Tests carried out on animals

Regulatory tests on animals are conducted to assess the safety, efficacy, or environmental impact of products such as pharmaceuticals, pesticides, chemicals, cosmetics, and medical devices. These tests are often mandated by government agencies to ensure compliance with regulations before products can be approved for human use or environmental release. The specific tests vary by country, regulatory body, and product type, but below is a comprehensive list of common regulatory tests carried out on animals, based on global practices and regulations.

Categories and Specific Regulatory Tests on Animals

Regulatory testing is typically standardized and governed by guidelines such as those from the Organisation for Economic Co-operation and Development (OECD), the U.S. Food and Drug Administration (FDA), the Environmental Protection Agency (EPA), the European Medicines Agency (EMA), and the EU's REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) program.

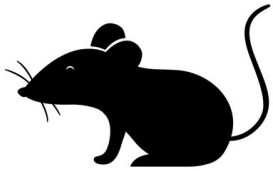
Animal Species Used

Common species include:

- **Mammals**: Mice, rats, rabbits, guinea pigs, dogs, non-human primates (e.g., macaques), pigs.
- **Birds**: Quail, mallards, chickens.
- **Fish**: Zebrafish, trout.
- **Invertebrates**: Daphnia, honeybees (for ecotoxicity).
- **Others**: Amphibians (e.g., frogs), reptiles (less common).

In the U.S., rats, mice, and birds bred for research are excluded from AWA protections, meaning no oversight for their use. The EU and UK cover all vertebrates and some invertebrates (e.g., octopuses).

- **Data Gaps**: Exact numbers of animals used are hard to pinpoint globally (estimated 190–275 million annually), as many countries (e.g., U.S.) don't track unprotected species like rats and mice.



1. Toxicity Testing

These tests evaluate the potential harmful effects of substances on living organisms, including humans and the environment. Animals are exposed to substances via ingestion, inhalation, skin contact, or injection, and effects are monitored.

- **Acute Toxicity Testing**: Determines the immediate effects of a single exposure to a substance.
  - **Oral Acute Toxicity (OECD 401, 420, 423, 425)**: Animals (typically rats or mice) are force-fed a substance to determine the dose that causes death or severe toxicity (e.g., Lethal Dose 50, LD50, where 50% of animals die).
- **Dermal Acute Toxicity (OECD 402)**: Substances are applied to the skin of animals (e.g., rabbits) to assess skin irritation, corrosion, or systemic effects.
- **Inhalation Acute Toxicity (OECD 403, 436)**: Animals (e.g., rats) inhale a substance to evaluate respiratory or systemic toxicity.

Subchronic Toxicity Testing: Assesses effects of repeated exposure over a short period (e.g., 28–90 days).

- **28-Day or 90-Day Repeated Dose Toxicity (OECD 407, 408, 409)**: Animals (e.g., rats, dogs) are dosed daily via oral, dermal, or inhalation routes to study organ damage, blood chemistry changes, or other effects.

Chronic Toxicity Testing: Evaluates long-term exposure (6 months to lifetime).

- **Chronic Toxicity/Carcinogenicity Studies (OECD 451, 452, 453)**: Animals (e.g., rats, mice) are exposed for most of their lifespan to assess cancer risk or organ damage.

Skin and Eye Irritation/Corrosion (OECD 404, 405): Substances are applied to the skin or eyes of animals (typically rabbits) to evaluate irritation or corrosive damage. Note: Alternatives like in vitro tests are increasingly replacing these for cosmetics in some regions.

- **Skin Sensitization (OECD 406, 429)**: Tests (e.g., Guinea Pig Maximization Test or Local Lymph Node Assay in mice) assess allergic reactions after repeated exposure.

2. Developmental and Reproductive Toxicity (DART)

These tests evaluate effects on reproduction, fertility, and offspring development.

- **Prenatal Developmental Toxicity (OECD 414)**: Pregnant animals (e.g., rats, rabbits) are dosed to assess effects on fetal development, such as malformations or embryo death.
- **One-Generation or Two-Generation Reproduction Toxicity (OECD 415, 416)**: Animals (e.g., rats) are exposed over one or two generations to study fertility, mating behavior, and offspring health.

3. Carcinogenicity Testing

Carcinogenicity Studies (OECD 451, 453): Long-term studies (18–24 months) in rodents (e.g., rats, mice) to determine if a substance causes cancer.

Animals are exposed daily, and tumors are evaluated post-mortem.

4. Genotoxicity Testing

These tests assess whether substances cause DNA damage, potentially leading to mutations or cancer.

In Vivo Micronucleus Test (OECD 474): Rodents (e.g., mice) are exposed to a substance, and bone marrow or blood is analyzed for chromosomal damage.

In Vivo Comet Assay: Measures DNA strand breaks in tissues of exposed animals (e.g., rats).

Unscheduled DNA Synthesis (UDS) Test (OECD 486): Evaluates DNA repair in liver cells of rats after exposure.

5. Neurotoxicity Testing

- **Neurotoxicity Studies (OECD 424)**: Animals (e.g., rats) are exposed to assess effects on the nervous system, such as behavioral changes, motor function, or nerve damage.
- **Delayed Neurotoxicity of Organophosphates (OECD 419)**: Hens are used to test for delayed nerve damage caused by certain pesticides.

6. Ecotoxicity Testing
These tests evaluate environmental impacts, particularly for pesticides and chemicals under regulations like REACH.
Acute Fish Toxicity (OECD 203): Fish (e.g., zebrafish) are exposed to a substance in water to assess mortality or behavioral changes.
Daphnia Acute Immobilization Test (OECD 202): Water fleas (Daphnia) are exposed to evaluate mobility or mortality.
Avian Acute Toxicity (OECD 223): Birds (e.g., quail) are dosed to assess toxicity of pesticides or chemicals.
Honeybee Toxicity (OECD 213, 214): Bees are exposed to assess mortality or behavioral effects.

7. Pharmacokinetic and Toxicokinetic Studies
Absorption, Distribution, Metabolism, and Excretion (ADME) Studies: Animals (e.g., rats, dogs) are dosed to study how a substance is absorbed, distributed, metabolized, and excreted. These are critical for drug and chemical safety assessments.

8. Safety Pharmacology
Core Battery Tests (ICH S7A, S7B): Evaluate effects on vital systems before human trials.
Cardiovascular Safety (e.g., in dogs or non-human primates): Assesses heart rate, blood pressure, or ECG changes.
Respiratory Safety (e.g., in rats): Measures breathing rate or lung function.
Central Nervous System Safety (e.g., in rats): Evaluates behavior, coordination, or seizures.

9. Vaccine and Biologics Testing
Potency and Efficacy Testing: Animals (e.g., mice, guinea pigs) are used to test vaccine effectiveness, often involving challenge studies where animals are exposed to a pathogen post-vaccination.
Batch Release Testing: Animals (e.g., mice, rabbits) are used to verify the quality of vaccine or biologic batches, such as for rabies or botulinum toxin.
Lethal Dose 50 (LD50) for Botox: Tests

10. Medical Device Testing

- **Biocompatibility Testing (ISO 10993)**: Animals (e.g., rabbits, pigs) are used to assess tissue response to implanted devices, including irritation, sensitization, or systemic toxicity.
- **Hemocompatibility**: Evaluates blood interactions with devices, often in dogs or rabbits.

11. Animal Rule Testing (FDA)
Efficacy Testing for CBRN Agents (21 CFR 314, 601): Used when human trials are unethical (e.g., for drugs against chemical, biological, radiological, or nuclear threats).
Animals (e.g., non-human primates, rodents) are exposed to simulants of lethal agents to test drug or vaccine efficacy.

Safety is still tested in humans.

12. Cosmetic Testing (Limited Use)

- **Skin and Eye Irritation (Historical)**: Previously common in rabbits (Draize test), but banned in the EU since 2009 for cosmetics and ingredients. Still used in some countries (e.g., China for certain products) where non-animal alternatives are not fully accepted.

Systemic Toxicity: Required in some regions for cosmetic ingredients under chemical regulations (e.g., REACH),

13. Pesticide Testing

- **90-Day Dog Feeding Study (EPA)**: Dogs are fed pesticides for 90 days to assess toxicity.
- **Avian Reproduction Test (OECD 206)**: Birds (e.g., mallards) are exposed to evaluate effects on egg production or chick survival.
- **Fish Early-Life Stage Toxicity (OECD 210)**: Tests effects on fish embryos and juveniles.

Key Regulatory Bodies and Guidelines
United States:
Animal Welfare Act (AWA): Regulates care and use of warm-blooded vertebrates (excludes rats, mice, birds bred for research). Enforced by USDA's Animal and Plant Health Inspection Service (APHIS).

FDA: Requires animal testing for drugs, biologics, and medical devices under the Federal Food, Drug, and Cosmetic Act. Encourages alternatives but accepts animal data.

EPA: Mandates animal tests for pesticides and chemicals under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Public Health Service (PHS) Policy: Applies to NIH-funded research, covering all vertebrates. Enforced by the Office of Laboratory Animal Welfare (OLAW).

European Union:
Directive 2010/63/EU: Governs animal use, emphasizing the 3Rs (Replacement, Reduction, Refinement). Requires project licenses and ethical reviews.

REACH: Requires animal testing for chemicals when non-animal methods are unavailable, but prioritizes alternatives.

Cosmetics Regulation (EC 1223/2009): Bans animal testing for cosmetics and ingredients in the EU since 2009, though REACH can override for chemical safety.

United Kingdom:
Animals (Scientific Procedures) Act 1986 (ASPA): Requires personal, project, and establishment licenses. Includes cost-benefit analysis and 3Rs compliance.

Netherlands:
Experiments on Animals Act: Mandates establishment and project licenses, with oversight by the Central Animal Testing Committee (CCD).

OECD Guidelines: Internationally accepted standards (e.g., OECD 401–453) for toxicity, ecotoxicity, and other tests, used by many countries.

Global Variations
U.S.: Heavy reliance on animal testing for drugs and pesticides, with limited AWA protections for most lab animals (rats, mice, fish).
EU: Strict regulations, bans on cosmetic testing, and emphasis on alternatives, but REACH may require animal tests for chemicals.
UK: Tightest regulatory system globally, with mandatory cost-benefit analysis and 3Rs compliance.
China: Requires animal testing for certain cosmetics (e.g., sunscreens), though reforms are reducing this.
Netherlands: Strong focus on 3Rs, with animal welfare bodies monitoring compliance.