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The anaesthetic economy of the laboratory: care-killing work and One Health in early-career animal research

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Abstract

Laboratory animal research occupies a central yet ethically contested place in contemporary biomedical science, but its everyday organisation as scientific labour remains comparatively underexplored. Drawing on 26 in-depth interviews with early-career researchers (ECRs) and ethnographic laboratory observations at a university in Istanbul, Türkiye, this article examines how animal care, experimental harm and ethical responsibility are negotiated within institutional and professional arrangements. Bringing together the sociology of work, Science and Technology Studies (STS), and medical ethics, it approaches animal experimentation as morally demanding labour rather than merely the application of ethical principles.

The article develops the concept of an *anaesthetic economy* to capture two interconnected but distinct processes: the use of anaesthesia to prevent or reduce animal pain and the ways researchers learn to manage the moral discomfort associated with performing experimental interventions. Within this economy, care-killing work involves caring for animals while undertaking procedures that may cause harm or end their lives. The findings suggest that decision-making authority, practical responsibility and emotional burdens are unevenly distributed across laboratory roles and institutional arrangements. Yet professional distancing does not necessarily entail indifference, as researchers may continue to experience moral discomfort, question established practices or refuse interventions. Viewed through a One Health perspective, the findings also highlight aspects of animal use and its environmental implications that may remain peripheral to everyday ethical considerations. The article demonstrates how ethical responsibility in laboratory animal research is shaped not only by formal principles and regulatory procedures but also by the organisation of scientific labour.

1. Introduction

At the laboratory bench, early-career researchers weigh mice or rats, administer injections, observe behavioural responses and collect biological samples. Experimental protocols may also require painful interventions and the ending of animals' lives. The animals involved are at once experimental models, sources of biomedical evidence and sentient beings whose welfare carries ethical and legal significance. The laboratory is thus both a site of knowledge production and a workplace where ethically demanding human–animal relationships are enacted. This raises two related sociological questions: how are living bodies made workable as experimental objects, and how do researchers learn to undertake and negotiate the practical and moral demands of this work?

The study draws on researchers at an early stage of laboratory animal work, primarily master's and doctoral researchers. Rather than treating animal experimentation solely as a matter of ethical justification or regulatory compliance, it examines how tasks, authority, tacit norms and emotional demands are organised in the laboratory workplace (Hughes 1958; Strauss 1985). Attention is directed to supervision, training, scientific deadlines and ethical approval as conditions shaping what researchers can do, question or refuse.

Early-career researchers may be closest to the procedures through which animals are housed, handled, anaesthetised, injected and euthanised, while holding limited authority over experimental design, animal numbers or model selection. This disparity between practical proximity to harm and decision-making power makes early career a revealing position from which to study scientific labour. Researchers' practices are shaped by training, laboratory norms and supervisory expectations, while emotional and ethical support may be insufficient (Gonzalez-Uarquin et al. 2025; Morahan et al. 2024b). These conditions can shape how ethical concerns are expressed and acted upon.

The Three Rs (Replacement, Reduction and Refinement) remain central to governing animal experimentation (Russell and Burch 1959). One Health adds attention to the interdependence of human, animal and environmental health (OHHLEP et al. 2022; Zinsstag et al. 2011). The question pursued here is how early-career researchers encounter these commitments in everyday work, especially where practical responsibility, decision-making authority and experimental continuity do not coincide.

This article conceptualises the organisation of animal experimentation as an *anaesthetic economy*. The term brings two distinct yet interconnected processes into view: biomedical anaesthesia intended to prevent or reduce animal pain, and professional management of moral discomfort, through which researchers may need to temporarily numb themselves to, or distance themselves from, the harm they inflict in order to carry out experimental interventions. These processes are connected through laboratory routines without being ethically equivalent or implying inevitable desensitisation. The argument is developed through care-killing work, moral relay, protocolised conscience, procedural compassion and the hidden curriculum of detachment. Rather than assuming that One Health is unknown to researchers, the analysis asks how far its interrelated concerns enter routine decisions. The study thus examines how ethical principles may protect welfare while the organisation of scientific labour shapes the distribution and visibility of moral responsibility.

2. Animal research ethics and governance: the Three Rs and One Health

Animal research governance has developed through efforts to reconcile scientific objectives with ethical responsibilities towards animals, drawing on legal and institutional regulation (McLeod and Hartley 2018; Pietrzykowski 2021; European Parliament and Council of the European Union 2010). These arrangements have evolved alongside changing research practices and societal expectations (Vorstenbosch 2023; Brink and Lewis 2023). A central framework is the Three Rs of replacement, reduction and refinement, formulated by Russell and Burch (1959) and subsequently incorporated into legislation, ethical review procedures and reporting standards (Vorstenbosch 2023; European Parliament and Council of the European Union 2010; Pietrzykowski 2021; Percie du Sert et al. 2020). In the European context, harm-benefit assessment addresses whether animal use is justified, while the Three Rs guide efforts to replace animal use where possible and to reduce and refine procedures when it remains necessary (European Parliament and Council of the European Union 2010; Ulman et al. 2026).

Regulatory requirements, however, do not settle all the ethical questions raised by animal experimentation. Kiani et al. (2022) draw attention to the extensive use of animals in research and the comparatively limited consideration given to the ethical principles involved. Lauwereyns et al. (2024) similarly argue for a more rigorous, case-based application of the Three Rs, taking animal sentience and pain seriously when assessing experimental practices. Alongside these discussions, efforts to improve research practice have increasingly addressed institutional conditions. The ARRIVE guidelines focus on methodological rigour and transparency in reporting animal experiments (Percie du Sert et al. 2020). Culture of Care initiatives, meanwhile, place greater emphasis on institutional responsibility and the working environments in which animal research is conducted (Brown et al. 2018; Morahan et al. 2024a). Such approaches recognise that ethical practice also depends on how laboratory work is organised and supported.

One Health extends ethical attention to the interdependence of human, animal and environmental health (OHHLEP et al. 2022; Zinsstag et al. 2011). Applied to animal research, this perspective raises questions about the place of laboratory practices within these relationships. Yet One Health approaches may retain an anthropocentric emphasis (Ulman et al. 2026). Ulman et al. (2026) call for a multispecies ethical approach that combines scientific standards with greater attention to animal welfare and investment in non-animal alternatives. Whether these considerations enter everyday decisions about animal experimentation remains an open question.

Yet formal governance and ethical frameworks offer only partial insight into how responsibility is negotiated by those performing experiments (Pietrzykowski 2021). This limitation is particularly salient for early-career researchers (ECRs), whose responsibilities for acts of animal care and harm may exceed their authority over experimental design and ethical decision-making. Although existing studies have examined researchers' emotional distress and support needs (Morahan et al. 2024b; Baysal et al. 2024), how moral agency, responsibility and ethical judgement are organised within everyday laboratory labour remains comparatively underexplored. Addressing this gap requires examining animal research ethics not only as a matter of regulatory compliance or normative principles, but also as a situated dimension of scientific work.

3. Theoretical framework

This article brings the sociology of work into dialogue with Science and Technology Studies (STS) and medical ethics to examine how animal experimentation becomes an ordinary form of scientific labour. Making animals experimentally workable involves bodily practices, institutional permissions and professional training. The analytical concern is how researchers learn to care, intervene, justify and sometimes challenge procedures, and how the organisation of work shapes their capacity to exercise ethical judgement.

3.1 From laboratory life to laboratory work

The central contribution of laboratory studies to this argument is not simply that scientific facts are produced through situated material and interpretive practices (Latour and Woolgar 1986; Knorr Cetina 1981). Rather, these practices require arrangements of bodies, instruments, and expertise. A laboratory animal becomes an experimental model through interconnected operations of selection, classification, handling, monitoring, and inscription. Species and strains are related to research questions, animals are counted in experimental designs, and bodily responses are rendered into measurements, records, and endpoints. These operations make living bodies comparable and scientifically workable without removing their capacity to experience pain, distress, or uncertainty (Lynch 1988; Rader 2004; Ankeny and Leonelli 2011). Nor is this transformation merely technical. The authority to intervene in animal life depends on institutional and regulatory arrangements that establish which actions are permissible, whose judgements carry weight, and how animal bodies can be made to stand for wider biological processes (Asdal 2008; Friese and Clarke 2012).

The transformation is therefore reciprocal. As animal bodies are made workable, researchers are trained to see, touch, classify, and respond to them in particular ways as part of their scientific and professional development. For early-career researchers, competence involves learning to recognise signs of distress, handle animals consistently, judge when intervention is warranted and translate observations into protocol-defined categories. Holmberg's (2008) account of developing a "feeling for the animal" captures this cultivated practical sensibility. Such attentiveness can improve welfare while simultaneously supporting experimental reliability; it is part of knowledge production rather than an ethical supplement to it (Druglitrø 2018; Greenhough and Roe 2018). What researchers learn to notice, record, or set aside thus has epistemic and moral consequences. The move from laboratory life to laboratory work brings the labour of making animals scientifically usable into the same analytical frame as the formation of those who handle them. It also makes visible a central tension: the animal must be rendered sufficiently stable for scientific comparison while remaining a sentient being whose responses and suffering require situated judgement.

3.2 Animal experimentation as care-killing work

Care-killing work describes a labour process in which attending to the needs and welfare of animals is inseparable from experimental procedures that may injure or end their lives. The concept draws on Hughes's account of "dirty work" and subsequent analyses of moral taint (Hughes 1958; Ashforth and Kreiner 1999), but it does not depend on treating laboratory researchers as morally compromised workers. Its focus is the organisation of tasks that combine apparently opposing obligations. Gentle handling, monitoring, analgesia, and timely intervention protect animals, yet also help make experimentation feasible and scientifically reliable. The biomedical purposes invoked to justify animal use cannot, on their own, explain how those required to carry out these practices manage their practical and moral demands.

Ethnographies have described the transformation of animal bodies into scientific objects and the coexistence of attachment, care and killing (Arluke 1988; Birke, Arluke, and Michael 2007). Subsequent studies show how animal technologists reconcile care and harm, sometimes exceeding formal welfare

requirements (Roe and Greenhough 2023; Druglitrø 2018; Greenhough and Roe 2018). Building on these accounts, care-killing work locates this tension within the organisation of experimental labour, examining how welfare practices, procedures that may cause harm, and the production of scientific evidence are coordinated within institutional constraints. The same researcher may monitor an animal's condition, check the adequacy of anaesthesia, assess an endpoint, and participate in the collection of tissues after death. Care is not thereby rendered insincere, nor does the presence of harm negate the reality of welfare work. The analytical question is how protocols, scientific expectations, and the demands of experimental continuity hold these activities together. For early-career researchers, experimental duties may involve close contact with animals but limited authority over design, alternatives or stopping criteria (Morahan et al. 2024b; Gonzalez-Uarquin et al. 2025). This distance between practical exposure to harm and authority over its conditions helps explain whose concerns can influence experiments. It also leaves room for negotiation and refusal rather than implying uniform compliance.

Care-killing work also entails forms of emotional and often unrecognised labour. Hochschild's account of feeling rules helps explain expectations of professional composure, while the sociology of invisible work directs attention to activities that sustain laboratory routines without necessarily appearing in scientific outputs (Hochschild 1983; Star and Strauss 1999). Recognising distress, steadying one's hands, conveying concerns to a supervisor, or returning to work after euthanasia may demand considerable effort. Studies of laboratory animal personnel have documented occupational distress and support needs (Glenk et al. 2020; LaFollette et al. 2020; Ferrara et al. 2022). The further question pursued here is how these demands are distributed through training, supervision, and unequal decision-making authority. Care-killing work thus brings animal welfare, scientific production, and the organisation of moral agency into a shared account of labour.

3.3 The *anaesthetic economy* of the laboratory

The *anaesthetic economy* denotes the institutional and affective arrangements through which animal pain, researchers' moral discomfort and the continuation of experimental work are managed together. Building on Daston's (1995) account of the moral economy of science, *economy* refers here not to a market in suffering but to the patterned distribution of labour, tasks, decision-making authority, moral responsibility and emotional burdens through which animal experimentation is organised and sustained. *Anaesthesia* operates in two distinct yet interconnected senses: literally, as a biomedical intervention intended to prevent or reduce animal pain, and metaphorically, as researchers may need to temporarily numb themselves to, or distance themselves from, the moral discomfort of inflicting harm in order to carry out experimental procedures. These processes are connected through the organisation of scientific work but are not ethically equivalent. Neither the complete elimination of animal suffering nor the disappearance of researchers' moral sensitivity is assumed.

Care-killing work is the central labour process within the anaesthetic economy, while four interrelated processes shape how this work is institutionally organised, ethically negotiated, and sustained. First, the moral relay describes how responsibility is distributed and negotiated among researchers, supervisors, veterinary personnel, ethics committees, and experimental protocols. This does not mean that formal

accountability disappears. Rather, the authority to decide and the burden of carrying out a decision may be located at different points in an institutional arrangement (McLeod and Hartley 2018). This distinction is particularly consequential for early-career researchers, who may perform experimental procedures while exercising limited authority over the decisions that govern them (Morahan et al. 2024b; Gonzalez-Uarquin et al. 2025). Braverman's (1974) account of the separation of conception from execution in the labour process helps clarify this asymmetry, while the moral burden of performing animal experiments adds another dimension. Second, protocolised conscience captures how procedural categories shape moral perception and the interpretation of animal suffering and death. Distress may be registered as a severity score, death as an authorised endpoint, and unexpected mortality as experimental loss. These categories are essential to oversight and welfare protection, yet they may also narrow the terms in which suffering is recognised or discussed. The protocol need not erase conscience to reorganise its field of attention.

Third, procedural compassion describes how genuine care and welfare practices are integrated into experimental procedures that also serve scientific reliability and continuity (Druglitrø 2018; Greenhough and Roe 2018). Practices such as careful handling, analgesia, anaesthesia, and monitoring protect animals while enabling experimental work to proceed. Their embeddedness in a protocol does not make such care false, but it raises questions about which needs and forms of attentiveness receive institutional recognition. Fourth, the hidden curriculum of detachment refers to how researchers learn, through supervision, repetition, and everyday laboratory interactions, to manage emotional distress while maintaining professional competence (Hochschild 1983; Holmberg 2008). This process does not necessarily produce indifference. Rather, early-career researchers may learn to continue working while experiencing moral discomfort. These processes can reinforce each other when care is recognised primarily insofar as it remains compatible with the experiment, but they also leave room for dissent, alternative practices, and refusal.

The anaesthetic economy also draws attention to the limits of what becomes visible as an ethical concern in everyday laboratory practice. The Three Rs guide efforts to replace and reduce animal use and refine procedures to minimise harm, whereas One Health calls for attention to the interdependence of human, animal, and environmental wellbeing (OHHLEP et al. 2022; Ulman et al. 2026). Reading One Health through the anaesthetic economy extends ethical analysis beyond animal welfare to consider the relationships among researchers' working conditions, institutional responsibility, scientific production, laboratory waste, and broader ecological consequences. Describing One Health as an "absent horizon" therefore means examining whether these relationships inform everyday laboratory decisions, rather than assuming that researchers lack broader ethical concerns. The explanatory value of the anaesthetic economy lies in showing how experimental work can be sustained through the coordination of care, harm, authority, and affect, while also identifying circumstances in which these arrangements are questioned or changed.

4. Methodology

This study adopts an interpretive qualitative research design combining in-depth interviews and ethnographic laboratory observations to examine animal experimentation as a form of scientific labour shaped by institutional arrangements, ethical responsibilities, and everyday research practices. The empirical material consists of 26 semi-structured, in-depth interviews with early-career researchers (ECRs) affiliated with the Graduate School of Health Sciences and the Graduate School of Natural and Applied Sciences in Istanbul, Türkiye, alongside ethnographic observations conducted at the university's Experimental Animals Application and Research Centre. The centre operates under applicable national regulations governing laboratory animal research, with experimental protocols requiring prior approval by the relevant Animal Research Ethics Committee. Combining in-depth interviews and ethnographic observations enabled researchers' experiences and ethical understandings to be examined in relation to everyday laboratory practices and institutional working conditions (Emerson et al. 2011).

Participants were eligible for inclusion if they were early-career researchers affiliated with university-based health or life sciences programmes, had at least six months of experience working with laboratory animals, and had been directly involved in animal care, handling, or experimental procedures. Early-career status was defined by participants' involvement in animal research and professional training rather than their academic degree level. Participants were recruited through purposive and snowball sampling (Noy 2008). The sample comprised 17 women and 9 men, aged 24–45 years. Eighteen participants were doctoral researchers, seven were master's researchers, and one was an undergraduate researcher. The undergraduate participant was included because early-career status was defined by participation in animal research and professional training, not postgraduate enrolment alone. Participants had experience with mice (n = 22), rats (n = 15), rabbits (n = 2) and zebrafish (n = 3). Categories overlap because several researchers worked with more than one species (Table 1).

Table 1
Characteristics of the participants

Participant	Educational programme	Animal species	Experience
P01	Medical Biotechnology (PhD)	Mice	2 years
P02	Histology and Embryology (MSc)	Mice, Rats	3 years
P03	Histology and Embryology (MSc)	Mice, Rats	1.5 years
P04	Physiology (PhD)	Zebrafish	3 years
P05	Medical Biotechnology (MSc)	Mice	2 years
P06	Neuroscience (PhD)	Mice	3 years
P07	Translational Medicine (PhD)	Mice, Rats	5.5 years
P08	Biophysics (MSc)	Mice, Rats	3.5 years
P09	Biotechnology (PhD)	Mice	6 years
P10	Medical Biotechnology (MSc)	Mice	4 years
P11	Neuroscience (PhD)	Rats, Mice	4 years
P12	Pharmacology (PhD)	Mice, Rats	2 years
P13	Translational Medicine (PhD)	Mice	3 years
P14	Physiology (PhD)	Mice, Rats	4 years
P15	Neuroscience (PhD)	Mice, Rats	4 years
P16	Pharmacology (PhD)	Mice, Rats	2 years
P17	Medical Biotechnology (MSc)	Mice	6 months
P18	Neuroscience (PhD)	Mice, Rats	2 years
P19	Translational Medicine (PhD)	Mice, Rats	3 years
P20	Medical Biotechnology (PhD)	Mice, Rats	8 years
P21	Molecular Biology and Genetics (BSc)	Zebrafish	9 months
P22	Biomaterials (MSc)	Mice, Rats, Zebrafish	1 year
P23	Neuroscience (PhD)	Rats	2 years
P24	Medical Biotechnology (PhD)	Mice	1 year
P25	Biomaterials (PhD)	Rabbits	6 months
P26	Histology and Embryology (PhD)	Mice, Rats, Rabbits	3 years

Face-to-face interviews were conducted in August 2025. They addressed pathways into animal experimentation, training and everyday practices, relationships with animals, moral and emotional experiences, institutional responsibility, the Three Rs, alternative methods and human-animal-environmental relationships. The semi-structured format allowed participants to expand on issues beyond the interview guide. The research team considered the material from 26 interviews sufficient for the study's interpretive aims; this judgement of thematic coverage does not imply that further interviews could yield no additional perspectives (Guest et al. 2006; Hennink et al. 2017).

Field observation at the Experimental Animals Application and Research Centre at the same university included one full day of focused observation by first author (GB) and documented through field notes. The observation focused on everyday laboratory routines, animal care practices and the institutional organisation of experimental work. The fourth author (YIU), a bioethicist, visited the centre frequently in connection with her membership to Animal Research Ethics Committee, developing contextual familiarity with its procedures and working arrangements. These visits were distinguished from formal field observation. The field notes were considered alongside the interview accounts to contextualise descriptions of practical training, care and the division of labour. The interviews remained the principal source for analysing participants' moral experiences and emotional responses, while the observational material was not used to estimate the prevalence of practices.

Ethical approval was obtained from Acıbadem University and Acıbadem Healthcare Institutions Medical Research Ethics Committee (ATADEK) on 10 July 2025 (approval no. 2025-11/422) before fieldwork began. Participation was voluntary, and written informed consent was obtained from all interview participants. With participants' consent, interviews were audio-recorded, yielding 783 minutes of recordings. Recordings were transcribed using Transkriptor software and checked against the original audio by the researchers. Interviews were conducted in Turkish, and the quotations in the findings were translated into English. The original Turkish passages are retained in the interview transcripts rather than reproduced alongside the translations in this manuscript. Participant identities were anonymised, and identifying details were excluded from the findings. Audio recordings, interview transcripts and other fieldwork materials are stored on the researchers' password-protected computers.

Qualitative data were analysed using MAXQDA (version 27.0), using a thematic analysis approach supported by a structured codebook (Fereday and Muir-Cochrane 2006). Coding was undertaken primarily by two authors (GB and KB). The initial coding framework was developed from the study aims and research questions, the topics addressed in the semi-structured interview guide, and theoretical perspectives drawn from the sociology of work, Science and Technology Studies (STS), and biomedical ethics. It was subsequently refined through iterative comparison with the empirical material. The coding framework comprised 9 main code families and 58 subcodes, with a total of 1,523 coding assignments made across the dataset (Table 2). Rather than using interview topics directly as analytical themes, codes captured participants' experiences, practices, justifications, emotional responses, and institutional relationships as expressed in their narratives.

Table 2
Qualitative coding framework

Main code family	Subcodes
1. Entering and adjusting to laboratory work	1.1 Pathways into animal research
	1.2 First encounters and shock
	1.3 Process and duration of habituation
	1.4 Learning by observing others
	1.5 Feeling rules in the workplace
2. Care and killing	2.1 Animal care and welfare labour
	2.2 Forming bonds with animals
	2.3 Deliberate distancing
	2.4 Killing and termination work
	2.5 Adverse events and traumatic moments
	2.6 Invisible labour
3. Emotional labour and emotion management	3.1 Emotional distress
	3.2 Suppressing and shutting down emotions
	3.3 Expectations of composure
	3.4 Spillover into private life and the body
	3.5 Sources of support
	3.6 Lack of support and understanding
4. Organisation of laboratory work	4.1 Ethics committee procedures
	4.2 Housing and physical conditions
	4.3 Comparisons across institutions and countries
	4.4 Monitoring and feedback
	4.5 Publication and career pressures
	4.6 Division of labour in the laboratory
5. Shifting responsibility	5.1 Lack of decision-making authority
	5.2 Delegation to supervisors
	5.3 Delegation to ethics committees
	5.4 Delegation to protocols, scoring sheets and endpoints

Main code family	Subcodes
	5.5 Delegation to “science” and necessity
	5.6 Delegation to technicians and veterinarians
	5.7 “If I do not do it, someone else will”
	5.8 Witnessing and reacting to others’ practices
	5.9 Personal boundaries and refusal
6. Protocolised conscience and procedural compassion	6.1 Translating pain into “data”
	6.2 Framing death as “completion” or “loss”
	6.3 Language of killing
	6.4 Reassurance from following rules
	6.5 Care beyond formal rules
	6.6 Compassion serving the experiment
7. Researchers' justifications	7.1 Human-benefit rationale
	7.2 Justifications concerning animals’ status
	7.3 Species and age hierarchies
	7.4 Awareness of self-justification
	7.5 Choosing not to know
	7.6 Continuing despite rejecting the justification
8. The Three Rs in practice	8.1 Determining animal numbers
	8.2 Uncounted animals
	8.3 Ethical versus economic reasons for reduction
	8.4 Refinement practices
	8.5 Knowledge and use of alternative methods
	8.6 Limitations of alternatives
	8.7 Inability to change methods
9. One Health and the future	9.1 Unfamiliarity with One Health
	9.2 Inferences and associations about the concept
	9.3 What happens to animals after death
	9.4 Assessment of environmental costs

Main code family	Subcodes
	9.5 Intentions and reasons to remain in the field
	9.6 Intentions and reasons to leave the field
	9.7 Future of the field and structural critique

The analysis moved from descriptive coding to identifying broader patterns of meaning and relationships among codes. Coded interview accounts were examined comparatively, with particular attention to practices of animal care and harm, the relationship between responsibility for experimental procedures and decision-making authority, institutional hierarchies, and the organisation of emotional labour. Observational material was used to contextualise interview accounts of work routines and institutional conditions rather than as independent evidence of participants' emotional states. Analytical themes were developed through iterative engagement with the empirical material and the study's theoretical framework, with the aim of identifying patterns across the dataset rather than reproducing the organisation of the interview guide (Braun et al. 2019; Fereday and Muir-Cochrane 2006). This analytical process contributed to the development of the anaesthetic economy as a conceptual framework bringing together the organisation of care-killing work, institutional responsibility, procedural understandings of ethics, and emotional labour.

5. Findings

5.1 Care-killing work: the coexistence of care, harm and procedural compassion

Working with laboratory animals involves certification, observation and supervised practice. Participants described learning experimental techniques gradually. P03 reported observing laboratory work during an internship before obtaining certification and subsequently participating in experiments under the supervision of the principal investigator. P12 described a related progression from observing a veterinarian perform tissue extraction to undertaking the procedure themselves:

"At first, the veterinarian there did the extraction. They showed us. Then we did it ourselves. That was how it happened." (P12, mice and rats, 00:00:53)

These accounts describe technical learning through observation and guided practice. Participants reported that care, monitoring, experimental intervention and tissue collection were divided in varying ways among postgraduate researchers, experienced colleagues, technicians and veterinarians. Such divisions of labour brought welfare practices and potentially harmful interventions into the same scientific work.

Care begins well before experimental intervention. P03, whose animals were scheduled for dissection, described the period before their deaths and the efforts made to maintain their welfare in the following

terms:

"Suppose I have an animal. It will be dissected in two months. My aim is for it to live happily during those two months. I have no other aim. I do not want it to feel anything; I want it to be happy. So, my teammate and I always look after them, stroke them. We speak quietly, so that they will not be stressed. You know, the animal only has two or three months to live. At least let it live well during that time. That is how we think about it." (P03, mice and rats, 00:17:18)

P02 described care as an obligation requiring regular presence in the laboratory:

"You are the one who gives it food, you are the one who gives it water, you are the one who gives it [unclear in transcript]. [...] Control over the animals' lives is, to some extent, in your hands, and they depend on you. [...] You cannot leave the animal unattended. If you have to be there at that time in the morning, you have to come then. Without fail." (P02, mice and rats, 00:07:29)

Feeding, monitoring and responding to distress can extend beyond preferred working hours. Participants also described attending to animals beyond experimental requirements. P02 recounted attempts to save an animal with a congenital condition:

"For five days, we went downstairs in the morning and evening. We gave it saline, prepared food for it, and kept it warm. Unfortunately, it did not survive. The end of the experiment... I was devastated. I could not even bring the experiment to its conclusion. We would not have used it in the experiment even if it had survived. But for five days we lived and breathed looking after it. That was all we did." (P02, mice and rats, 00:30:54)

P02's account suggests that an animal's survival could matter beyond its experimental value. P15, by contrast, described deliberately avoiding attachment in order to work rationally ("I do not form bonds. I try to act rationally, to think rationally. I know that if I formed a bond, it would be wrong", 00:15:14). The tension between care and intervention was especially evident in anaesthesia. P16 identified maintaining its appropriate depth during surgery as particularly difficult:

"If you give too much anaesthetic, the animal can die during surgery. If you give too little, it can feel it. We do not want it to die, and we do not want it to feel anything. [...] I think that is the hardest part of my work: maintaining the anaesthesia during surgery." (P16, mice and rats, 00:02:02)

P16 checked "paw reflexes" to assess anaesthesia ("when you squeeze its paw like this, the animal pulls its foot away. The disappearance of this reflex means the animal is under anaesthesia", 00:14:18). P05 waited until death was confirmed before tissue collection and found involuntary movements after death distressing ("even when its heart has stopped [...] its leg can jerk", 00:23:30). These accounts suggest that attending to bodily responses is simultaneously a technical skill and a practice intended to limit suffering.

Care may also extend beyond formal requirements while facilitating experimental procedures. P14 described habituating animals to researchers through repeated contact before interventions:

"Before we start working with each animal, we go there for about a week and begin taking care of it. We help out too, so that it gets used to us and so on. Then, as part of what we call handling, we go there every day for five or ten minutes." (P14, mice and rats, 00:13:14)

P01 similarly described rubbing cage bedding onto gloves to provide a familiar smell when handling mice ("We take some of their bedding and rub it on our hands, so the smell will be familiar. [...] So that they do not suddenly feel unfamiliar with the glove", 00:01:00). Such practices exemplify procedural compassion: attempts to reduce stress that also facilitate intervention. Their practical usefulness does not imply that researchers' concern for animals is insincere.

Nevertheless, participants' experiences of the care shown to animals differed. P17, who said they were responsible for care and injections in the project but had limited decision-making authority, stated that animal welfare took second place to the goal of obtaining data:

"Neither the animals' comfort nor their health is taken into account. The only thing that matters there is data. [...] When handling the animals, putting them in their cages, cleaning them, feeding them and so on, the only concern is that the animal stays alive so that I can get my data." (P17, mice, 00:08:08)

This account illustrates how formal welfare procedures may coexist with less attentive practices. The material conditions of care also matter.

P21 described manually changing water and feeding zebrafish before the required quarantine system had been installed ("we were manually giving our fish water and food. The pH and temperature actually need to remain very stable, and I think they were probably affected in this respect", 00:11:14). The account connects animal welfare to infrastructure as well as individual attentiveness.

P26 reported pausing an intervention when an animal showed signs of pain, but also described the importance of completing an experiment so that the harm would not be purposeless:

"Ultimately, you have to carry out that procedure because the experiment has to be done. Otherwise, you would only have harmed the animal." (P26, mice, rats, and rabbits, 00:30:11)

For P26, completing the experiment justified harm that had already occurred. Taken together, these interviews and the contextual ethnographic observations suggest that care and potentially harmful interventions may be closely intertwined in routine laboratory work. Care-killing work does not imply that welfare concerns are merely instrumental; rather, it describes how protective attention, scientific goals and sometimes conflicting ethical judgements are coordinated within the same labour process.

5.2 Moral relay and protocolised conscience: negotiating responsibility and ethical judgement

Participants' accounts indicate that researchers who performed animal care and interventions did not always control the decisions governing animal use. P05, for example, joined a project after the decision to use animals had already been approved:

“When the project was being written, that is, when the decision to conduct an animal experiment was first being made, I was not involved in that process. By the time I joined the project, that part had already been approved. But because I had an animal experimentation certificate, I was able to get directly involved.” (P05, mice, 00:15:56)

P12 described their supervisor's authority over alternative methods: “We actually have to do whatever our supervisor says” (P12, mice and rats, 00:08:07). However, discretion varied across projects. P19 described increasing freedom to shape methods as they became more senior: “I have now become one of the most senior members of my team. So, we have a little more opportunity to provide direction, of course, when people ask. My supervisor also gives me a lot of room. Things like, ‘How should we do it? You think about it, you set it up’.” (P19, mice and rats, 00:17:36). By contrast, P17 reported routine care and injection duties without comparable authority: “I wasn't really the main authority. I was only responsible for care, injections and so on. Routine experiments, those were my responsibilities.” (P17, mice, 00:02:28). These accounts illustrate moral relay: those directly performing interventions may have limited control over the decisions authorising them. Researchers may invoke supervisors, ethics committees or veterinary expertise when explaining the allocation of responsibilities. P02 described how a veterinarian's role in ending an animal's life could alleviate their own moral burden:

“Perhaps this may also be a way of easing my own conscience. I think of it as the veterinarian ending their lives, and me taking tissues from animals whose lives have already ended” (P02, mice and rats, 00:36:14).

P05 left killing to technicians, citing both reluctance to perform it personally and confidence in experienced staff: “I don't carry out the killing procedure, the 'ex' procedure, either. I have the technicians do it. Because I don't want to be the person who kills them (…) at least having someone more expert than me end their life also makes me feel a little more at ease in terms of my conscience.” (P05, mice, 00:08:32). P04, who worked with zebrafish, described the veterinarian as “a second pair of eyes” who might notice overlooked health problems. P24 similarly valued a technician's monitoring role: “The technician checks that place [the laboratory environment] every day. Let's say that animal underwent a procedure. There is more careful monitoring at that point as well.” (P24, mice, 00:21:58). Together, these accounts suggest that delegating tasks may ease moral discomfort while also providing expertise and safeguards for animal welfare. *Moral relay* does not simply mean avoiding accountability.

Ethics committee approval could similarly reassure participants while providing formal safeguards. P22 described completing a procedure despite personal discomfort because it had been approved:

“It wasn't pleasant, but the ethics committee approved it. So, whether I liked it or not was not very important; it was something that had to be done with ethics committee approval.” (P22, mice, rats and

zebrafish, 00:04:26)

Protocolised *conscience* refers here to interpreting acceptable practice through approval and procedures rather than the disappearance of personal judgement. Interview accounts also describe how ethics review may reduce proposed animal numbers, while veterinary consultation can lead to early termination or exclusion of an animal. Such mechanisms can therefore shape research conduct and protect welfare even as they provide researchers with an institutional basis for difficult decisions.

When an animal displays unexpected reactions, pre-established “humane endpoint” (humane termination point) criteria may provide grounds for ending the experiment early: “There are points we call endpoints, that is, humane endpoints. If pain is being inflicted or something different occurs, you may have to proceed to termination. You may have to end it early” (P09, mice, 00:05:20). These criteria both constrain animal suffering and standardise stopping decisions. Yet technical terminology does not remove the moral significance of killing. P11's words, “I don't want to say killing. On the day we are going to terminate the experiment, for example, I try not to look at them that way anymore” (P11, mice and rats, 00:07:26), show that the linguistic distinction between “killing” and “termination” also shapes the relationship the researcher establishes with their own action. Similarly, an ECR described the death of an animal due to inappropriate anaesthesia as a “loss” (P06, mice, 00:30:12) and stated that this also posed a problem for the experimental process. Death can thus be interpreted simultaneously as the end of a life and as an experimental event.

Scientific necessity was one justification for continued animal use, but it did not eliminate participants' doubts about their influence. P15 observed that “even if I said no, the use of animals or animal experimentation there would not decrease” (P15, mice and rats, 00:02:41). Other accounts, however, describe researchers questioning the relation between scientific validity and animal welfare. These differences indicate neither universal acceptance of animal use nor an equal capacity to challenge it.

Some participants described objecting to or refusing particular procedures. P04 described being emotionally affected when rats made “such a thin, high-pitched, squeak-squeak sound” as epileptic seizures were experimentally induced and, following this experience, objected to their supervisor with the words, “If I have to do this with rats, I don't want to do it; I said, let's change my research topic.” P04 then stated that they switched to working with zebrafish (P04, zebrafish, 00:18:59). Another early-career researcher refused to perform the killing procedure despite having been shown how: “When they are sacrificed, I don't know for whom we are sacrificing them, offering them up. (…) I have never ended any animal's life. They showed me, I didn't want to do it, I didn't do it (…) I really don't want a living being to die under my hands.” (P23, rats, 00:06:18).

These accounts indicate that opportunities to question or refuse interventions varied with researchers' project positions and working conditions. Within the *anaesthetic economy*, supervisory authority, review procedures and occupational expertise may help distribute moral burdens while protecting welfare. However, they do not necessarily extinguish researchers' ethical judgement or prevent the modification of established practices.

5.3 Emotional labour and the practice of professional detachment

Technical learning also involves managing the emotions evoked by laboratory animal work. While one participant described the emotional difficulty they experienced during laboratory animal training by stating, “on the second day, I left halfway through the class and had a panic attack” (P03, mice and rats, 00:02:42), other accounts repeatedly mentioned ECRs’ fear of holding animals during the first days of training. Some researchers stated that their emotional responses to experimental procedures changed as they gained experience working with animals. One researcher recounted feeling more upset during their first dissections, particularly when removing an animal’s brain for the first time but said that over time they had begun to view these procedures “completely professionally” (P02, mice and rats, 00:36:14). Nevertheless, not all participants experienced a similar process of habituation over time.

Professional detachment was often described as a condition of attention and bodily control. One researcher described their effort to keep emotions in the background, stating, “because if emotions come into play, your hands may tremble, you may think about other things, and your attention may be distracted” (P09, mice, 00:26:27). The same participant emphasised the importance of holding the animal in a single attempt wherever possible and completing the intervention without repeating it. Similarly, P16 reported initially finding it difficult to assess an animal’s level of anaesthesia during their first surgical procedures, describing the process in the words “I was trying to understand the animal by assessing its different reflexes”, and stated that this assessment became easier with experience (P16, mice and rats, 00:02:57). These accounts connect composure to procedural care and technical competence rather than emotional indifference.

Participants also distinguished caring for animals from forming close attachments. One researcher expressed this boundary in the words, “of course, you have to make the animals feel your affection. But unfortunately, you must not form a bond as though they were your own pets” (P26, mice, rats and rabbits, 00:11:08). Other accounts frequently mentioned avoiding such bonds out of concern that they would make subsequent interventions more difficult. However, this intention was not always realised. P11, for example, stated that during prolonged experiments, “even though I say I try not to form a bond, at some point I do form a bond with those animals”, explaining that this made ending the animal’s life more difficult (P11, mice and rats, 00:10:32). Detachment thus appears as a boundary that researchers may try, but fail, to sustain.

Participants described learning experimental procedures by observing experienced colleagues, while also acquiring informal expectations about emotional expression. P24 reported feeling inadequate during training when others volunteered for procedures that they did not wish to attempt. P17 suggested that expressing emotional distress could be viewed as 'a weakness' in academia: “in academia, they want you to adopt a somewhat more unemotional stance on these matters. When it becomes apparent that you have been very affected, they see it as a weakness” (P17, mice, 00:04:04). By contrast, P01 recalled an instructor reprimanding a trainee who insulted a mouse after being bitten. These accounts

suggest that professional socialisation transmits differing norms of composure and respect rather than a uniform demand for indifference.

One researcher described the discomfort experienced particularly after working with baby mice by saying, “I immediately erase this situation from my mind, right then” (P24, mice, 00:44:04). Another researcher, believing that they would be unable to continue this work if they carried the emotional effects of their laboratory experiences beyond working hours, understood their activity as “this is a job” (P16, mice and rats, 00:15:21). Invoking the scientific purpose of experiments may similarly help some researchers temporarily contain discomfort. Emotional labour thus concerns when and how feelings can be expressed as well as how they are managed.

However, the detachment established in the laboratory is not always sufficient to keep the effects of these experiences out of everyday life. One ECR described how experiments had affected their eating habits, stating, “Since I started working with animals, I cannot eat meat or meatballs. Especially if there has been a dissection that day, I cannot eat them for psychological reasons anyway (…) I feel disgust. It feels as though I can smell it”, and recounted that they could still sense the smell of formalin, used to preserve tissues, outside the laboratory (P03, mice and rats, 00:00:01). Similarly, P10 stated that they did not eat meat for three to four months after their first animal experiment. P15 described finding it emotionally difficult to think that there was no significant difference between the rat they had experimented on and their cat, which they encountered on returning home. P24 expressed a similar moral tension, asking, “How can I look my pet in the eye at home?” (P24, mice, 00:29:36). P05, meanwhile, reported feeling the moral burden of ending an animal’s life before and after dissection days. These accounts suggest that experimental work can affect life beyond the laboratory, including eating habits and relationships with companion animals.

Habituation did not follow a single trajectory. P12 stated that they initially felt more comfortable working with animals but, over time, became more sensitive to the animals’ condition. P05, however, expressed the limits of habituation by stating, “no matter how much you do this work, a feeling like ‘I’ve really got used to it now’ or anything like that does not develop; that feeling just does not arise” (P05, mice, 00:07:04). P09 also recounted that ending an animal’s life remained as difficult for them as it had been in the first year. Ways of coping with these difficulties and seeking support also vary. While some researchers reported being able to talk to their supervisors or colleagues, others said that they mostly dealt with their emotional burdens on their own.

These varied experiences suggest that professional detachment is not inevitable desensitisation but a practice negotiated between occupational expectations and ethical sensitivities. Emotional discomfort may influence some researchers' willingness to undertake future animal work; others continue while maintaining boundaries and developing technical skills. Within the anaesthetic economy, invisible emotional labour can help sustain experimental practice without resolving its moral tensions.

5.4 Beyond the cage: the uneven boundaries of laboratory responsibility

Participants most often discussed laboratory ethics in relation to experimental justification, animal numbers and the reduction of pain. Breeding, losses before experiments, procedures that produce no data and post-experimental disposal were discussed less consistently. This suggests variation in which stages become visible as matters of ethical responsibility, not a lack of concern among researchers.

One Health offers a perspective for considering research intended to benefit humans alongside animal lives and environmental consequences. The anaesthetic economy helps explain why particular harms may be recognised and addressed in everyday work while others receive less attention.

In the planning of experiments, the 3Rs principles, power analysis, literature-based calculations of animal numbers and ethics committee approval emerge as important points of reference. Participants emphasised reducing animal numbers and pain. One researcher framed reducing animal numbers as an explicit moral obligation, stating, ‘if you don’t need that animal, you shouldn’t kill it’ (P02, mice and rats, 00:07:29). The reasons differed. Another ECR stated that efforts to reduce animal numbers in their working environment arose ‘not from an ethical standpoint, but from an economic one’ (P15, mice and rats, 00:09:31). P17, meanwhile, explained that the animals had already been obtained when they joined the study and that they had not been involved in the project design, suggesting that practical responsibility and authority over animal numbers may reside with different actors.

Participants referred to animals bred without the desired genotype, losses before experiments, and interventions that yielded no results. Questioning the animal numbers reported in published studies, one researcher remarked, ‘who knows how many animals were used before that’ (P24, mice, 00:18:04). Some researchers reported that the microchips used to track laboratory animals’ identities sometimes became dislodged, meaning that animals whose identities could no longer be established might be excluded from experiments. Another early-career researcher described how an animal might have ‘died for nothing’ following a procedure that produced no data (P11, mice and rats, 00:06:12). These accounts distinguish reported experimental animals from the wider breeding and preparatory processes supporting research.

Some participants advocated more extensive preliminary studies before experiments began and obtaining as much data as possible from the same biological material. One participant explained that obtaining cells from brain tissue would normally require six or seven animals, but that they had initially attempted to work with a single animal in order to reduce the number used. When this attempt did not yield sufficient cells, rather than increasing the number of animals, they described exploring an alternative method, stating, ‘we are in the process of trying to move away from using animals and return to a cell line’ (P05, mice, 00:04:06). Reduction involved reconsidering the method itself, although the alternative had not yet been implemented.

Although organoids, cell cultures, organ-on-chip systems and computer modelling were viewed favourably by many participants, it was suggested that existing options might be insufficient, particularly for studying behavioural processes or effects at the level of the whole organism. Limited knowledge of alternative methods and examples of their practical application, together with established laboratory

ways of working, were also described as factors that make the transition to these methods more difficult. It was further noted that even bioinformatics studies conducted without using animals may rely on data obtained from previous animal experiments. Adopting alternatives thus depends on institutional resources and established practices, and does not necessarily eliminate reliance on earlier animal research.

Some researchers know that animals are placed in bags and transferred to cold storage but say that they are unfamiliar with the details of subsequent procedures. While one researcher expressed their lack of knowledge about what happened to animals after experiments by stating, ‘I have no idea what happens afterwards’ (P12, mice and rats, 00:26:13), another explained that they had previously asked about the disposal process but had not followed up on it: ‘I might have asked once or so. Then I think I put it out of my mind. Could they be incinerated?’ (P24, mice, 00:43:17). By contrast, P03 shared their understanding that deceased animals were incinerated in a furnace equipped with a filtration system, using a process intended to minimise environmental harm, while P26 emphasised the need to prevent animals exposed to chemicals used in experiments from entering soil and water. Post-experimental disposal therefore appears both as an unfamiliar downstream process and, for some participants, a matter of environmental risk management.

Single-use protective materials, animal housing, energy consumption and medical waste are among the costs identified by some participants. Others emphasised that alternative methods also require chemicals, imported materials, production infrastructure and computing power. One researcher’s question, ‘When we speak of sustainability, sustainability for whom?’, encapsulates uncertainty over the scales and processes against which environmental benefits should be assessed (P18, mice and rats, 00:19:32). These are participants' assessments rather than measurements of ecological impacts.

These findings suggest that ethical attention cannot be confined to treatment during experimental procedures. Animal numbers, preparatory losses, methodological choices and disposal involve decisions distributed across different people and stages. Within the anaesthetic economy, welfare procedures and ethical approval can make some harms visible and manageable while other consequences receive less routine scrutiny. *One Health* provides a basis for considering these uneven boundaries alongside human health aims and potential environmental effects. The material therefore indicates not an absence of ethical sensitivity but a selective distribution of ethical attention within the organisation of laboratory work.

6. Conclusion

By approaching animal experimentation not merely as a procedure subject to ethical approval but as a form of labour, this study draws attention to an important feature of biomedical knowledge production: the care that makes animals usable in scientific research is often provided by the same individuals who perform interventions that may harm them. Interviews with early-career researchers, considered alongside ethnographic observations conducted in a university animal research setting in Türkiye, point

to an unequal relationship between responsibility for performing experimental interventions and the authority to decide on their necessity. The ethical difficulties encountered in animal experimentation should therefore be understood not solely in terms of researchers' individual attitudes, but also in relation to the organisation of scientific labour.

The concept of the *anaesthetic economy* brings together two distinct processes in laboratory animal research. Anaesthesia and analgesia are used to prevent or reduce animals' pain during experimental procedures, while researchers may learn to distance themselves, at least temporarily, from the moral discomfort of inflicting harm. These processes are not ethically equivalent, but they become connected through the organisation of scientific labour. Within this labour process, care for animals coexists with procedures that may injure or end their lives. Situated at the intersection of medicine, anthropology, sociology, and philosophy, the concept highlights the ethical significance of seemingly technical practices such as anaesthesia, analgesia, and euthanasia. Protocols, institutional authority, the division of labour and professional socialisation make experimental interventions technically feasible and help researchers manage their emotional demands. Responsibility is distributed among different actors (moral relay), procedural categories shape ethical judgement (protocolised conscience), and welfare practices are incorporated into experimental routines (procedural compassion). Expectations of professional detachment further shape how researchers respond to the moral demands of their work. Nevertheless, moral distancing is neither complete nor inevitable. Researchers' continued experience of moral discomfort, their questioning of established practices or their refusal to perform interventions demonstrate that ethical agency can persist despite institutional constraints.

Another important implication of this study concerns the boundaries of ethical attention within the laboratory. Animal breeding and losses before experimentation, interventions that yield no scientific results, and post-experimental disposal processes may remain less visible than experimental procedures themselves. A One Health perspective enables ethical assessment to extend beyond experimental interventions by considering the relationships among animal lives, scientific labour, human health objectives and environmental consequences together. However, rather than assuming that alternative methods are inherently sustainable, this approach requires questioning which processes fall within the scope of ethical responsibility.

Conducted within a single institutional context, this research offers an analytical framework for understanding the organisation of ethical responsibility in laboratory animal research rather than claiming that its findings are directly generalisable. The central contribution of the anaesthetic economy concept lies in making visible how practices intended to protect animal welfare and the institutional and professional arrangements that enable researchers to manage their moral discomfort can come together within the same labour process. Strengthening ethical governance therefore requires attention to decision-making authority, emotional labour and opportunities to question established methods, alongside procedural compliance. Ultimately, the issue is not merely whether an experiment has received ethical approval, but who has the authority to define its necessity, whose ethical concerns can alter its course, and which consequences remain beyond the boundaries of ethical assessment.

Declarations

Data availability

The qualitative materials generated and analysed in this study include anonymised interview transcripts and observational material from laboratory fieldwork. Owing to the sensitivity of the material and confidentiality commitments to participants, these materials are not publicly available.

Competing interests

The authors declare no competing interests.

Author contributions

GB: Conceptualization, Methodology, Investigation (data collection), Data curation, Formal analysis, Writing—original draft, Writing—review & editing.

KB: Investigation (field interviews), Formal analysis, Writing—review & editing.

GK: Investigation (field interviews), Writing—review & editing.

YIU: Research proposal development, Writing—review & editing (including proofreading).

Declaration of generative AI use

ChatGPT (OpenAI, GPT-5.6 Sol) was used to assist with language editing and translation of text originally written by the authors. It was not used to generate research data, analyse the data, or interpret the findings. DeepL was used to translate interview excerpts from Turkish into English, and these translations were checked against the original transcripts by the authors, who are native Turkish speakers. All AI-assisted output was reviewed and verified by the authors, who take full responsibility for the accuracy, integrity, and content of the manuscript.

Ethics statements

Ethical approval for this study was granted by the Acıbadem University and Acıbadem Healthcare Institutions Medical Research Ethics Committee (ATADEK) on 10 July 2025 (approval no. 2025-11/422), prior to the commencement of fieldwork. The research was conducted in accordance with relevant ethical guidelines and regulations, including the principles of the Declaration of Helsinki.

Informed consent

Written informed consent was obtained from all participants prior to their interviews, including consent for the use of anonymised quotations in publications arising from the study.

Author Contribution

GB: Conceptualization, Methodology, Investigation (data collection), Data curation, Formal analysis, Writing—original draft, Writing—review & editing. KB: Investigation (field interviews), Formal analysis, Writing—review & editing.GK: Investigation (field interviews), Writing—review & editing.YIU: Research proposal development, Writing—review & editing (including proofreading).

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