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# The importance of being earnest with mastitis research

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## Letter to the Editor

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To the Editor

A recent Research Reflection raised the issue of the relevance of a sizeable part of the current research on mastitis (Hillerton, 2020). The main criticism is that the surge of molecular, DNA-based technologies and *in silico* research tools occurred at the expense of animal experimentation. I concur with this view and would add a few comments.

In the last decade, 'omics' studies have been flooding the mastitis research field. There would be nothing wrong with this if these studies were followed or accompanied by experimental testing of the hypotheses generated. Initial explorations made possible by technological breakthroughs generate databases that can be mined thanks to powerful bioinformatics. These techniques are sensible means of opening-up new avenues of research. It has been convincingly argued that data-driven science and hypothesis-driven science are complementary and best carried out iteratively (Kell and Oliver, 2004). Proponents of DNA-based techniques point out that one of the strengths of their approach is that there is no initial hypothesis that could serve as blinders for research: no input, high throughput … but, all too often, no output (Friedberg, 2008). In any case, interpretations of their results are no evidence, to acquire this quality they need experimental testing.

The problem with the current stream of 'omics' studies on mastitis is that there is often no visible attempt or even commitment to doing experiments that might produce evidence consistent or inconsistent with the hypothesis generated by the analysis of the data. The desire to understand and acquire new knowledge is difficult to perceive in many studies, and the motivation seems to be only the possibility of publishing articles in specialized 'omics' journals which often have a good impact factor, due to cross-citations of so many publications, a foaming effect. It is certainly a temptation to surf the latest cutting-edge technologies, from transcriptomics (microarrays, then RNA sequencing), to proteomics, to metabolomics, to multi-omics approaches. A common example is the fishing of drugs, herbal extracts or probiotics touted as able to relieve mastitis based on *in vitro* experiments, claims which are seldom tested *in vivo*, but often followed by a series of studies of the same type with miscellaneous molecules. Another example is the glut of papers describing intramammary microbiota, in the absence of culture tests and *in vivo* experimentation. Some claims appear so unfounded that attempts to verify their biological significance would only reveal their irrelevance. As if the lack of thought and common sense could be compensated for by the sophistication of frontline methodologies. One of Oscar Wilde's maxims 'for the instruction of the over-educated' is that 'It is a very sad thing that nowadays there is so little useless information.' This was meant for Art for Art's sake without any use. But when it comes to science, it is a very sad thing that nowadays there is so much useless information generated by so many scientific publications. These publications do not serve the advancement of knowledge and do not provide any service to dairy farmers. Deplorably, this is a waste of the limited funding allocated to animal research.

My criticism goes to immediate development without research, to adventurous innovation without upstream investigation, to the use of powerful research tools without a thoughtful purpose. What could be a clever and sensible use of 'omics' in mastitis research, how could these powerful but descriptive tools be usefully integrated into experimental studies? One way to get the most out of 'omics' approaches is to combine several to investigate all possible samples and observations from an animal experiment, which necessitates the creation of a research consortium involving researchers from different disciplines and requires a lot of preparatory thinking. An additional positive fallout will occur at the ethical level, as fewer animals will be needed to obtain maximum useful information. Such scientific endeavors are labor-intensive and financially demanding, but what is the consolidated cost of many inconsequential studies? To resort to Oscar Wilde's help again, we cannot afford to overlook the importance of being earnest with the use of research funds devoted to mastitis research.

## References

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**Kell DB and Oliver SG** (2004) Here is the evidence, now what is the hypothesis? The complementary roles of inductive and hypothesis-driven science in the post-genomic era. *BioEssays* **26**, 99–105.

## Response by J Eric Hillerton:

The developments in controlling mammary gland health have come from testing hypotheses, revising (or rejecting) them based on evidence and, eventually, arriving at some agreed understanding. The understanding, in some cases, may only have been temporary, but that is the nature of progress in biology. Confidence in understanding comes often from contemporary work in different laboratories or other independent investigations. Similarly with thinking. Prof. Rainard and I, independently, have arrived at similar views. I welcome his erudite expansion of my recent Reflection. I find little to no fault in what he writes, I might only add that much of the solution to our dilemma might come from research funders rediscovering big and multigroup science, in place of 'big (and cheap) data' which, so far, has mostly only produced speculative and unvalidated models.

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