9 Open Science, Sustainability and Qualitative Assessment of Merit for an Objective Evaluation of Research

Roberta Gualtierotti

The evaluation of scientific research has changed over the last few decades. This is not only due to the introduction of innovative technologies such as the so-called multi-omics and the increasing awareness of the need of a personalized approach to healthcare [1], but also due to the growing consideration given to open science, which envisages open access publications, open data and open peer review [2]. However, different parameters should be evaluated in different research fields. Preclinical studies, even when dealing with primary cell cultures, should consider the differences of each individual such as sex, ethnicity and genetics. Translational medicine should be aimed at finding practical solutions for unsolved questions and unmet needs of patients, such as new therapeutic targets and novel biomarkers. The aims of clinical research in general should be feasible and practical, with socio-economic impact and, possibly, resource attraction from industry. Research aimed at implementing personalized medicine should be incentivized as it may provide more realistic disease models and efficient healthcare approaches. Ideally, pharmacoeconomic evaluations should be the foundation of each new study on pathogenic mechanisms and therapeutic targets, in order to demonstrate that research on that topic is useful. Another interesting concept is the sustainability of research [3]. Scientific research based on sustainable materials and methods should be encouraged, because it allows the reproducibility of the experiments and reduces the discrimination of low-income countries, thus contributing to a global dissemination of scientific knowledge.

In an open science environment, collaboration, transparency and accessibility of data contribute to worldwide scientific progress. Transparency should be evaluated based on preregistration of the aims and analysis plan before the beginning of a study and based on the accessibility of research materials, data and reports [2,4].

Stakeholder engagement is gaining considerable attention in research fields such as personalized medicine and guideline development and it should be positively evaluated.

As far as the value of a researcher is concerned, it should be evaluated based not only on the scientific production, but also based on merits and achievements. The h-index increases with the age of the researcher, even in the absence of new publications. Therefore, the evaluation of a researcher cannot be reduced to a number,

because the career of a researcher is the result of a complex set of different variables. The well-known Hirsch (h) index [5] varies greatly from field to field and researchers have diverse "missions" and indicators may be based on the relevance to policy, industry or the public rather than on academic excellence [6]. Furthermore, the h-index is often distorted by other variables such as length of career, age of the researcher or time of publication of an article [6]. The use of multi-dimensional criteria based on the specific research field [7] or the use of adjusted indexes that consider age and career of the researcher [8,9] may represent alternative solutions.

In evaluating a researcher, also other skills should be considered, such as the capability of searching collaborations with national and international research groups, of coordinating team members with different specialties. Knowledge is the only resource that increases when used. Therefore, the ability of disseminating findings to different stakeholders, including politicians and public, in order to inform decision-making and spread knowledge should be rewarded. Finally, although the presence of a mentor is often important and sometimes fundamental in the career of a young scientist, researchers should demonstrate that they are independent, for example, by being first or last authors, at least in the latest publications.

More importance should be given to negative trials. Indeed, if well conducted, negative studies require as much effort as other studies with positive findings. Similarly, negative results may be relevant as they may prevent other researchers from a waste of time and resources on similar studies and may pave the way for future research.

Based on this profile, the best researchers should be rewarded for their commitment with job promotions and funding. It would be great if funding agencies and sponsors could collaborate with the Academy to co-fund tenured positions or support the development of a laboratory with a team of co-workers. Even then, researchers should be periodically re-assessed.

In conclusion, the quality of scientific production should be based not only on indexes and metrics, but also on a set of qualitative criteria such as the practical consequences of findings, the rational use of resources, the way of conducting studies and the integrity and transparency of researchers.

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