A p-value below 0.05 was considered a statistically significant change.

Results

In Germany, funding for life sciences research is provided by the federal and German federal states through various channels. Whilst translational research is funded directly by the BMFTR in the form of project grants, basic research is funded through federal and German federal state expenditure on the core funding of universities, institutional funding and DFG grants. No distinction is made when allocating funds between research projects with or without animal testing, and even a breakdown beyond the level of the life sciences proves difficult. Accordingly, no further differentiation was made in this analysis.

The BMFTR's public data portal contains the majority of the available data on federal and German federal state ("Laender") expenditure on research and development. The relevant part of the data is summarised at Figure 7.8 and Figure 8.9.

Federal expenditure on science, research and development

Project funding from the BMFTR is a significant factor in the funding of research in Germany. This funding is primarily directed towards translational research and is divided into individual funding areas. The funding area 'Health Research and the Health Economy', within which most animal experiments are likely to take place, had the highest level of research and development expenditure of all funding areas right up to 2024 (Figure 7.8). Expenditure rose steadily to a high level by 2019. In 2020 – presumably due to the COVID-19 pandemic – there was a sharp rise in expenditure on health research and the health sector, only for it to fall again in 2021. Since 2021, expenditure in this domain appears to have stagnated, whilst expenditure on defence research, for example, has increased significantly in recent years.

²⁰ <https://www.datenportal.bmftr.bund.de/portal/en/data.html>

²¹ <https://www.dfg.de/en/news/facts-figures>

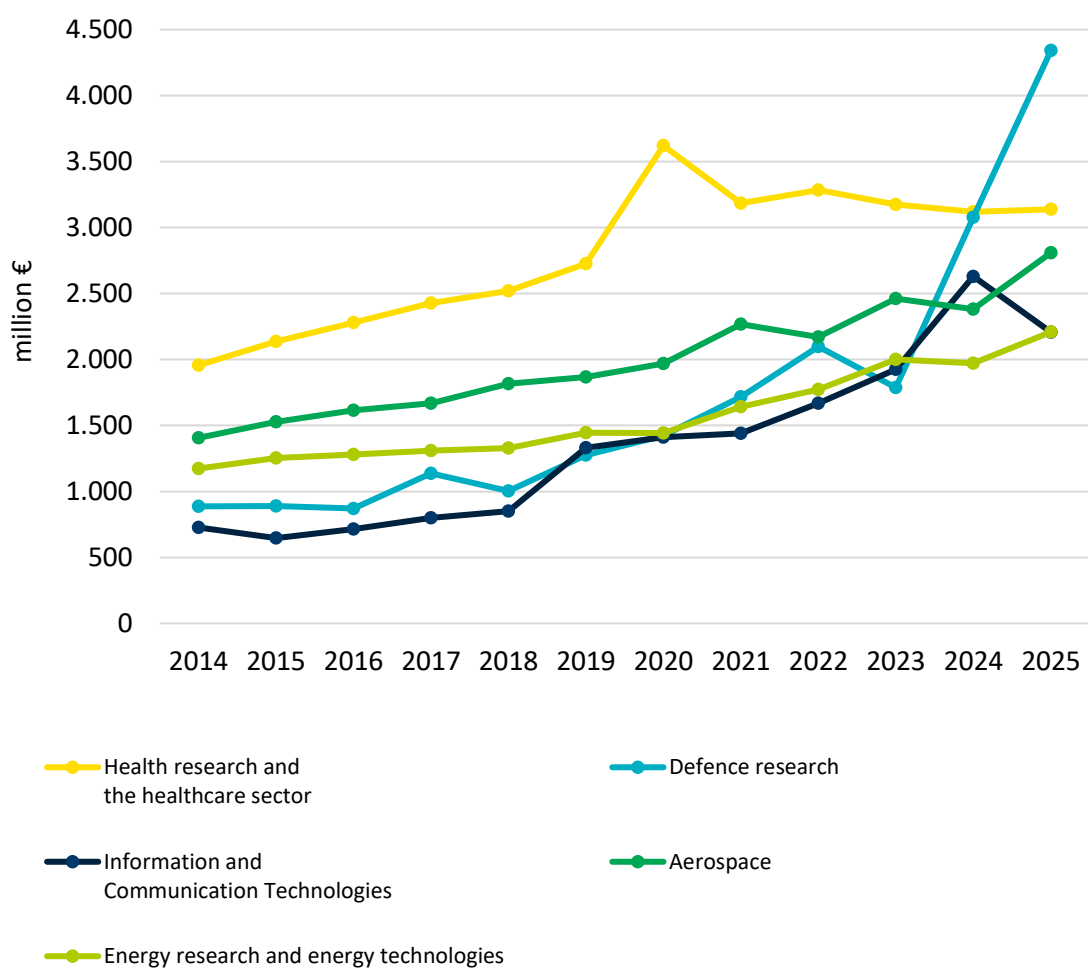


Figure7: Federal expenditure on science, research and development by funding area in millions of euros for the period from 2014 to 2025. This figure represents only the proportion of expenditure allocated to research and development. The chart is limited to the five funding areas with the highest levels of funding. Source: Federal Ministry of Education and Research, special analysis²²

Taking into account the changes over the last 12 years, health research and the health sector recorded growth of 60 per cent. At the same time, expenditure on defence research rose by 390 per cent and on information and communication technologies by 204 per cent. Expenditure on research and development in the domains of aerospace (100 per cent) and energy research and energy technologies (88 per cent) also rose more sharply than in the domain of health research. This suggests that, particularly in recent years, the focus of funding has shifted, with expenditure on health research and the health sector being given lower priority.

²²<https://www.datenportal.bmfr.bund.de/portal/en/K1/chart-1.1.5.html>, updated on 6 May 2026

Research funding by the DFG

With funding for over 30,000 projects per year, the DFG is one of the world's largest research funding bodies and is financed almost exclusively by federal and German federal state ("Laender") funds. The DFG's annual reports were evaluated in terms of annual grants for ongoing projects by scientific discipline, in order to also address directly the funding of basic research in the life sciences (Figure 8 9). Both the total amount of funding and the amount allocated to the life sciences rose by 89 per cent and 83 per cent respectively between 2014 and 2024. The increase in the life sciences thus lagged slightly behind the rise in the total funding volume. Compared with all other domains (humanities and social sciences, natural sciences, engineering), funding for the life sciences – which, at the DFG, comprises biology, medicine, agricultural and forestry sciences, and veterinary medicine – is at the highest level.

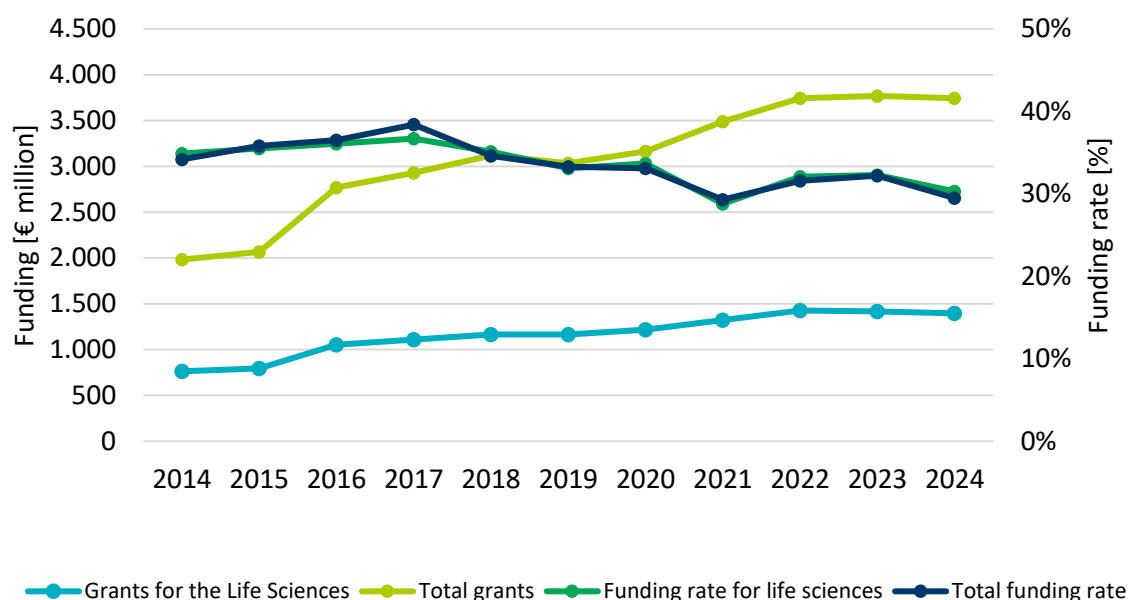


Figure 8: Annual DFG grants for ongoing projects by scientific domain in millions of euros (left-hand scale) for the period from 2014 to 2024. This figure is limited exclusively to the life sciences and shows total funding excluding interdisciplinary funding. Funding rate for individual grants, expressed as the ratio of the number of grants awarded to the number of applications submitted to the DFG, in per cent (right-hand scale), both overall and for the life sciences for the period from 2014 to 2024. For the sake of clarity, data for the humanities and social sciences, the natural sciences and the engineering sciences have been omitted. Source: DFG Annual Reports

In addition to the total funding amount, the funding rate also plays an important role. This indicates the ratio of the number of approved applications to the total number of applications. In the life sciences, it rose from 34.9% to 36.7% between 2014 and 2017, before falling to 28.8% in 2021, likely due to an increase in the volume of research. Following a further rise to 32.3% in the two subsequent years, the rate fell again to 30.3%. The 'Overall' funding rate showed a very similar trend. Over the entire period analysed, this indicates a significant downward trend in the funding rate both in the life sciences ($p=0.0195$) and overall ($p=0.0127$). It can therefore be concluded that, although the total

funding awarded rose steadily over the period in question, competition for DFG research grants also increased at the same time.

Interim conclusion

In conclusion, the analysis of funding for university and non-university research in the domains of health research and the life sciences, based on publicly available data from the BMFTR and the DFG's annual reports, suggests that the focus of research funding shifted towards other subject areas during the period under review. Federal expenditure on core funding for universities – and in particular in the domain of health research and the health sector – has risen only slightly, or in some cases even declined, especially over the last three to four years. The number of DFG-funded projects approved in the life sciences has also not increased to the same extent as the total funding volume. Overall, the figures in the DFG's annual reports do not indicate significant growth in basic life sciences research, nor do they suggest a drastic decline. However, there are indications that competition for research funding may have increased significantly.

Limitations

When considering the funding of life sciences research in Germany, the following limitations must be taken into account:

- The greatest limitation when conducting an assessment of trends in research funding in Germany is the inability to distinguish between the allocation of government funds and third-party-funded projects, as well as between research involving animal experimentation and research that does not involve animal experimentation.
- In the case of federal expenditure, it was not possible to differentiate further between the funding areas of health research and the health sector.
- The analysis of the data was limited to federal and German federal states ("Laender") expenditure. However, EU funding also plays a significant role, particularly in larger research consortia.
- Although the Consumer Price Index²³ relates exclusively to goods and services used by private households for consumption purposes, it can nevertheless be used as an indicator of the rate of inflation in Germany. The general rate of inflation plays an important role in expenditure on research and development. If, therefore, the drastic rise in the consumer price index of 25.3 per cent between 2014 and 2024 were taken into account, the expenditure by the federal and German federal states ("Laender") would be put into a much clearer perspective. At the same time, the staff costs relevant to the conduct of animal experimentation – which is regularly associated with significant staffing requirements – have also risen.

²³ <https://www-genesis.destatis.de/datenbank/online/statistic/61111/table/61111-0001>

- Furthermore, during the evaluation of the DFG's annual reports, no link to research involving animal experimentation could be established, despite the differentiation made in the life sciences.
- The DFG's funding rate relates to individual grants. It therefore accounts for only around one third of the DFG's total funding volume. In addition, there are other funding programmes such as coordinated programmes involving, for example, research groups and Collaborative Research Centres, infrastructure funding, and the federal and German federal states' Strategy for Excellence. However, these are not broken down by life sciences.²⁴

2.4.2 Use of alternative methods: Trends over time in the proportion of animal-free methods in research areas where animal experimentation is prevalent

Research question

The increased use of alternative methods could contribute to a reduction in animal experiments. To investigate this trend, the scientific literature in Germany over the last ten years was examined for evidence of an increasing use of *in vitro* methods. As cell culture-based approaches account for a significant proportion of alternative methods, the analysis focused on these methods. Using machine-learning models, the literature from the PubMed database was classified by individual research fields into cell culture and *in vivo* methods. The analysis examined in greater detail the three research fields in which the highest number of laboratory animals continue to be used in both basic research and translational and applied research, namely oncology, immunology and neuroscience.

Method

This study was based on abstracts published in PubMed. PubMed is an online database of the US National Library of Medicine (NLM), in which a large proportion of the world's biomedical literature is indexed. The abstracts were classified using machine-learning models according to cell culture (*in vitro*) and *in vivo* methods. To this end, specific search queries were developed for the three research areas in which the most laboratory animals are used in Germany, namely oncology, immunology and neuroscience. The search covered exclusively the publication period from 2013 to 2024. Articles that did not contain original research, such as review articles, were excluded. In a further, individually programmed step, only those abstracts were included where the first author was affiliated with an institution in Germany, as it is to be expected that in most cases they would also have carried out a significant proportion of the experiments. In total, 39,058 abstracts were classified for oncology, 22,714 for immunology and 42,369 for neuroscience.

Various labels were assigned to the abstracts of these articles using a pre-trained large language model from the deep learning domain. The model used is based on a pre-trained language model (PubMedBERT) and was fine-tuned specifically for this task using the GoldHamster corpus as well as a new corpus designed to represent the broad spectrum of

²⁴ <https://www.dfg.de/en/about-us/about-the-dfg/key-figures-portal>

biomedical literature²⁵. The following labels were assigned: ‘*in vivo* experiments on vertebrates’, ‘cell culture’ (representing *in vitro* methods), ‘both’ or ‘neither’ of the aforementioned categories. To increase the confidence in the ‘cell culture’ label, all the different types of cell culture recognised by the model (primary cell culture or cell lines, of animal or human origin) were grouped together. A large proportion of the abstracts examined fell into the category ‘none of the methods in focus’ (28,316 (72.6 per cent) in oncology, 10,845 (48.2 per cent) in immunology and 31,391 (74.3 per cent) in the neurosciences). These comprised, in particular, clinical trials conducted exclusively on human subjects or publication types irrelevant to the evaluation (not primary research), as well as *ex vivo* or *in silico* methods. For the evaluation of the results described below, abstracts labelled ‘none’ were excluded. The prevalence of each method was then determined for each year and each research field. Mann–Kendall tests were carried out to analyse linear trends over time. A p-value below 0.05 was considered a statistically significant change.

Prior to carrying out the data extraction, the study protocol was registered on the Open Science Framework²⁶ to ensure the transparency of the procedure and enhance the credibility of the results. In particular, the hypothesis and the method used were defined in advance.

²⁵ Neves, M., Klippert, A., Knöspel, F. *et al.* Automatic classification of experimental models in biomedical literature to support searching for alternative methods to animal experiments. *J Biomed Semant* 14, 13 (2023). <https://doi.org/10.1186/>

²⁶ Heini, C., Neves, M. L., Butzke, D., & Bert, B. (6 August 2024). Study protocol for the evaluation of the use of animals and alternative methods in biomedical publications from Germany. Retrieved from osf.io/ts3yh

Results

Significant differences can be observed across the three research fields in the proportions of publications from the last ten years that utilise cell cultures and in vivo experiments (Figure 9 10). Whilst the majority of publications in oncological research employ cell culture methods, most studies in the neurosciences continue to be based on in vivo experiments.

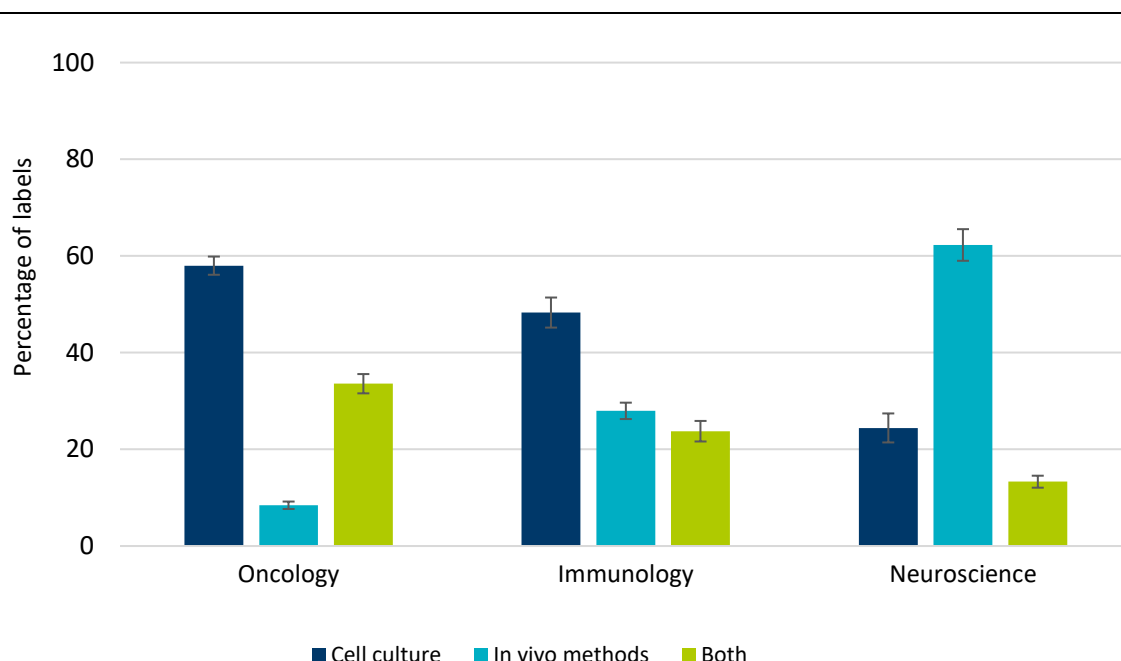


Figure 9: Mean percentage of experimental methods used over the last ten years, relative to all abstracts falling into one of the three categories (cell culture, in vivo experiments on vertebrates, and both cell culture and in vivo experiments), shown for the research fields of oncology, immunology and neuroscience. The error bars represent the standard deviation of the mean over the last ten years.

Over the period from 2013 to 2024, it is evident that the percentage shares of the assigned labels have developed differently across the various research fields. In oncology, the proportion of the distributed method labels remains stable over time (Figure 10 11). In immunology, by contrast, there is a slight but significant increase over the period under consideration in the number of studies classified exclusively as cell culture. This increase is accompanied by a significant decrease in the number of abstracts that contain references to both cell culture and in vivo methods. In the neurosciences, there is also an increase in the number of abstracts identified as cell culture methods, as well as a significant reduction in the number of studies classified as in vivo studies.

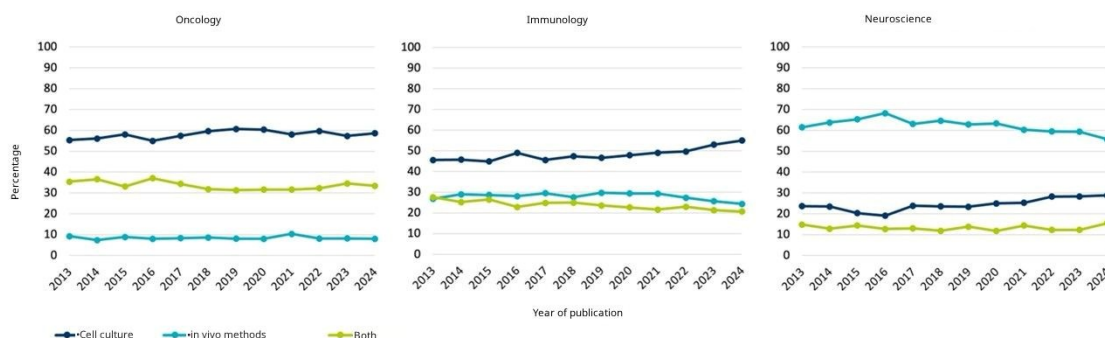


Figure10: Trends in the percentage of experimental methods used, relative to all studies falling into one of the three categories, per year from 2013 to 2024. No significant trends are apparent in oncology (cell culture: $p=0.1499$; both: $p=0.2437$; in vivo methods: $p=0.6312$). In immunology, there is a significant increase in the number of studies whose abstracts contain references to cell culture ($p=0.008$) and a decrease in those classified under both the 'cell culture' and 'in vivo experiments' labels ($p=0.008$). In the neurosciences, a decline in the use of the label 'in vivo experiments' over time can be observed ($p=0.0112$), as well as an increase in the use of the label 'cell culture' ($p=0.0049$).

Interim conclusion

In immunology and the neurosciences, a slight but significant trend towards more frequent use of alternative methods can be identified. No trend can be detected in oncology. The increased use of in vitro methods could contribute to a reduction in animal experiments in Germany.

Given these slight but significant trends, this development should be monitored further. The investigations could also be extended to other areas of research.

Limitations

The following limitations and uncertainties should be borne in mind when conducting the assessment of the data.

- Our study covers only the three research areas that use the highest number of laboratory animals. All other research areas have not yet been considered.
- Only PubMed, as the largest freely available database for biomedical research, was used for the search. Consequently, it is not possible to provide an overview of the entire scientific literature in the life sciences. However, PubMed covers a significant proportion of this domain. The publications contained in PubMed provide an overview of academic research in particular, as research and development activities in industry are less likely to result in publications in scientific journals.
- The classification considered only three categories: in vivo experiments on vertebrates, cell culture as a proxy for in vitro methods, and the use of 'both' or 'neither' of these methods. The 'neither' category, in particular, may include other alternative methods, such as in silico methods or experiments on insects. However, the majority of alternative methods for animal experiments continue to be based on cell cultures.

- The scientific publication process can take several months. Consequently, several weeks to years may elapse between the use of the last animals and the publication of the results. This means that a certain time lag must be assumed for the data evaluated here compared with the statistics on laboratory animals.
- When interpreting the data, it is also important to bear in mind that the number of publications does not directly correlate with the number of animals used. Each publication counts as a single data point, regardless of how many animals are described in it.
- A study may be the result of international collaboration. German authorship as first author therefore does not necessarily mean that the experiments described therein were carried out in Germany. However, given the large number of studies considered, it is assumed that significant trends for Germany can be identified.
- The use of the classification tool is also subject to limitations. For instance, the classification decision is based exclusively on the abstracts of the publications. An inadequate description of the methods used in the abstract may therefore make classification difficult. Furthermore, the tool may, even with a low degree of certainty, still assign an abstract to a category. This probability of assigning an abstract to a class was not taken into account in our evaluation. Another limitation may be the reliability of abstract classification when multiple methods are used. The certainty of classification when multiple methods are applied has not yet been assessed in detail.
- The chosen search strategy does not aim for exhaustiveness across every field of research. Rather, the aim is to cover the majority of publications within a research area in order to observe relevant trends.

2.4.3 Relocation abroad: A systematic investigation of the locations where animal experiments were conducted in publications from Germany

Research question

The continuous decline in animal experiments may have a variety of causes. One reason that has repeatedly been brought to the attention of the BfR is the relocation of animal experiments abroad. It is argued that a stricter interpretation of the laws, as well as increased bureaucratic burdens, could prompt researchers to deliberately relocate animal experiments abroad in order to avoid these. To date, this has been based exclusively on anecdotal evidence.

This study is the first to investigate whether evidence of this phenomenon can be found in the scientific literature. To this end, publications from Germany in the over the last ten years, which described animal experiments involving rats, were systematically evaluated with regard to the location where the experiments were carried out.

Method

To compile the sample, a search was conducted in the biomedical literature database PubMed using the MeSH term and the search term 'rats' to identify all publications from 2014 to 2024 with a German institutional affiliation (Figure 1). Reviews were excluded at the outset via our search strategy. The authors' institutional affiliations can be identified in PubMed via the 'Affiliation' data field, and the search can be restricted accordingly. In a further step, only first and last authorships with a German affiliation were included in the analysis. This allowed us to exclude, from the outset, some of the classic forms of collaboration that may manifest as the first and last authorships being split between two institutions. The initial screening of the abstracts was carried out semi-automatically using the DistillerSR programme (DistillerSR Version 2025.7.1). Abstracts were included or excluded based on the following criteria: original publication; publication between 2014 and 2024; first and last authors from Germany; in vivo experiments on rats.

For the 6,226 publications retained, the full texts were obtained and uploaded to DistillerSR. Each study was then reviewed by a member of staff (screener) against the inclusion and exclusion criteria. Where a study was included, the location where the animal experiments were carried out was extracted. The following information was used to identify the location: the authorising body, and any reference to the German Animal Welfare Act or institutional regulations. This information was found in the vast majority of publications and has increased steadily over the last ten years. If there was no direct indication of the location, but the animals originated from Germany, all authors of the publication had affiliations exclusively in Germany, and the respective publications stated that the animal experiments had been authorised locally or nationally, this was also classified as the location being in Germany. The animal experiments in the included studies were categorised as follows: location in Germany; location outside Germany; location both in Germany and outside Germany; and no information on the location.

Mann–Kendall tests were carried out to analyse linear trends over time. A p-value below 0.05 was considered a statistically significant change.

Prior to data extraction, the study protocol for the systematic review was registered on the Open Science Framework²⁷ to ensure transparency of the procedure and enhance the credibility of the results. In particular, the hypothesis, search strategies, inclusion and exclusion criteria, and the screening and extraction process were defined in advance.

²⁷ Heini, C., & Diederich, K. (2 December 2025). Protocol for a scoping review: Is there an outsourcing of animal experiments from Germany? Retrieved from osf.io/sc439

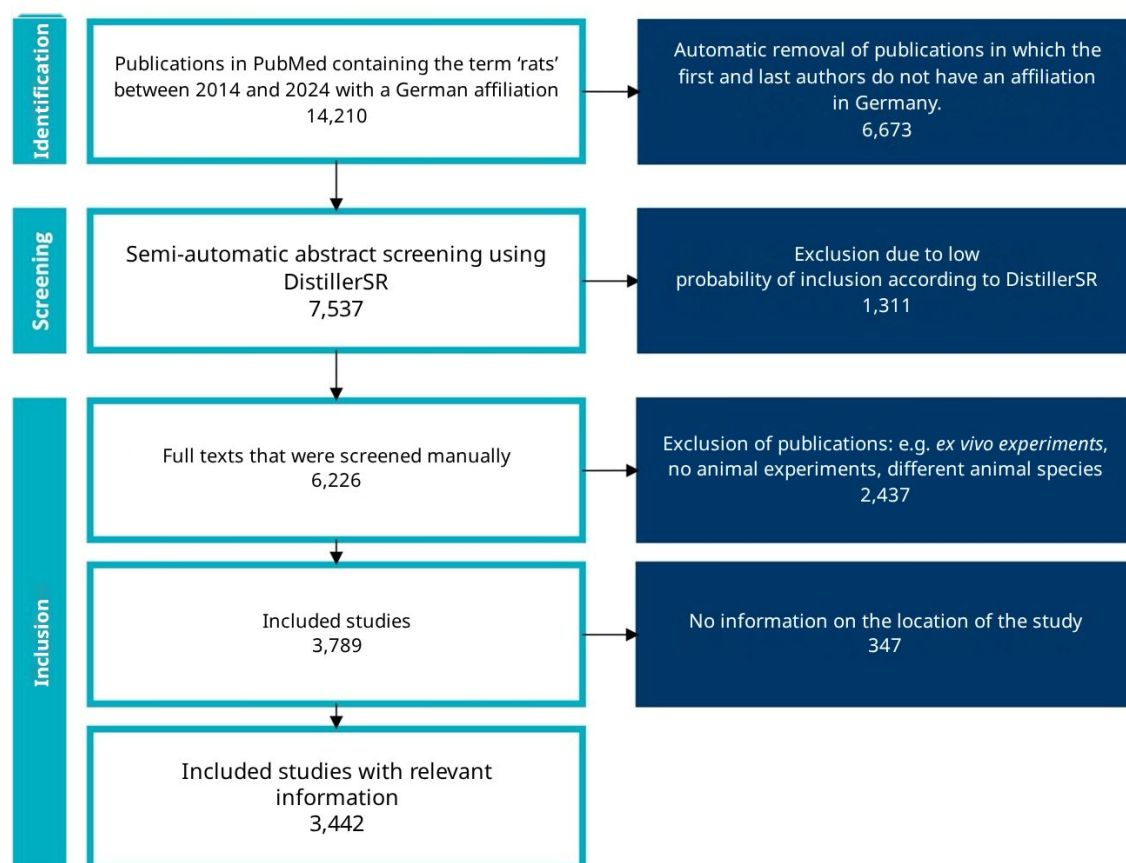


Figure11 : Process for identifying the relevant studies for our sample.

Results

A total of 3,789 studies were included in our analysis, of which 3,442 provided information on the location where the animal experiments were carried out (Figure11 12). In 3,122 studies (approx. 90 per cent), the animal experiments were conducted exclusively in Germany, whilst 320 studies (approx. 7 per cent) described animal experiments carried out abroad. The remaining proportion (approx. 3 per cent) of the publications describe locations in both Germany and abroad. Viewed over time, a slow but steady increase in the proportion of experiments carried out abroad can be observed, from 3.7 per cent in 2014 to 8.8 per cent in 2024 (Figure12 13) ($p=0.0127$), which is accompanied by a significant decrease in the proportion of experiments carried out in Germany ($p=0.0293$).

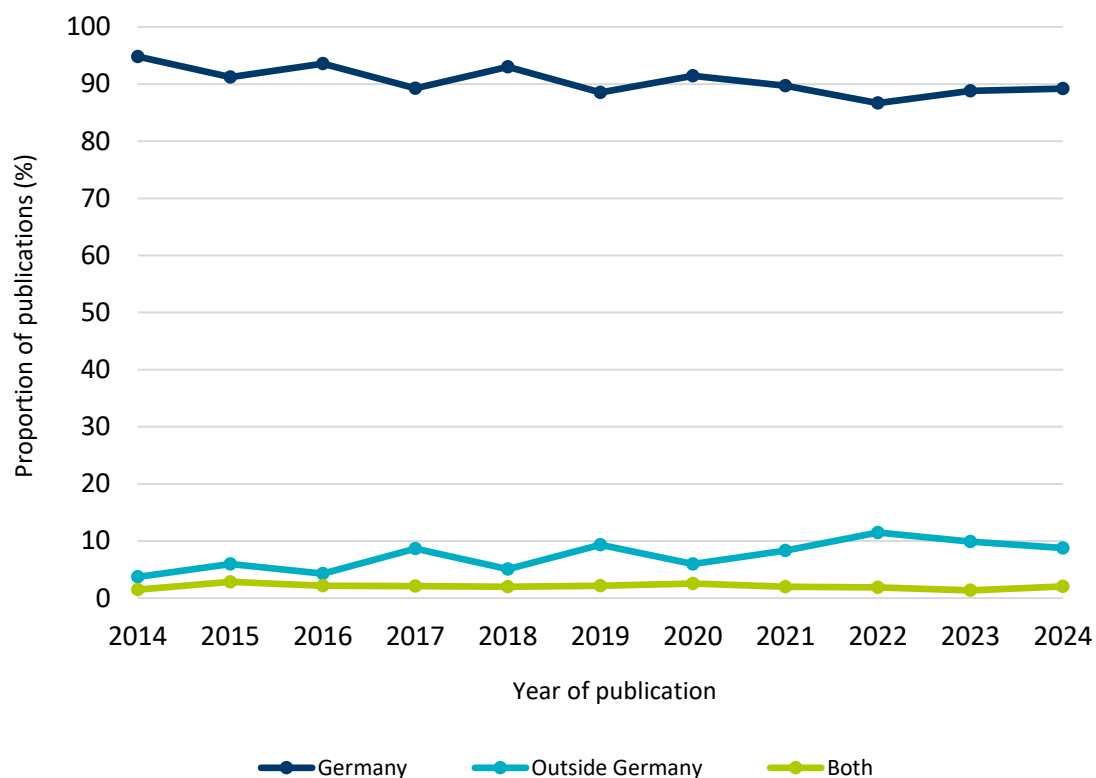


Figure12 : Percentage share of locations where animal experiments were carried out, relative to all included studies with information on the location, over time. The proportion of studies carried out in Germany is decreasing slowly but significantly ($p=0.0293$), whilst the proportion of studies carried out outside Germany is increasing steadily ($p=0.0127$). The number of studies describing experiments carried out both abroad and in Germany remains unchanged ($p=0.3502$).

Table2: List of locations outside Germany mentioned in the publications, sorted by frequency. It should be noted that a single study may include animal experiments from several countries.

Position	Country	Number of studies per country
1.	France	32
2.	USA	31
3.	Hungary	18
4.	China	16
5.	Brazil	15
6.	Egypt, the Netherlands, the United Kingdom	14
7.	Denmark, Italy, Japan, Russia, Serbia	12
8.	Switzerland, Spain	11
9.	Sweden	10
10	Austria, Canada	8
11.	Israel	6
12	Finland, Poland, Slovakia	5
13.	Belgium, the Czech Republic, Norway, Portugal	4
14.	Australia, Iran, Belarus	3
15.	India, Saudi Arabia, Romania, Uganda, Ukraine	2
16.	Argentina, Armenia, Chile, Jordan, Kenya, Colombia, Mexico, Nigeria, Pakistan, South Korea, Thailand, Turkey	1

A total of 46 countries outside Germany were identified in the sample as locations where animal experiments were carried out (Table2 2). Most of these animal experiments were carried out in France or the USA. It is striking that, in the list of animal experiments carried out abroad, the majority of the experiments were conducted in other EU countries and were therefore subject to similar statutory animal welfare regulations.

Interim conclusion

Over the past ten years, a slow but significant increase has been observed in the proportion of experiments involving rats carried out outside Germany. The reasons for this increase cannot be determined precisely using the chosen methodology. It could, for example, be due to an increase in international collaborations.

Given the slight but significant trends, this development should be monitored further. Automating the analysis process used here using artificial intelligence would make it possible to investigate the phenomenon in larger samples and to track it over the coming years. A survey of researchers could shed light on the reasons for conducting animal experiments. Both approaches have already been initiated.

Limitations

The following limitations and uncertainties should be borne in mind when conducting the assessment of the data:

- The analysis deals only with studies carried out on rats. It is therefore not possible to draw conclusions regarding animal experimentation involving other animal species.
- The number of publications using rats has been declining over the last ten years in Germany and worldwide. Consequently, the use of rats is increasingly being replaced by other animal species. However, this decline should not distort the evaluation, as the results are based exclusively on the percentage shares of the locations where the studies were carried out out of all included publications involving rats.
- This approach does not allow conclusions to be drawn about the reasons for the choice of location. Cross-border collaborations are commonplace in biomedical research. Such collaborations may also involve the conduct of animal experiments abroad. In order to reduce the proportion of such traditional research collaborations somewhat, only publications were included in which both the first and last authors were affiliated with an institution in Germany.
- In particular, the publications provide an insight into academic research. Although our sample also included publications involving larger pharmaceutical companies or smaller biotech firms, the vast majority of authors are affiliated with a university or non-university research institution.
- The scientific publication process can take several months. Consequently, several weeks to years may elapse between the use of the last animals and the publication of the results. This means that a time lag must be expected between the data analysed here and the laboratory animal statistics.
- When interpreting the data, it is also important to bear in mind that the number of publications does not directly correlate with the number of animals used. Each publication counts as a single data point, regardless of how many animals are described in it.
- PubMed, as the largest database for biomedical research, was used exclusively to compile the sample. Consequently, it is not possible to provide an overview of the entire scientific literature in the domain of life sciences from Germany. However, PubMed covers a significant proportion of published research. Unlike in traditional systematic reviews, however, completeness – that is, the inclusion of all rat studies conducted in Germany – is only of secondary importance. Rather, the aim was to include a sufficiently large number of studies covering various disciplines and types of experiments. With 3,789 studies included, this aim was achieved.
- All retrieved abstracts were uploaded to the DistillerSR programme. Here, 615 abstracts were initially screened by a human screener against inclusion and exclusion criteria. Based on this screening, the DistillerSR AI tool was trained and all remaining abstracts were sorted according to their probability of inclusion. Abstracts with a probability of inclusion of less than 25 per cent were excluded. Consequently, it cannot be ruled out that some studies may have been incorrectly excluded. It should be noted, however, that even after this training, an exclusion rate of

approximately 39 per cent remained, suggesting that the threshold was not set too high.

- Each full text was reviewed by only one person. Consequently, errors in judgement cannot be ruled out.

2.4.4 Approval procedures: Analysis of approved animal experimentation projects in Germany, recorded in the AnimalTestInfo database

Research question

One possible explanation for the falling numbers of laboratory animals in Germany could be a decline in new approvals for animal experimentation projects or in the number of approved laboratory animals, which ultimately leads to a reduction in the total number of laboratory animals.

This work package aims to investigate how the number of authorisations granted for animal experimentation projects in Germany has developed over the last ten years. The evaluation is based on the non-technical project summaries (NTPs) published for each authorisation granted following a full assessment procedure. In addition, the study aims to show how many laboratory animals are authorised annually by the competent authorities in Germany. This data will reveal whether the granting of authorisations has limited the number of animal experiments that can be carried out in Germany, which could also explain the decline in the number of laboratory animals.

Method

The data analysis was based on the NTPs published in the AnimalTestInfo database²⁸, which is operated by the BfR. The NTPs are intended to inform the public and are brief, accessible summaries of animal experimentation projects for which researchers have applied for authorisation and which have been approved by the competent authorities of the federal states ("Laender"). The NTPs include, amongst other things, the purpose of the experiment, the animal species, the number of animals, the stress to which the animals are exposed, and which 3Rs measures have been taken to reduce animal experiments to the minimum necessary and to minimise pain, suffering and harm to the animals.

Should there be a change to an already approved experimental project – in particular, a change to the purpose of the experiment, an increase in the level of pain, suffering and harm, or an increase in the number of laboratory animals used – these changes require renewed approval by the competent authority. As a result, the NTP for the ongoing experimental project is amended by the applicants, and the existing NTP in AnimalTestInfo is replaced by the updated version.

The aim of this analysis was to draw conclusions from the published NTPs regarding the number of authorisations granted each year. In addition, the number of newly authorised laboratory animals for each year was to be calculated from the NTPs. The number of

²⁸ www.animaltestinfo.de

authorisations and laboratory animals was also to be presented separately for each purpose of use that can be specified in the NTPs.

To estimate the number of authorisations granted annually, the NTPs for initial authorisations – that is, the first NTP published for each experimental project – were first evaluated (Figure 14). Every authorisation granted that resulted in the publication of an NTP was taken up in the analysis and assigned to the year of publication (even if this was only an interim publication). A similar approach was taken with regard to the number of authorised animals. In the case of initial authorisations for a project, the number of animals stated in the NTP was attributed to the year of publication. In the case of amendments requiring authorisation, the change in the number of animals (usually an increase) was first calculated relative to the last published NTP. Consequently, only the authorised change in the number of animals was attributed to the year of publication of the (amended) NTP.

The number of research projects authorised for the first time, as well as the number of authorised laboratory animals, was analysed according to the following research purposes (Figure 13 and Figure 14): basic research, translational and applied research, regulatory affairs and routine production, education, training and further education, conservation breeding of genetically modified animals, and other purposes. Where multiple purposes were specified in an NTP, the authorisation and the respective numbers of animals authorised were apportioned equally across all specified experimental purposes.

The years 2016 to 2025 were evaluated for the graphical representation of the data. The years 2013 to 2015 were excluded, as the database was not yet fully paperless at that time and a high degree of variability was therefore to be expected between the publication of an NTP and the authorisation date.

Unless otherwise stated, only the years 2019 to 2025 were included in the evaluation of the data. Data from 2016 to 2018 were excluded because it can only be assumed from 2019 onwards that authorisations granted by the competent authorities were correctly labelled in the database as changes requiring authorisation or initial authorisations. Furthermore, in 2015, the National Committee for the Protection of Laboratory Animals issued a recommendation that changes requiring authorisation should result in an update to the NTP. This practice subsequently had to become established. Statistical trends were calculated using a two-sided Mann–Kendall test with a significance level of $p = 0.05$.

Results

Overall, it can be observed that, over the last ten years, the total number of authorisations granted in Germany (initial authorisations and amendments requiring authorisation) fluctuated between 2,807 in 2022 and 3,795 in 2020 (Figure 14). Over the period from 2019 to 2025, there is no long-term trend towards rising or falling approval figures ($p=0.4743$). However, looking at first-time authorisations since 2019, it is noticeable that fewer trial projects were authorised for the first time in the last four years (2022 to 2025) than in the three years prior (2019 to 2021). This trend is not statistically significant, however ($p=0.26$). The trend in the number of first ($p=0.13$) and second amendments requiring authorisation ($p=0.45$) is similarly unremarkable. The number of further amendments, however, shows an upward trend, although this does not exhibit clear statistical significance ($p=0.06$).

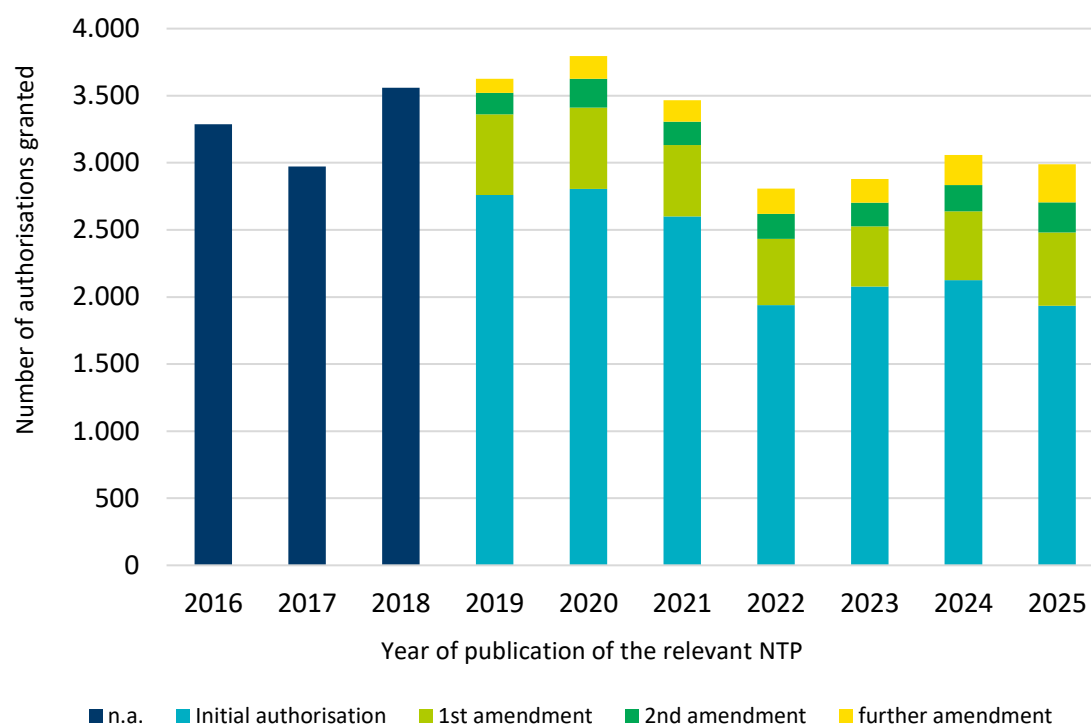


Figure 14: Number of first authorisations and amendments subject to authorisation granted annually, based on the NTPs published in the corresponding years. First authorisations correspond to NTPs which, at the time of their publication, did not replace any previously published NTPs. NTPs that replaced previously published NTPs were classified as amendments requiring authorisation (first, second or subsequent amendments). Between 2016 and 2018, the AnimalTestInfo database was still under development, meaning that the type of authorisation could not be reliably classified. The data were therefore classified as n.a. (not available).

To gain an impression of how many animal experimentation research projects were initiated in recent years and what proportion these accounted for in the individual research areas, the purposes of the initial authorisations for the period from 2019 to 2025 were analysed (Figure13 15). The trend analysis using the Mann- Kendall test shows no significant downward trend in the total number of newly approved projects ($p=0.0715$).

However, the number of projects approved for basic research fell significantly during the selected period ($p=0.0355$, Figure13 15). The numbers of animal experiments approved in the domain of translational and applied research ($p=0.2296$), as well as in the domain of regulatory applications and routine production ($p=0.0715$) and for other purposes ($p=0.0715$), also declined, though these decreases did not reach statistical significance. The number of projects focusing on the maintenance of genetically modified lines shows no statistically significant trend ($p=0.5480$). The total number of animal experiments authorised for training purposes increased overall and rose significantly, particularly in 2023 and 2024; however, due to the short analysis period, no statistically significant trends were observed here either ($p=0.0715$) (Figure13 15).

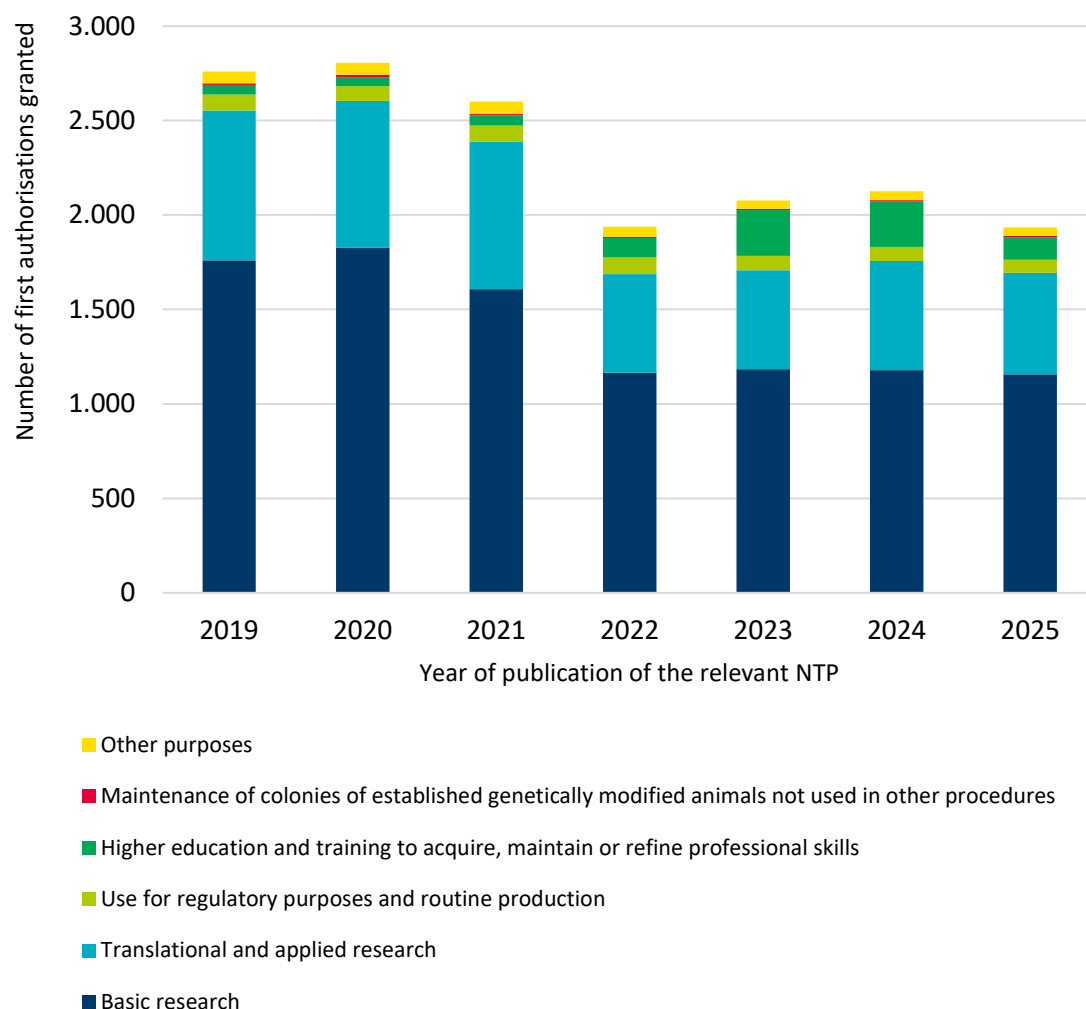


Figure13: Number of initial authorisations granted annually for experimental projects, estimated on the basis of the NTPs published in the corresponding years. Initial authorisations correspond to NTPs which, at the time of their publication, did not replace any previously published NTPs. The data were colour-coded according to the experimental purposes specified in the NTPs.

To test the hypothesis that fewer laboratory animals have been authorised in recent years and that this has contributed to a reduction in the number of laboratory animals, the numbers of laboratory animals covered by initial authorisations – including amendments requiring authorisation – were analysed, broken down by purpose of the experiment (Figure14 16). With regard to the number of laboratory animals, a significant downward trend is evident over the seven-year period analysed ($p=0.0355$). The trend analysis also shows a decline in the number of animals authorised for basic research, although this narrowly fails to reach statistical significance ($p=0.0715$). By contrast, there has been a significant decline in the number of animals authorised for research in the translational and applied domains ($p=0.0355$). The number of animals intended for regulatory purposes, however, remained unchanged ($p=0.5480$), and there were also no changes in the number of animals used for other purposes ($p=0.7639$), the number of animals authorised for training purposes ($p=0.7639$) or the number of animals intended for the maintenance of genetically modified lines ($p=0.2296$).

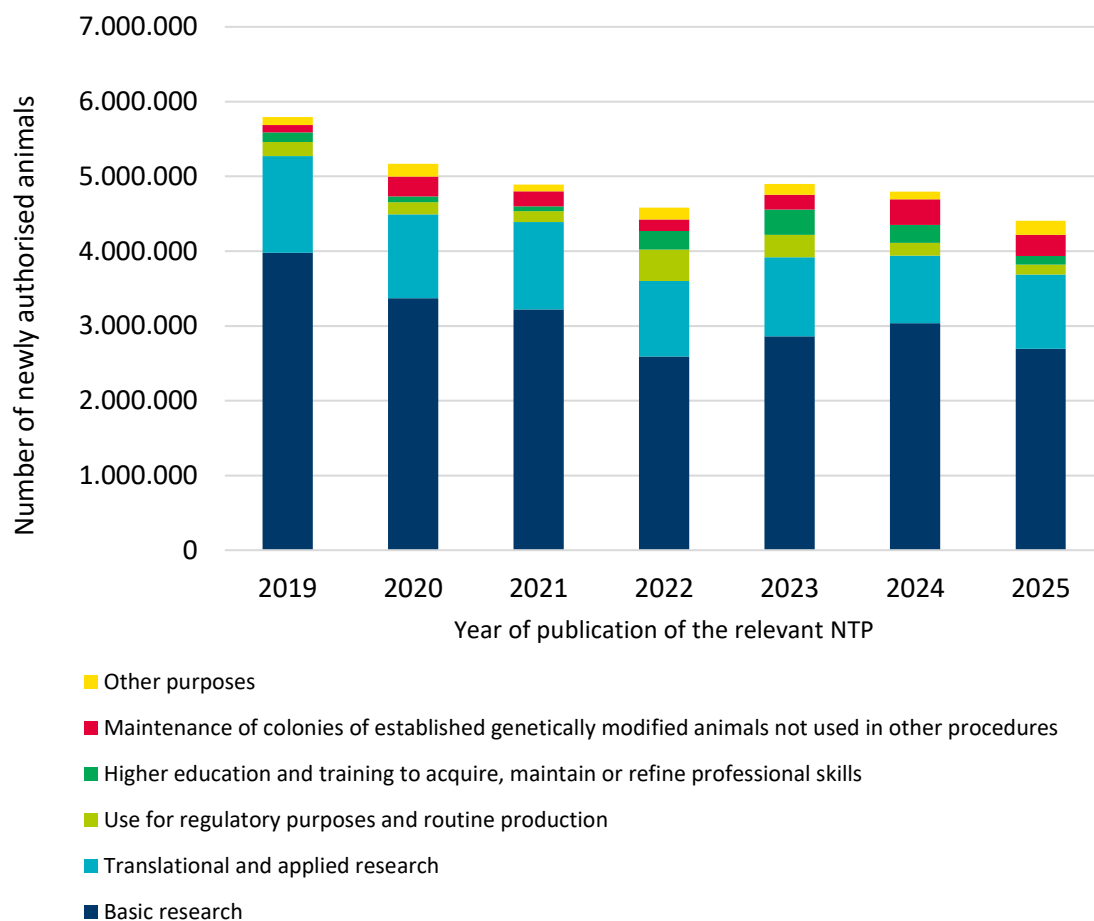


Figure14: Number of laboratory animals authorised annually under initial authorisations for experimental projects and their amendments requiring authorisation, based on the NTPs published in the relevant years. Initial authorisations correspond to NTPs which, at the time of their publication, did not replace any previously published NTPs. NTPs that replaced previously published NTPs were classified as amendments requiring authorisation and contributed to the animal count in each case by the increment relative to the previous publication. The data were colour-coded according to the purposes of the experiments specified in the NTPs.

Interim conclusion

The analysis of the NTPs shows that the number of authorisations granted in Germany for experimental projects, as well as the number of animals included therein that are to be used in animal experiments, has experienced a slight but, depending on the purpose of the experiment, statistically significant decline in recent years. Despite the comparatively short analysis period, it is evident that in recent years both the number of newly approved projects and the number of newly approved laboratory animals have decreased in the domains of basic research, translational research and applied research. At the same time, the number of projects authorised for training purposes rose significantly in 2022. This can easily be explained by the amendment to the Animal Welfare Act in 2021: experiments for the purposes of initial, further and continuing training have only been authorised since 2022 and therefore require the publication of an NTP. However, no clearly defined trends were evident in the number of projects intended for the conservation of genetically modified

breeding lines or in the animals listed therein that would indicate a change in breeding plans in the domain of genetically modified animals in Germany.

It is, however, worth noting that the number of animals earmarked for the various projects and purposes exceeds the number of animals actually used by a factor of many (see section 2.1 and Figure 1 – Figure 5). Only around one in four authorised animals is actually used.

In summary, it can therefore be concluded that no obvious limit is set on the conduct of animal experiments in Germany, either in terms of the number of approved projects or the number of approved animals. There is no evidence of any steering effect by German authorities aimed at reducing the number of laboratory animals through the rejection of animal experimentation authorisations. Nevertheless, it can be observed that the decline in the number of authorisations correlates with the decline in the number of reported animal experiments, although this does not yet imply a causal relationship. This trend should continue to be monitored.

Limitations

The following limitations and uncertainties should be borne in mind when conducting the assessment of the data:

- NTPs are published only for full authorisation procedures. Procedures carried out under the simplified procedure (Section 8a of the Animal Welfare Act) are not published. Accordingly, animal testing authorisations granted in this way were not included in the present analysis. This limitation particularly affects the domain of regulatory applications, which are often required by law and therefore qualify for the simplified procedure. Basic research, on the other hand, is not affected.
- Although NTPs are published for every approved experimental project, it is the responsibility of the competent authority to authorise the publication of the NTPs. To this end, the authority must ensure compliance with a three-month deadline in accordance with Section 41(1) of the VersTierMeldV. However, when the authority releases the NTPs, it does not specify how much time has actually elapsed since the authorisation was granted. Consequently, there is, on the one hand, a certain time lag, as the publication of the NTPs always takes place after the authorisation has been granted, and, on the other hand, a variation in the speed of transmission from one authority to another. Consequently, the authorisation figures derived from the NTPs for a single year could deviate significantly from the actual authorisation figures. However, over the long-term average, as analysed here, this uncertainty is likely to even out.
- The information contained in an NTP is provided by the applicants. Whilst, from the BfR's perspective, the authority has a duty to verify the NTPs, it is not possible to ascertain whether a comprehensive cross-check of all data takes place on a regular basis. In particular, it is conceivable that the stated purpose of the experiment in the NTP may occasionally differ from the information provided in the authorisation application.
- Where several purposes of the experiment were stated in the NTP, the number of authorised animals had to be allocated to the different purposes. We have opted

here for an equal distribution. This basic assumption may have led to slight distortions in the data.

3 Summary of the results

3.1 Analysis of laboratory animal numbers

The number of laboratory animals in Germany has been falling continuously since 2019 and reached a new low in 2024. This decline is statistically significant when viewed over the past ten years and is particularly evident in the domain of regulatory animal experiments, but also in translational and applied research. The figures for 2024 also indicate a downward trend in animal experiments in basic research; however, when viewed over a ten-year period, this trend falls just short of statistical significance.

A comparison with France and the United Kingdom – two countries with numbers of laboratory animals comparable to those in Germany – shows that in the United Kingdom the numbers of laboratory animals are following a similar trend to those in Germany, whilst in France the figures remain stable, albeit with some fluctuation. In all three countries, there was a significant drop in the number of laboratory animals in 2020, the year of the coronavirus pandemic; in Germany, this was primarily due to a reduction in animal experiments in the domains of regulatory affairs, translational and applied research, as well as species conservation and environmental concerns, but not in the domain of basic research. In the United Kingdom and France, there was initially a rise in the number of laboratory animals again in 2021, which did not occur in Germany. It is worth noting that in France, the number of genetically modified animals bred has risen significantly since 2021, whilst in Germany it has tended to fall. The increase in France is likely due to a change in authorisation practices and not necessarily to a shift in breeding programmes from Germany to France.

3.2 Impact of the decline in the number of laboratory animals

Publication output

The publication output of researchers affiliated with German institutions rose steadily between 2014 and 2025, peaking between 2020 and 2022. A similar trend is also observed in the publication output of researchers affiliated with French or British institutions, as well as globally, although the growth rates are lower on a global scale. The significant increase in publications between 2020 and 2022 could be indirectly linked to the COVID-19 measures. Researchers may have found more time to finalise publications presenting the results of previous experimental work or to write review articles. In the years that followed, this effect may have subsided again. The analysis therefore does not reveal a decline in German publication output compared with other countries.

Satisfaction among pharmaceutical companies

In the pharmaceutical domain, there are indications that companies are relocating their research and development abroad to a limited extent. According to a separate analysis by the German Research Foundation (DFG) of the 2023 report by the Expert Commission for Research and Innovation (EFI) on companies engaged in research into pharmaceutical products and medical devices, approximately 30 per cent of German companies already

carry out their research and development abroad. A small proportion of these companies stated that this proportion had increased over the last five years. It can also be expected that, over the next two to three years, a small proportion will increasingly outsource research and development, i.e., to German contract research organisations or abroad. Pharmaceutical companies cited primarily economic reasons for relocating their research abroad (securing markets, speed of innovation, cost advantages). However, reduced bureaucracy and regulatory burdens, as well as more innovation-friendly framework conditions, also play an important role. These aspects are also highlighted in the joint strategy paper 'Pharma R&D 2035 – Germany's Innovation Framework for the Future' by Fraunhofer Health and the Association of Research-Based Pharmaceutical Manufacturers ⁽²⁹⁾, which explicitly identifies bureaucratic hurdles in the authorisation process for animal experiments as an obstacle.

However, it can also be noted that, according to the annual report of the German Patent and Trade Mark Office³⁰, patent and trade mark applications in the pharmaceutical products domain increased by 12 per cent in 2024 compared with the previous year.

3.3 Reasons for the decline in the number of laboratory animals

The cause of the reduction in the number of laboratory animals cannot be attributed to a single factor, but has a very high probability of being due to a combination of factors.

funding

Federal expenditure on core funding for universities and on project grants in the domain of health research and the health sector has, particularly over the last three to four years, not risen to the same extent as in other domains (e.g. information and communication technologies or defence research) and has in some cases even declined. Nor has the number of DFG-funded projects in the domain of basic life sciences research grown in line with the overall funding volume. Reduced financial support in the life sciences may have an impact on biomedical research involving animal experimentation and thus contribute to a reduction in the number of laboratory animals.

Use of alternative methods

Over the last ten years, there has been a trend in Germany towards the increased use of in vitro methods in the two research fields of neuroscience and immunology – which account for the majority of laboratory animals used – whilst animal-based research has declined slightly. This could be a sign that alternative methods are being used more widely in Germany, contributing to a decline in animal experiments. However, this trend is not evident in the field of oncology.

²⁹ Available at: <https://www.gesundheit.fraunhofer.de/de/download-strategiepapier.html>

³⁰ See footnote 2

Shift abroad

The shift of animal experiments abroad could also be contributing to the decline in the number of laboratory animals. This is demonstrated by an analysis of publications from Germany describing experiments involving rats. Here, a slow but significant increase in the proportion of experiments carried out outside Germany has been observed over the last ten years. However, it would need to be investigated whether this trend is continuing and can also be observed in other samples.

More onerous authorisation procedures

The frequently cited argument that animal experiments in Germany are heavily regulated and that long processing times mean fewer and fewer animal experiments can be carried out cannot be either confirmed or refuted. Analysis of animal experimentation projects authorised in Germany shows that, whilst the number of authorised projects has fallen in recent years, the number of authorised laboratory animals has declined only slightly, if at all, and remains well above the numbers of laboratory animals reported annually. Consequently, the analysed data do not reveal any trend suggesting that the authorisation procedures make it more difficult to carry out animal experiments in Germany.

Nevertheless, it cannot be denied that there is a high level of dissatisfaction within the scientific community regarding the authorisation procedure in Germany. This is evident from the opinion of the Senate Commission for Animal Experimentation of the German Research Foundation (DFG) on the authorisation procedure for animal experiments³¹. The statement criticises, in particular, the long processing times and calls for the harmonisation of the authorisation procedure. This point is also addressed by the Association of Research-Based Pharmaceutical Companies and Fraunhofer Gesundheit in their joint strategy paper³². The BfR has therefore conducted a nationwide online survey on the authorisation procedure amongst researchers and authorising authorities in order to identify the problems involved in authorising animal experiments in greater detail and to pinpoint possible solutions. The results of these surveys will be summarised in a separate report.

4 Risk management options, recommended measures

Not only in Germany, but also in other EU countries, a decline in the number of laboratory animals has been observed over the last ten years.³³ This decline is generally to be welcomed, as it shows that the European Commission's efforts to limit animal experiments to what is strictly necessary are bearing fruit. However, the reasons for the Europe-wide reduction vary greatly; they are likely to be country-specific and, given the complexity of the issue, very difficult to determine.

³¹ Genehmigungsverfahren für Tierversuche – aktuelle Bestandsaufnahme und Handlungsbedarfe, 01.10.2025, Deutsche Forschungsgemeinschaft, Ständige Senatskommission für tierexperimentelle Forschung, <https://zenodo.org/records/17177763>

³² Gemeinsames Strategiepapier »Pharma F&E 2035 – Deutschlands Innovationsrahmen für die Zukunft« von Fraunhofer Gesundheit & dem Verband Forschender Arzneimittelhersteller e.V. verfügbar unter: <https://www.gesundheit.fraunhofer.de/de/download-strategiepapier.html>

³³ This is also demonstrated by the report from the Dutch National Committee NCad, published on 15 June 2026. Available at: <https://www.ncadierproevenbeleid.nl/documenten/2026/06/12/rapport-dierproeven-in-nederland-2015-2024>

The cause of the reduction in the number of laboratory animals is clearly multifactorial. Both the funding of biomedical research and the increased use of alternative methods are contributing to the decline in numbers. The relocation of research abroad may also play a role in the downward trend in some cases.

Even though the results do not authorise clear conclusions regarding the causes of the reduction in the number of laboratory animals, the concerns raised by the scientific community and the pharmaceutical industry in the research and development domain should be taken seriously, not least to prevent a further shift of animal-based research and development abroad in the future.

The BfR therefore recommends the following measures:

- The trend in the number of laboratory animals and authorised animal testing projects in Germany should continue to be monitored and analysed, including with regard to shifts within Europe.
- Likewise, trends towards the increased use of alternative methods should continue to be monitored and, where appropriate, the analyses should be extended to include further areas of research.

Further information is available on the Bf3R website

Website of the German Centre for the Protection of Laboratory Animals (Bf3R)
<https://www.bf3r.de/en/>

Overview of laboratory animal numbers for Germany
<https://www.bf3r.de/en/offers/laboratory-animal-numbers/>

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About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the German Federal Ministry of Agriculture, Food and Regional Identity (BMLEH). It protects people's health preventively in the fields of public health and veterinary public health. The BfR provides advice to the Federal Government as well as the Federal States ('Laender') on questions related to food, feed, chemical and product safety. The BfR conducts its own research on topics closely related to its assessment tasks

About the Bf3R

The German Centre for the Protection of Laboratory Animals (Bf3R) was founded in 2015 and is an integral part of the German Federal Institute for Risk Assessment (BfR). It co-ordinates nationwide activities with the goals of restricting animal experiments to only those which are considered essential, and safeguarding the best possible protection for laboratory animals. Moreover, it intends to stimulate research activities and encourage scientific dialogue

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Publisher:

German Federal Institute for Risk Assessment

Max-Dohrn-Straße 8-10

10589 Berlin, Germany

T +49 30 18412-0

F +49 30 18412-99099

bfr@bfr.bund.de/en

bfr.bund.de/en

BfR-Autor/innen: Philipp Schwedhelm, Céline Heintz, Diana Rubel, Daniel Butzke, Bettina Bert

Weitere BfR-Autor/innen: Mariana Lara Neves, Susanne Fieberg, Katja Metz, Elisa Wistorf, Matthias Steinfath, Marta Barenys, Kai Diederich, Lars Lewejohann, Nils Ohnesorge, Jenny Wilzopolski, Stefanie Banneke, Ines Schadock, Michael Oelgeschläger

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