

Editorial

The “So What?” factor

The “So What?” factor is, quite simply, the most important test that any scientist can put his or her work to, before starting, during execution, and following completion prior to presentation and/or publication. It is the ultimate judge of the worthiness of any scientific (or other) endeavour, and is too often failed by the studies that are currently being presented at conferences and/or published in the peer reviewed literature.

This Editorial originated with a conversation at CIC-TA Iberoamerican Congress of Environmental Contamination and Toxicology 2005 in Cadiz, Spain (25–28 September, 2005). One of us (PMC) is an older researcher, who was a keynote speaker at that conference. The other (LMG) is a student, completing his Bachelor’s degree and attending the conference to learn as much as possible.

The conversation began with some simple questions regarding biomarkers, measurements of whole organisms or specific tissues, and the validity of studies whose overall applicability and purpose were not immediately obvious. By this time the conversation was no longer simple; it was touching on key issues regarding why we do science and what we should and should not do when doing science. It now dealt with the “So What?” question.

Towards the end of the conversation the student asked the older researcher if he had ever published guidance to students and researchers regarding the “So What?” question. He had not, but it was a wonderful idea for an editorial, and an even better idea was for a joint editorial, comprising two key points of view—a student beginning his career, and an older researcher with more years behind than ahead in his career.

Hence this Editorial, which provides the two points of view, and then provides joint advice to researchers of all ages and level of experience. We begin with the viewpoint of the older researcher and continue with that of the student, finishing with our joint advice to any and all researchers.

I (PMC) have noted too often that researchers’ reports, posters, presentations, and publications fail to follow what we were taught in University: set up testable hypotheses;

attempt to falsify them; then report the results in terms of those hypotheses. I have also noted that too many studies are, to say the least, not as useful as they could/should be. Specifically, there are too many studies that might as well not have been done: for instance, testing the toxicity of a chemical to yet another organism without any plan other than to conduct and report such testing; developing a new index of some sort where there are already too many indices of doubtful utility; applying established tools to yet another location with nothing really new such that the study may be of local interest but is hardly of global interest (yet it may still be published in an international journal). When the “So What?” test is applied to such studies there is no clear answer as to why they were done, what overall purpose they serve, nor how they fit into what should be our main focus as environmental scientists: determining pollution; assessing pollution; and providing decision-makers with the necessary information to address pollution that is adversely affecting the environment in which we live.

In the beginning of a work/project I (LMG) usually have a question in my mind: what is the purpose of this work/project? Sometimes, when I don’t understand or don’t have the answer, the work/project does not make sense to me. So I ask myself: regarding this situation what should I do? Write the work even though I don’t understand its purpose or not write it? This was one of the points of my conversation with PMC, to whom I referred my doubts about the validity of a work of mine: I didn’t achieve my initial objectives, which were making it a good environmental managing tool. Should I publish it? It’s a fact that I need to improve my résumé, but if it is not a good work it is of no use for my personal satisfaction and reputation neither for the overall scientific work. His answer was “only a So What? test can solve it”. At this point John Lennon’s words came to my mind: “There’s something else I’m going to do, only I don’t know what it is, but I do know this isn’t for me” (The Daily Telegraph, Wednesday, 5 October, 2005, p. 23).

Based on our joint experience, we propose that both new and not-so-new researchers heed the advice given to Alice

by the Cheshire Cat in the children's book "Alice In Wonderland", written by Lewis Carroll. Those with children will recall that Alice asked the Cat "Would you tell me please which way I ought to go from here?", and the Cat, sitting on a branch just above her and slowly disappearing except for its grin, replied "That depends a good deal on where you want to go".

As scientists, we need to choose where we go by, in order:

1. Beginning with one or more questions.
2. Ensuring that those questions are worthwhile and address pollution issues in a "big-picture" context—be sure of why you want to answer those questions, and that the time and money (usually not your own) spent will be well spent. In this regard, ask yourself why anyone would be interested in the answers to the questions you are asking, and how many would really be interested/benefit from this information. Be honest with yourself. Answer the "So What?" question.
3. Setting up testable hypotheses based on those questions. Be prepared to find those hypotheses falsified and to obtain results that are not what you expected and that may not even make sense. This is far from an atypical situation in science—we often find that the answers we get do not match the question we asked, and now we have to determine the question(s) being answered. Finding those answers can provide more useful information than the questions themselves—particularly if the answer turns out to be "42" (Douglas Adams, *The Hitchhiker's Guide to the Galaxy*, The Ballantine Publishing Group, June 1997).
4. Conducting the study, and being flexible as you proceed, relative to item 3, above. Continue asking yourself the "So What?" question.
5. Writing up the study, presenting and/or publishing it. Ensure you again answer the "So What?" question, and again answer it honestly. Based on the answer to that question, make a final decision regarding presentation or publication. Remember, it is better not to present or publish a study that will not add to your reputation and may even detract from it, than to proceed irregardless.
6. Being proud of yourself for following all of these steps and truly contributing to the environmental sciences and thus, in a small but meaningful way, to the well-being of our planet.

The "So What?" question is also known as the "Laugh Test" and, as such, has been applied in a variety of human endeavours, ranging from aircraft design to political campaigns. It is the ultimate test to which we should apply both our work and ourselves. To do less is to betray both ourselves and our profession.

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