

## Section 4: Expert Opinion

Science, music, literature and the one-hit wonder connection

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It is a well known fact that publishing in Science or Nature, the scientific world's top journals, is an incredibly difficult task. Despite being near-compulsory reading for any scientist, most never get a chance to air findings in their pages. Yet in the event of success, one's career may take a turn for the better, with doors opening to lucrative academic positions, conference invitations, funding possibilities, and more.

### Chance favors the prepared mind

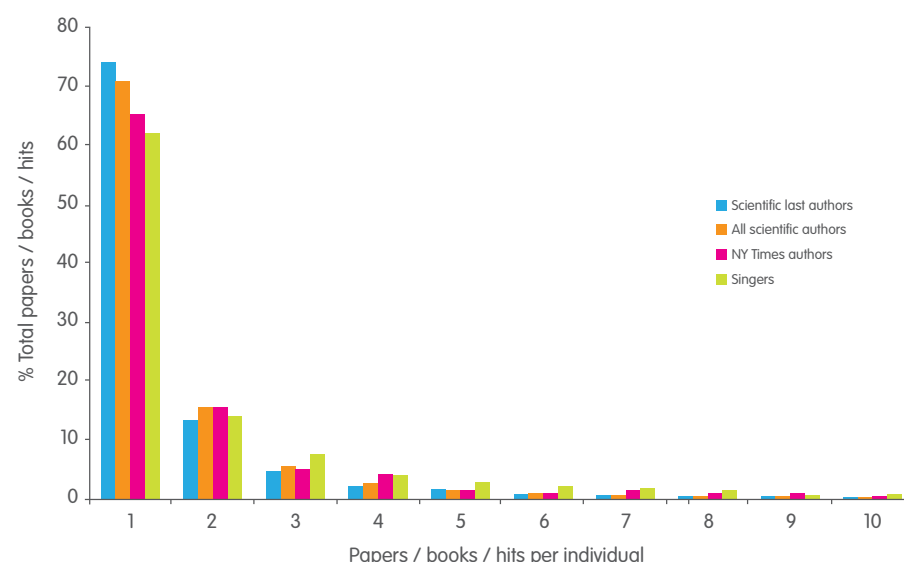
What then does it take for a scientist to publish in Science or Nature? Is it that those who publish in the "top two" are simply better scientists, in terms of skill, funding, infrastructure, co-worker availability and so on? Or is publication simply a matter of chance that depends on researchers stumbling upon an interesting finding? Clearly, both factors are important for success, as eloquently stated by Pasteur<sup>1</sup>, yet their relative contributions remains unknown.

In an attempt to address this question an analysis was undertaken with the aim of estimating the repeat probability of publication in Science or Nature.

The rationale was based on the fact that if one finds that most publications in the top journals are by authors that publish in them repeatedly, then sheer chance does not seem to be a major contributing factor to publication.

Yet if a publication in Science or Nature is a singular event, then one might conclude that the success might have been fortuitous, in a sense that the same individual is unlikely to publish there ever again. The results of such an analysis on 37,181 Science and 28,004 Nature publications are presented in Figure 1. Of these, 71% are by authors who have just one Science or Nature paper to their credit, with 15% of papers by researchers with two, and 6% with three. Interestingly, a slightly more polarized distribution is obtained when analyzing repeat publications by "last authors", taken to represent the principal scientist of a particular study. Here, 74% of last authors in Science or Nature are unlikely to be last authors again in the same venue.

**Figure 1** – Percentage of all publications in Science and Nature as a function of the number of publications per individual researcher (all authors or last authors). In order to focus on scientific publications, rather than editorials and commentaries, the following limiting criteria for a publication's "eligibility" were used: the presence of an abstract; no review qualifier in the PubMed database; and article length of at least three pages. Finally, in an attempt to minimize grouping publications from different individuals, only publications in which the author has at least two initials were selected for analysis. The bibliographic database used was the PubMed portal of the United States National Library of Medicine. Also shown is an analysis of authors whose books reached the top of the New York Times' bestsellers list (according to the data assembled by Hawes Publications). A similar analysis is also presented of the probability of musical artists (both groups and individuals) repeatedly placing their songs in the top 40 chart based on data compiled by the MBG top 40



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These findings suggest the following conclusions:

- There is less than a 30% chance of repeat publication in Science or Nature. Moreover, the odds are slightly worse for repeating last authors. Thus a scientist who has published in the top two journals is unlikely to repeat the endeavor by a ratio of more than 3:1.
- The chances of publishing repeatedly in Science or Nature are slightly smaller for the principal authors of the work in comparison with the other authors.
- The above potential success rate of repeat publication in Science or Nature is much higher than that of an “average” scientist, whose probability of publishing in Science or Nature is vanishingly small. Thus a publication in Science or Nature is an indication that the scientist is far more likely to publish there again compared with one who has not done so.
- Despite being in the minority, there is a definitive proportion of articles in Science or Nature that are published by authors that do so repeatedly. This list includes, not surprisingly, some of the most famous and influential scientists of our times.

Taken together, since most of articles in the top two scientific journals are written by authors that are unlikely ever to publish there again, they may be vernacularly classified as “one-hit wonders”.

### The one-hit wonder phenomenon

In line with the above, it is intriguing to repeat this analysis on other human creative endeavors, such as literature and music. Thus one can compare the sporadic nature of scientific productivity (as manifested in publications in the top two scientific journals) with other human vocations. Specifically, the analysis was repeated, searching for singers (or groups) whose songs reached the “top 40” charts, and for authors of books that topped the New York Times’ bestsellers list. As seen in Figure 1 there is a similarity between the repeat probability of success between singers, authors and scientists. Once more, nearly two-thirds of all the songs at the top of the charts, or books that make it to the top of the bestsellers list, are by individuals that will never repeat this feat. Thus, one finds that the sporadic nature of scientific creativity is mirrored to an extent in other human activities, such as literature and music. Finally it is notable that music, the field from which the term one-hit wonder arose, is the one in which the probability of repeat success is comparatively the highest.

One final analysis was undertaken with the aim of examining the predictive power of a publication in the best journals by potential academic recruits. In other words, in some of the world’s best academic institutions, candidates for tenure track positions are normally expected to have published in the top two journals prior to appointment. It is therefore interesting to examine whether researchers who published in Science or Nature during their post-doctoral fellowship or Ph.D. studentships are likely to publish in the top journals as independent group leaders. This question may be answered by examining the likelihood that an individual who has published in Science or Nature as a first author (as is common for post-docs and students) will later have publications in these journals in which they are listed as a last author (as is common for principal investigators/corresponding authors).

As seen in Figure 2, more than 87% of all scientists that have published in Science or Nature as first authors are unlikely to publish in the same venue later on as last authors. Furthermore, less than 7% of middle authors in Science or Nature will ever become last authors. Thus candidates who successfully published papers in the world’s top journals during the course of their studies are highly unlikely to repeat this feat as independent researchers.

In conclusion, it is possible to state that for the significant majority of Science or Nature authors publication represented a one-hit wonder, and the transition from a first (or middle) author to an article’s principal investigator is highly unlikely. Thus, chance seems to be of paramount importance in relation to preparedness<sup>1</sup> for the majority of scientists.

### References:

1. Dans les champs de l’observation le hasard ne favorise que les esprits préparés. “In the fields of observation chance favors only the prepared mind”. Louis Pasteur, Lecture, University of Lille (7 December 1854).

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**Figure 2** – Probability that an individual who has published in Science or Nature as a first author (light blue) or middle author (dark blue) will publish there later on as a last author. The same qualifying limitations were applied as in the analysis of Figure 1.

