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Editorial Open Access

The Future of Scientific Research: Going Beyond the P-value

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The time has come to change the way research is performed and communicated. Traditional research was limited to established researchers working in institutions under controlled settings. When new strategies based on published research were applied in the field, often they didn't show the same results as in the original research. Examples that come to mind are calf feeding and timed-insemination protocols. Why is that?

I think the answer is a combination of three things; lack of causal relationship, lack of applicability in the field and lack of repeatability. Researchers commonly question the 'why'; why does something behave the way it does? This is why we establish study protocols where we control as many of the potential confounding factors as we can, exposing one group of animals to the factor of interest and measure the outcome. When all is said and done, we conclude that 'when we applied factor X, we either are likely to obtain outcome Z, or we are not'. When this association exists, it is commonly assumed by researchers to be a causal relationship, oblivious of the other criteria necessary to determine that a causal relationship really exists. This is one of the major flaws in research today. It would be interesting to know how many researchers apply these criteria for a causal relationship which were established by the Surgeon General, Sir Austin Bradford Hill, back in 1965 [1]. Besides the existence of a strong association, to establish causality, there is a need for a clearly defined temporal relationship between the factor and the outcome; does the outcome exist before the factor is present or applied? Moreover, the association needs to be biologically plausible, consistent and specific. There are a few other criteria that can help determine if the relationship is causal, but they are not necessary.

Of all these criteria, most researchers only look at the strength of the association between a factor and the outcome.This is where the coveted 'p-value<0.05' comes into play. This measure of statistical significance has become the outcome itself in many studies, completely disregarding the biological significance and field applicability of the studies. With enough animals in a study, we can show that, for example, a 5% increase in conception risk in a timed-insemination study is statistically significant. But is this 5% increase biologically significant? In other words, is it worth it? Is it worth handling animals more often, investing time, labor and resources to go from 35% to 40% conception risk? Is it worth it to the farmer to spend all that time to find and handle animals multiple times as opposed to invest that time in observing natural estrus that has 55% or greater conception risk? Is it worth it to the animals to be subjected to multiple handling and drug applications? Is it worth to chemically stimulate the oocyte to ovulate as opposed to allow nature to run its course and wait for the oocyte to be ready on its own?

Lastly, there is the issue of repeatability and external validity. Publishers should request researchers to detail the materials and methods section of their articles to assure the study can be repeated by other researchers under the same settings. Only this way will it be possible to establish whether a relationship is repeatable or not, and under multiple conditions, which is another necessary criterion for establishing a causal relationship. How many times have you found research articles studying the same associations but with different definition of an outcome, different materials, or even different testing methods? These studies are investigating different things and this is the reason why different or even opposite results are published.

The answers to the above questions may not be readily established in a study, but need to be thoroughly explored and discussed. This is a major black hole in many research publications. Some publications have an inane requirement of an extensive introduction but then skim through the materials and methods section and the discussion. Notice that some journals reduce the font size of the materials and methods section, which is the main part of the publication. Furthermore, how many articles have you read that show no association or negative results? You barely see them, but they are needed, too, so that nobody else spends time researching the same question.

Today, research is performed at many levels, especially under field conditions. Researches are looking to answer common daily problems that are identified as 'confounding and interaction factors' and subsequently lead to new questions and studies. Open access journals like this one are providing the necessary information for researchers around the world to advance science. However, just because there are more journals to publish our work to day, does not mean every research study should be published.This is where the standards are to be upheld by fellow researchers, through the anonymous peer-review process. Once a study is published in a peer-reviewed journal, it becomes an acceptable truth. Instead of focusing on publishing flashy results, we all need to make sure that only rigorously performed research is accepted for publication, independent of the results. This is for example a major flaw in an article published in 1987 that concluded in its abstract "*…that food animals are a major source of antimicrobial-resistant salmonella infections in humans and that these infections are associated with antimicrobial use on farms*" [2]. The authors of this article never measured antimicrobial use on farms, never measured other sources of antimicrobial-resistant *Salmonella* to compare to, and never proved the absence of resistance in humans previous to eating beef. The flashy conclusion, although flawed, trumped the required rigor that should be used in scientific publications, and unfortunately this paper is still today considered the foundation for that line of research. Keep in mind that their conclusion was not even included in the full body of the publication, and yet it is still considered an acceptable truth that haunts science to these days.

So, the time has come to change the way research is performed and communicated. By using open-access journals to publish our research, we all benefit from better access to knowledge around the

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world. By publishing both positive and negative outcomes, we all benefit from previous experience, so that science can advance even faster. By requiring detailed materials and methods to ensure that all published research is repeatable, we ensure that causal relationships can be proven over time, with plenty of external validity. And finally, by following an anonymous peer-review process, we can avoid pitfalls such as publishing a study that does not meet standards just because it was produced by a known researcher, or not publishing something worthwhile because it was produced by someone unknown; someone working in a non-recognized institution or by him/herself in the field. Everybody should be able to contribute to the universal knowledge, as long as their research is performed with the highest standards.

References

1. Hill AB (1965) The Environment and Disease: Association or Causation. Proceedings of the Royal Society of Medicine 58: 295-300.
2. Spika JS, Waterman SH, HooGW, St Louis ME, Pacer RE, et al. (1987) Chloramphenicol-resistant Salmonella newport traced through hamburger to dairy farms. A major persisting source of human salmonellosis in California. N Engl J Med 316: 565-570.