

COMMENTARY

Improving planning, design, reporting and scientific quality of animal experiments by using the Gold Standard Publication Checklist, in addition to the ARRIVE guidelines

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Several studies have demonstrated serious omissions in the way research that use animals is reported. In order to improve the quality of reporting of animal experiments, the Animals in research: reporting *in vivo* experiments (ARRIVE) Guidelines were published in the *British Journal of Pharmacology* in August 2010.

However, not only the quality of reporting of completed animal studies needs to be improved, but also the design and execution of new experiments. With both these goals in mind, we published the Gold Standard Publication Checklist (GSPC) in May 2010, a few months before the ARRIVE guidelines appeared. In this letter, we compare the GSPC checklist with the ARRIVE Guidelines. The GSPC describes certain items in more detail, which makes it both easier to use when designing and conducting an experiment and particularly suitable for making systematic reviews of animal studies more feasible. In order to improve not only the reporting but also the planning, design, execution and thereby, the scientific quality of animal experiments, we strongly recommend to all scientists involved in animal experimentation and to editors of journals publishing animal studies to take a closer look at the contents of both the ARRIVE guidelines and GSPC, and select the set of guidelines which is most appropriate for their particular situation.

LINKED ARTICLES

To view the article by Kilkenny *et al.* visit <http://dx.doi.org/10.1111/j.1476-5381.2010.00872.x>. To view the editorial by McGrath *et al.* visit <http://dx.doi.org/10.1111/j.1476-5381.2010.00873.x>

Abbreviations

ARRIVE, Animals in research: reporting *in vivo* experiments; GSPC, Gold Standard Publication Checklist

The increasing number of bioscience journals and of published studies involving animals demonstrates an increased production of scientific data. However, the reliable, concise and scientifically valid synthesis of all data on a specific research topic, notably by means of systematic reviews [A systematic review can be defined as a literature review focused on a single question which tries to identify, appraise, select and synthesise all available high-quality research evidence relevant to that question. Often statistical methods are used (meta-analysis) in order to combine the results of the included

studies], remains a challenge, predominantly due to the lack of reporting of experimental details (Kilkenny *et al.*, 2009; MacCallum, 2010; Simera *et al.*, 2010). Against this background, the Animals in research: reporting *in vivo* experiments (ARRIVE) Guidelines were published in the *British Journal of Pharmacology* (BJP) in August 2010 (Kilkenny *et al.*, 2010).

Because the BJP is actively involved in encouraging the debate on strategies used in animal experiments and invites scientists to provide them with feedback on the ARRIVE guidelines (McGrath *et al.*, 2010), we have written this letter.

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First of all, we would like to stress that we strongly support the initiative of the ARRIVE guidelines and believe it will make an important contribution to improving the reporting of animal studies. However, besides guidelines, such as the ARRIVE, for increasing the quality of reporting of 'completed' animal studies, there was, in our view, also an urgent need for guidelines for the design and execution of 'new' experiments. In order to meet both needs, we developed the Gold Standard Publication Checklist (GSPC) (Hooijmans *et al.*, 2010a), which is freely available at the ATLA website [In order to obtain the (free) PDF you need to 'register' at the ATLA website (<http://www.frame.org.uk/register.php>). You do 'not' need to subscribe to ATLA]. This GSPC checklist was presented and discussed at the World Congress on Alternatives and Animal use in the Life Sciences in Rome in 2009 and was published in May 2010, a few months before the ARRIVE guidelines appeared.

Given their partly similar aims, the GSPC shows considerable overlap with the ARRIVE Guidelines. Nevertheless, because the GSPC focuses not only on the reporting but also on the planning, design and execution of animal experiments and aims to make implementing all items necessary for optimal design of an animal experiment as easy as possible, it describes certain items in more detail. For instance, the housing conditions (humidity, ventilation, lighting, noise, caging) as well as nutrition and water regimes are more elaborately described, thereby significantly diminishing the likelihood of interpretation errors. In addition, the items of the GSPC are operationalized and specified. For example, the ARRIVE guidelines mention the importance of reporting about the type of food and the access to food, whereas the GSPC specifies more exactly what it means by 'type of food' (natural-ingredient diets, chemically defined diets or purified diets) and 'food access' (*ad libitum*, meal feeding or restricted/paired feeding, and in case of a non *ad libitum* feeding regime, the amount of food and the frequency and time of feeding need to be noted), and describes other important details of feeding (such as the composition or batch number of food, and whether or not the food is pre-treated). These kinds of details make it much easier for scientists to take all the specific items necessary for planning, designing and performing animal experiments into account. Moreover, these detailed descriptions also help improve the repeatability of animal experiments and control the variation within experiments, through which the quality of research improves and the number of animals needed in an experiment diminishes.

Furthermore, the GSPC paper demonstrates the importance of reporting husbandry conditions and basic principles of the design of animal experiments (like randomization and blinded outcome assessment) by providing an overview of the literature on how and when interference with experimental results can occur when these aspects are neglected.

Last but not least, the GSPC is presented as a checklist, and is therefore well structured and easy to use when designing and executing animal experiments. All items mentioned in the checklist are on a separate line, and can be checked off when incorporated in an experimental design or a manuscript.

Use of guidelines for designing, executing and reporting animal experiments will also make systematic reviews and meta-analyses of publications on animal studies more feasible

(Hooijmans *et al.*, 2010a,b). Systematic reviews lead to better interpretation of the already existing scientific results from animal experiments, through which a better translation to the clinic and more guarantees for patient safety become a reality. Furthermore, unnecessary duplication of animal experiments, and thereby unnecessary animal use and time loss, will be prevented. Systematic reviews are already standard practice in clinical studies and it is about time that they were standard practice in the field of animal studies as well (Pound, 2001; Macleod *et al.*, 2005).

For many years, the BJP has provided, compared with many other journals, quite extensive guidelines for authors regarding animal experimentation. This is confirmed by the finding that out of 11 important biomedical journals, the BJP attained the third highest score of the numbers of items scored on the GSPC. Because they do so well, and stress the need of guidelines for planning, design and reporting about animal experiments (McGrath *et al.*, 2010), we believe that our GSPC belongs in the guidelines for authors of the BJP as well.

To conclude, in order to improve not only the reporting but also the planning, design, and thereby the scientific quality of animal experiments, we strongly recommend to all scientists involved in animal experimentation and to editors of journals publishing animal studies to take a closer look at the contents of both the ARRIVE guidelines and GSPC, and choose and use the set of guidelines which is most appropriate for them.

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