The 3Rs alone will not reduce total animal experimentation numbers: A fundamental misunderstanding in need of correction

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1 Introduction

It may seem obvious that efforts to promote the 3Rs – "replace, reduce, refine" – will eventually lead to a reduction in total animal distress in science. But this is a fundamental misunderstanding of the 3Rs framework with potentially disastrous consequences which results from a superficial engagement with the logic and original philosophy of the 3Rs. While the misunderstanding itself has been pointed out, if somewhat in passing (e.g., Eggel and Würbel 2020; Rodriguez et al. 2023), the problem it poses for animal experimentation policy and governance has not been widely discussed. The goal of this article is to highlight this problem and make some suggestions for how to look for solutions.

Today, the 3Rs are a cornerstone of animal research regulation in many jurisdictions across the world, often as a requirement for animal experimentation authorization (Bayne et al. 2015; Hubrecht and Carter 2019). But apart from their role as a regulatory principle, the 3Rs are also often considered to be a governance principle encapsulating an implicit strategy to decrease animal experimentation over time and increase the focus on New Approach Methodologies (NAMs). A rise in total animal experimentation is often considered to be evidence that the 3Rs have failed on their own terms (see e.g., Blattner 2019; Balls 2020; Marshall, Constantino, and Seidle 2022). Sometimes, the second "R" of Reduction is straightforwardly taken to denote a reduction in the overall number of animal experiments (as Olsson et al. 2012 point out). Evidently, there is a widespread expectation that 3Rs implementation and innovation should bring a drop in total numbers that are assumed to be

associated with distress, such as the total number of animal experiments, of severe experiments, or of animals used ("total animal experimentation numbers" or "total numbers" for short). This interpretation can also be found on the part of government authorities who set the conditions for animal research, with the Swiss authorities (specifically, the Federal Council and the Federal Food Safety and Veterinary Office) providing a particularly stark example by repeatedly and explicitly claiming that the purpose of the 3Rs lies in reducing total numbers (see section 2).

This article challenges the understanding of the 3Rs as a governance tool to reduce total numbers, and does so on logical and historical grounds. First, the 3Rs cannot function as a governance principle because their implications strictly concern experiment design in the individual study, not the steering of science policy and governance at large scale. Even with perfect implementation and great innovation, the 3Rs do not imply any particular change at the level of total numbers. Second, to expect the 3Rs to reduce total numbers is to misunderstand their historical intention and underlying philosophy. Although the 3Rs grew out of a philosophical outlook that did in fact call for reducing the "sum total of pain and fear" (UFAW 1952), the 3Rs were supposed to achieve this only with the addition of feasible reform strategies. Considering the early history and philosophy of the 3Rs thus helps to see what parts are still missing so that the 3Rs can in fact lead to change in total numbers.

In the short term, the misunderstanding that 3Rs implementation and innovation will reduce total numbers must urgently be corrected because it encourages strategic complacency. This complacency runs diametrically counter to the authorities' goal of reducing total numbers and threatens their credibility in endorsing it. An important upshot of this article's argument is that, if authorities are truly committed to reducing overall numbers, it is not sufficient for them to support 3Rs initiatives. Instead or in addition, they need to invest in research that aims at developing feasible strategies for transformative governance that affects the totality of animal research in their jurisdiction.

In the following, this article will showcase the understanding of the 3Rs as a governance principle using the example of the Swiss authorities (section 2). Second, it will

explain why the 3Rs by their internal logic cannot guarantee any change in terms of total animal experimentation numbers (section 3). Third, it will be argued that the 3Rs were not historically built for the purpose of changing total numbers, although their underlying philosophy calls for the development of feasible reform strategies that can serve this purpose (section 4). The article will then conclude with suggestions for how authorities can correct the misunderstanding (section 5).

2 Case in point: Swiss authorities' expectations of the 3Rs

Switzerland provides a stark example of how some authorities regard the 3Rs as a governance principle for the reduction of total animal distress. In contrast to the European Union (per article 10 of Directive 2010/63/EU), Switzerland has never officially endorsed the long-term goal of phasing out animal experimentation. However, the aim of *reducing* the overall amount of animal research carried out in Switzerland has been endorsed – at first only tacitly, then with increasing explicitness – in the government's communication about the 3Rs. Consider some examples.

Swiss efforts to accelerate the development of NAMs began in 1982 with a National Research Program (NRP) titled "Alternatives to Animal Experimentation" (Follath 1988). After completion of the program, a public 3Rs foundation was created in 1987 (Stiftung Forschung 3R 2011; see also Neuhaus et al. 2022). The purpose of this foundation was to support projects that showed promise in improving practices in animal experimentation, highlighting that "the focus is on reducing the suffering of the animal" (Stiftung Forschung 3R 2011). The singular "animal" made it ambiguous whether the foundation's focus was on effectively reducing total animal suffering in Swiss science, or merely on improving the lot of some select animals while ignoring the bigger picture. In hindsight, however, a 25-year report on the foundation's activities straightforwardly credited the 3Rs with having reduced total numbers, suggesting that this was their true purpose: "In 1983, two million animals were used for experiments. Thanks to the two 3R principles of *replacement* and *reduction*, it was

761'675 animals in 2010" (Kennel and Kohler 2014, author's translation).[1] In 1991, amendments were made to the Swiss Animal Welfare Act that tasked the government with supporting the development and application of methods to replace, reduce, and refine animal experiments, first introducting the 3Rs into Swiss law (Confederation 1991).

When total numbers began to rise again in 2011, a parliamentary commission concluded that the 3Rs foundation's activities and resources were insufficient to "finally help alternatives to animal experiments break through" (Federal Council 2015, p. i, author's translation). A breakthrough in the relevant sense, apparently, would have been one that recognizably affects the total numbers. The Federal Council was then asked to compile a report to determine the need for action and available options to support NAMs. The resulting report (Federal Council 2015) did not question the premise that 3Rs efforts serve to reduce the overall numbers. It mentioned other potential factors of the antecedent reduction in total numbers since the 1980s, specifically the cross-border displacement of animal experimentation in the pharmaceutical industry, but it still credited the 3Rs with having reduced total numbers "by about two thirds" (Federal Council 2015, 5), suggesting that this was their purpose.

In response to the perceived failure of the existing 3Rs foundation to reduce the total numbers, the Federal Council announced the creation of a new institution, the Swiss 3R Competence Centre (3RCC) (Federal Council 2015, 6). On its German, French, and Italian websites about the 3RCC, the Swiss administration claims that the 3Rs "aim at replacing animal experiments, *conducting fewer experiments*, and submitting animals to less constraint"[2] (FFSVO 2018, author's translation, emphasis added). Likewise, on a webpage explaining the 3Rs, the Swiss administration claims that the 3Rs demand "the reduction of animal experiments to the absolute minimum" (FFSVO 2022).

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[1] A statement to the same effect, but restricted to primates, was made by the Federal Council in response to an MP's motion in 2022: https://www.parlament.ch/de/ratsbetrieb/suche-curia-vista/geschaeft?AffairId=20223301

[2] The English translation says "using fewer animals" instead of "conducting fewer experiments."

A further measure was created by the Federal Council in 2021 with the NRP "Advancing 3R – Animals, Research and Society," the very first sentence of the press release stating that the NRP aspires "to demonstrably reduce the number of animal experiments in scientific research and thus also the number of requisite research animals" (Federal Council 2021, author's translation). The 3Rs are openly touted here as measures to curb the total amount of animal experimentation conducted in Switzerland. This was not a singular mishap. The NRP's call document, too, explicitly described its purpose in terms of total numbers:

> "From a bioscience technology perspective, it will devise and develop methods and instruments that, if systematically implemented and applied, *will reduce the number of animal experiments and animals used* in testing in university and private-sector research in Switzerland by a demonstrably significant amount" (SNSF 2021, emphasis added).

From the above examples, we can conclude that the Swiss authorities recognize the rising of total numbers as a problem that needs solving, and that they assume that 3Rs implementation and innovation are the way to solve it.

However, one should not overstate the consistency with which Swiss authorities put forward these views. When confronted by members of parliament about the rising total numbers, the Federal Council has repeatedly argued that these figures were comprised, on average, from smaller samples, and that this indicates 3Rs success after all.[3] In this way, an ambivalent view of the purpose of the 3Rs – reducing either total numbers or only the numbers within individual studies – allows authorities to move the goalposts of 3Rs success as needed.

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[3] https://www.parlament.ch/de/ratsbetrieb/suche-curia-vista/geschaeft?AffairId=20163839
https://www.parlament.ch/de/ratsbetrieb/suche-curia-vista/geschaeft?AffairId=20164075
https://www.parlament.ch/de/ratsbetrieb/suche-curia-vista/geschaeft?AffairId=20173240

3 The logical misunderstanding: The 3Rs do not imply change in total numbers

The idea has some intuitive pull that, if one keeps replacing, reducing and refining, eventually NAMs will become dominant and animal experimentation will decline. But in fact, the 3Rs principle itself does not suggest this effect. By themselves, the 3Rs have nothing whatsoever to do with total numbers.

The basic problem is that innovation occurs not just in NAMs, but also in animal methods. The assumption that NAMs innovation will in time lead to lower total distress discounts innovation at the other end of the spectrum, that of new distress-inducing animal methods. But of course, innovation in this area is constantly blooming, as every new animal experiment is also a methodological innovation. What is more, these innovations may often conform better to established paradigms and face fewer obstacles than innovative NAMs (Lohse 2021). A stark example of a breakthrough innovation in animal experimentation can be seen in the advent of genetically modified research animals, which led to a significant increase in total animal experimentation numbers worldwide (Ormandy, Schuppli, and Weary 2009). Actual conditions aside, in principle, for every distress-inducing technique replaced, reduced, or refined, two new ones can be invented, such that total distress increases despite the steady progress of the 3Rs. On the whole, the 3Rs can diminish total distress only under conditions that, by coincidence or by design, hinder the innovation and proliferation of new distress-inducing methods. But the 3Rs cannot ensure that such conditions obtain.

Earlier generations of 3Rs proponents were quite conscious of this fact. Laboratory animal care specialist William Lane-Petter illustrated the progress of humane techniques with the image of a pipeline (1961): Thanks to the 3Rs, some animals are no longer needed in research and thereby exit the pipeline of animal research, but science constantly raises new questions that call for novel animal experiments, so that new animals are entering the pipeline as well. One of the authors of the classic work on the 3Rs, *The Principles of Humane Experimental Technique* (Russell and Burch 1959), has himself emphasized that this implies that 3Rs progress can be concomitant with stagnating or even rising total numbers (Burch

2009, 274). Although the assumption needs to be challenged that animal experiments must always take precedence in scientific exploration (Lohse 2021), it is undeniable that Lane-Petter's pipeline continues to exist as long as animal research remains the initial step.

Another related problem is that the 3Rs do not address any factors that determine total distress apart from individual study design. One example is the total amount of scientific activity carried out in a given jurisdiction – more testing leads to greater total distress. Another example is the relative activity of fields of science with unequal availability of humane techniques. Increased activity in fields where existing humane methods are not applicable of course leads to greater total distress.

An additional misunderstanding of the principle of Reduction is perhaps more obvious. It is often mistakenly understood to denote a reduction in the number of animal experiments or in research animals used in a given jurisdiction (Olsson et al. 2012). In truth, Reduction strictly refers to a reduction in the sample size within an individual animal study. But equal or greater total numbers are possible in smaller sample sizes, depending on factors outside of Reduction's control. As we saw in section 2, the Swiss authorities invoke this fact to argue that an increase in total numbers can be consistent with 3Rs success, but do not seem to acknowledge that this *ipso facto* undermines the suitability of the 3Rs for the policy objective of reducing total numbers.

4 The historical misunderstanding: The 3Rs and UFAW's "sum total"

The expectation that the 3Rs should reduce total distress is not entirely unfounded, but testifies to a superficial engagement with the history and original philosophy of the 3Rs. Considering the basis of the 3Rs in fact helps to see what needs to be added to them so that a program results that can indeed reduce total distress.

The Principles of Humane Experimental Technique by William M. S. Russell and Rex L. Burch, was commissioned by an organization called the Universities Federation for Animal

Welfare (UFAW). The stated aim of this organization at the time[4] was "to promote humane behaviour towards wild and domestic animals in Britain and abroad *so as to reduce the sum total of pain and fear inflicted on animals by man*" (UFAW 1952, emphasis added).

Why the emphasis on the "sum total of pain and fear?" With its mission statement, UFAW distinguished itself from other approaches to animal issues deemed "sentimental" by founder and longtime secretary Charles W. Hume (1962, 13). By a "sentimental" approach, Hume meant a determination to do what feels good to do, rather than what actually benefits animals. One of Hume's central examples was the traditional animal welfare movement in the United Kingdom, which he thought too strongly guided by feelings of love for specific species. He charged animal welfare societies with spending too many of their resources on rescuing stray cats and dogs (1962, 12–13) and criticized the Cruelty to Animals Act of 1876 for giving preferential treatment to beloved animals like horses, dogs, cats (1962, 117), foxes, deer, and rabbits (1962, 13). Hume also expressed his anti-sentimental attitude to animal welfare the other way around, by arguing that rats deserve just as much moral concern as other animals irrespective of their lack of popularity with humans: "*Maxima reverentia debetur rattis*"[5] (1956, 38; see also 1962, 13). Another approach Hume deemed sentimental was antivivisection, which he thought was primarily guided by "an urgent sense of horror" (1962, 116) at the expense of reason, as well as by a desire for ideological purity: "The enunciation of impracticable ideals may gratify the feelings of high-minded human beings but does not, in fact, ease the feelings of suffering animals" (1962, 11). Hume's approach to animal welfare, in sum, aimed at generating as much actual benefit to animals as possible, enacting "disinterested beneficence" (Hume 1962, 195).[6]

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[4] The notion of the "sum total" can no longer be found on UFAW's website or in its annual reports.
[5] "The greatest respect is due to the rat."
[6] Hume's accusations of sentimentality seem rather uncharitable, as there might be sound organizational reasons to devote extra resources to particularly popular missions (e.g., rescuing stray cats and dogs; making radical antivivisectionist demands). Doing so might help with acquiring funding, public attention and public legitimacy, for instance. Thus, what Hume regards as sentimental could be defended as perfectly rational tactics under nonideal conditions. Conversely, Hume himself could be accused (equally uncharitably) of himself adopting a sentimental approach by being guided by feelings of intellectual superiority, contempt for other activists, or an authoritarian desire to collaborate with, rather than challenge, those in positions of power.

Doing what actually benefits animals, in Hume's view, required a scientific approach to animal welfare and to the determination of organizational priorities.[7] UFAW had four criteria by which it determined its priorities: "(1) the intensity of the suffering involved; (2) its usual duration; (3) the number of animals affected; and (4) the feasibility of practical reform." (Hume 1962, 15; UFAW 1952, 4). The parallel to today's philosophy of Effective Altruism (MacAskill 2015; Singer 2015) is striking: Both emphasize doing the most good one can, as well as the importance of science for beneficence. In contrast to Effective Altruism, however, Hume's und UFAW's philosophy was not founded on an outcome-oriented ethic of value maximization, but rather on a motive- and character-oriented ethic of disinterested beneficence that revolved around acting on purely altruistic principles as opposed to selfish sentimentality. Still, it is noteworthy that the 3Rs originally arose from a philosophy which, like Effective Altruism, aimed to tackle the most pressing moral problems in the most effective way possible by taking a scientific approach.

In the first section of the second chapter of *The Principles of Humane Experimental Technique* (Russell and Burch 1959), the words "reducing the sum total" appear again, but the discussion of this ultimate goal remains very brief. Two points are made: First, the authors argue that UFAW's mission statement should be understood to include not just the specific experiences of pain and fear, but all forms of animal distress, by which they mean any unpleasant experiences. Second, they argue that high-priority problems could in principle be determined by calculation, if pain and fear (and other kinds of distress) could be quantified and measured precisely. They add: "In practice, we may reasonably allot priorities in terms of *either* extreme unpleasantness *or* very large numbers of animals, *or* a combined estimate of the two" (1959, section 2.1). And this, it appears, is all Russell and Burch have to say about strategic priorities.[8]

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[7] This move of Hume's is debatable, because an ethic of disinterested beneficence vis à vis animals could be enacted without the aid of science, appealing instead to common sense about what benefits animals and reflecting critically on one's own motivations.

[8] Russell and Burch's advice on this point (still repeated by Richmond 2000, 766) is simplistic. Strategic problem-solving sometimes requires focusing on smaller problems first, rather than

Conspicuously absent in Russell and Burch's discussion is Hume's and UFAW's criterion (4), "the feasibility of practical reform." While Hume himself did not elaborate on what exactly constitutes "feasibility," his focus on doing what actually benefits animals, as opposed to what feels good to do, suggests that he meant the likely efficacy of reform efforts. Other things being equal, preference should be given to efforts in areas where reforms are likely to succeed – success being defined in terms of reducing total distress. Not only does this principle match Hume's outlook, but it is logically necessary if UFAW's priorities are to fit its mission statement of reducing total distress.

Had Russell and Burch wanted to elaborate on the notion of feasibility, they would have had to make a strategic assessment of the *status quo*, envision potential futures, and engage with strategies and tactics for changing the enterprise of science at the societal level – the level of total numbers. They would have had to reach out to governance scholars, political scientists, sociologists, historians, legal scholars, or philosophers of science, in addition to the animal researchers Burch did in fact interview (see Balls and Parascandola 2019). Thus, the *Principles* might have been a very different book, had Russell and Burch not omitted the criterion of feasibility.

It is not clear why Russell and Burch were allowed to ignore strategic considerations, especially since Russell's original job description was "to undertake research into *the history and progress* of the introduction of humane methods into biological research, *with a view to encouraging further such progress*" (Balls and Parascandola 2019, 2, emphasis added). In any case, the project soon pivoted from this more historically and strategically oriented endeavour towards conducting a survey of currently available humane techniques in experimental biology and interviewing British animal researchers, with Burch joining Russell upon Hume's insistence (Balls and Parascandola 2019, 2). The task at hand, from that point on, appears to have been merely to identify *immediate opportunities* for making science

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immediately tackling the greatest problem. Practical priorities must be determined based on strategies, not just the size of the problem.

more humane and scientifically sound at a small scale, not to devise a *strategic program* for progress in the big picture.

The lack of engagement with the feasibility criterion in the *Principles* has some unfortunate side effects. One is that no goal for the 3Rs is defined. How extensive and how rapid a reduction of the "sum total" of distress are we to opt for? How are we to tell if the 3Rs are being properly implemented? It is the lack of goal definitions in the *Principles* that makes these questions difficult to answer to this day. The writings of UFAW and Hume are of little help on this matter too. The issue of goal definition was never discussed directly in any publications to my knowledge, and longtime UFAW chairman Peter Medawar made conflicting statements about whether he believed a future science completely free from animal suffering was possible (Balls and Parascandola 2019, 3). By all appearances, UFAW in Hume's day lacked a clear conception of its own vision or ultimate goal, instead conceiving of progress merely in terms of piecemeal improvements over the present.

Another side effect of the neglect of feasibility is that the *Principles* provide no guidance on resource allocation between innovating humane techniques and ensuring their widespread proliferation at the expense of inhumane techniques. Russell and Burch do discuss some social factors of progress, discussing in particular the problem that highly specialized scientists may not mutually communicate enough and miss out on novel humane techniques (1959, chapter 8). They therefore call for specialized organizations for methodological integration and cross-fertilization. But in the absence of a framework to assess reform feasibility or efficacy, there is nothing to ensure that these efforts will be enough to give NAMs innovation a big enough edge over innovation in distress-inducing techniques to produce a reduction in total distress.

In summary, though UFAW's philosophy advocated reducing the sum total of animal distress, the *Principles* do not constitute a comprehensive program to achieve this goal. They address a narrow part of the problem, namely the lack of humane techniques, but they do not systematically address how these techniques, once innovated, can be proliferated so that total distress diminishes. To treat the 3Rs as a full-fledged program aiming to lower animal

experimentation numbers, as the Swiss authorities do, is to misunderstand what this framework was built for and what it can be expected to achieve.

5 Correcting the misunderstanding

To believe that one has a strategy, when in reality one does not, encourages strategic complacency. Switzerland again provides a good example: Neither does it have a plan for the reduction of total distress in animal research, nor is the development of any such plan systematically pursued. This complete lack of a strategic approach means that great opportunities for reductions in total animal distress and advances in NAMs-driven scientific innovation are likely being missed – it would be sheer luck if they were not. So, recognizing the gap between the 3Rs and the goal of total distress reduction, how should governments respond?

Of course, one way to remove the gap would be to abandon the goal. Governments like the Swiss could change tack and stop claiming that their 3Rs efforts serve to lower the total numbers and make science more animal-friendly overall. However, this solution has many downsides:

First, it removes a powerful ethical justification from 3Rs efforts, namely that they make a difference to animals on the whole. This will likely make them controversial among sectors of the public, including animal protection groups. Thus, the 3Rs may lose what is arguably their main advantage in the political arena, namely their lack of controversy.

Second, abandoning the goal of total reduction also raises the question what else should be the purpose of 3Rs innovation programs. Perhaps the best purpose one could reverse-engineer is that the 3Rs serve to improve the ratio of benefits over harms generated by animal experimentation. In other words, the 3Rs are not meant to lower animal distress overall, but rather to improve researchers' justification in inflicting it. Notice, however, that the 3Rs cannot achieve this at the total level either. In parallel to Lane-Petter's pipeline of animal methods, there can be a pipeline of merely marginally net-beneficial animal research, such that the 3Rs help improve the harm-benefit ratio of some research, while new only

marginally net-beneficial research is constantly being innovated. This makes it very challenging to give the 3Rs a convincing purpose.

Third and perhaps obviously, abandoning an animal protection goal a government has communicated for decades may reflect negatively on that government and runs the risk of public outrage. Overall, abandoning the goal of total distress reduction seems to be a very costly decision.

The more thorough and robust way to correct the misunderstanding requires a new culture of animal research policy and governance that embraces not only regulation and innovation but also transformation. Decades of discussions on transformative governance for sustainable economies have shown that transformative governance poses a range of complex empirical, conceptual and normative difficulties (Avelino et al. 2019; Bentz, O'Brien, and Scoville-Simonds 2022; Braams et al. 2021; Braun 2015; Chaffin et al. 2016; Kemp, Schot, and Hoogma 2007; Köhler et al. 2019; Loorbach 2010; Patterson et al. 2017; Schot and Geels 2008; Visseren-Hamakers et al. 2021). These difficulties must be engaged with directly.

Thus, the first step towards correcting the fundamental misunderstanding of the 3Rs lies in resource allocation. Authorities committed to reducing total distress need to dedicate research funding to the development of feasible strategies for the reduction of total distress in science. This includes research contributions by political scientists, sociologists, governance specialists, legal scholars, ethicists, and philosophers of science. Innovation in scientific methods will not proliferate sustainably without innovation in policy and governance.

Resources could be reallocated in one of two ways: The first is to reassess the vision and mission of existing 3Rs institutions such as the Swiss 3RCC. Currently, this vision and mission (3RCC n.d.) matches the narrow scope of the 3Rs and is completely divorced from the idea of reducing total distress (despite the fact that this was the original political aim behind its creation, see Federal Council 2015). The vision and mission of institutions like the 3RCC could be adjusted so that they support research into the development of feasible and effective strategies for the reduction of total distress in their jurisdiction. However, it is essential that this adjustment is not a mere rebranding of traditional 3Rs efforts, but a real

change in the range of activities carried out by the institutions. So in addition to the vision and mission, the budgets, networks and organizational structures of these institutions would need to be adjusted. This may prove to be costly and impractical. The second option is to create dedicated institutions for transformative governance in animal research. These could function as sister institutions to 3Rs centres – the latter promoting innovation in humane techniques, the former ensuring their integration into feasible strategies for reducing total distress. Until such institutions exist, however, hopes in a reduction of total numbers are unfounded and misplaced.

Second, when it comes to public communication, authorities should stop suggesting that 3Rs initiatives will bring change at the total level and should delete previous statements to this effect wherever possible. State misinformation, aside from being dubious from a democratic perspective, is a threat to the quality of public debate about animal research and to the credibility of the authorities themselves. Instead, authorities should be transparent about the fact that the numbers are not falling because no strategy is in place to make them fall. This transparency would enable a public debate about the "how" of transformation, which in turn would help to see the extent of broad public support for different transformative governance measures. In jurisdictions like Switzerland, where animals are acknowledged as beings worth protecting for their own sake (as per the notion of "animal dignity," Bolliger 2016), it should also be made transparent that the 3Rs stand in tension with these deeper value commitments precisely because they do not aim for a total reduction.

7 Conclusion

This article has drawn attention to the fundamental misunderstanding that "replace, reduce, refine" is a governance principle aiming at a reduction in total animal distress. The Swiss authorities serve as a case in point to illustrate the impact that this misunderstanding currently has. In truth, the 3Rs are a principle for the design of individual studies that implies nothing whatsoever at the total level. Presuming that 3Rs efforts alone will reduce total distress overlooks the fact that innovation also occurs in distress-inducing methods, and it

represents a misunderstanding of what the 3Rs were historically built to do. If governments are committed to reducing total animal distress in science, then they should stop suggesting that 3Rs programs alone can bring down the total numbers, and should instead reallocate resources to the development of feasible strategies to achieve that end.

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