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Mentorship in Science: Response to AlShebli et al., *Nature Communications* 2020

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On November 17, 2020, *Nature Communications* published a paper on the role of informal mentorship in the future careers of mentees (AlShebli et al., 2020). The authors analyzed millions of senior-junior author pairs in millions of papers across ten different disciplines over a century of research. "Informal mentorship" was defined as shared authorship in papers, with the junior scientist (mentee) being less than 7 years from first publication, the senior scientist (mentor) as more, and the two scientists sharing a discipline and belonging to the same US-based institution. Male or female gender was defined based on name. Mentors were identified as either a "Big-shot" or "Hub" based on citation or collaboration strength, respectively. Impact was measured by citation rate.

After their analysis, the authors concluded that, "*female protégés who remain in academia reap more benefits when mentored by males rather than equally-impactful females.*" Further, they note, "*our findings also suggest that mentors benefit more when working with male protégés rather than working with comparable female protégés, especially if the mentor is female.*" The authors then raised concern about diversity policies that promote female-female mentorships, on the grounds that not only would they negatively affect the career of the junior scientist,

but they would also be detrimental to the later success of the senior.

A major shortcoming of the paper is the inadequate definition of mentoring. Mentoring is a multifactorial process that cannot be measured solely on number of publications, order of authorship, or number of future collaborators. Informal mentoring is particularly difficult to measure and can have variable impacts depending upon how often the informal mentoring occurs and its substance. This point was clearly raised in the reviewers' critique. The authors defended their use of "mentorship" by adding a survey (that can only be described as cursory) to provide evidence that they had indeed successfully identified mentees. Notably, fewer than half of the 179 respondents self-identified as student mentees of co-authors. Hence the main topic of the paper is misrepresented; it is not about "mentorship" but "co-publication."

The authors examined the impact of female co-publication on mentee success measured by publication citation, an easily obtained metric that can be misleading when considering there is strong evidence for gender discrimination in science. Success in science depends on complex factors that are not considered in this number; we ask, hidden within the millions of datapoints, how many of these women took time off to have children? Or

changed their names? How many came to the US on a visa? How many had the choice of "Big-shot" mentors or were selected against in favor of men? How many were hired and promoted by major institutions? How many were subject to either explicit or implicit gender bias?

In an egregious oversight, the paper also did not acknowledge that over the century in which the publications were evaluated, women were and are underrepresented in the majority of scientific disciplines, and even fewer held leadership roles. The paper should have acknowledged this historical fact, while also noting that women receive smaller grants and less start-up funding than male peers (Oliveira et al., 2019; Sege et al., 2015), are paid less (Woolston, 2019), are promoted with reduced frequency, and hold fewer positions of power or influence (Niemeier and González, 2004). While there are now efforts to redress this imbalance, the paper merely highlights and confirms the long-existing gender disparity problem. Rather than using their analysis as a call for change, the paper is reactionary in its evaluation and response. This fuels the very prejudices that we must fight against.

An insight into the biased conceptual framework of the paper is shown by the authors' note, "A Closer Look





at the Protégés' Innate Ability," in which they write, "mentors with higher prior impact are more capable of selecting talented protégés, especially since these mentors are more likely to be good judges of innate ability in their area of expertise." That the authors believe a successful scientist will be born with scientific ability, and consider that successful mentors can recognize it, should make us all question the premises of the study.

Within hours of publication, reactions erupted on the internet, most expressing concerns about the validity of the conclusions. Many also criticized the editorial process that had apparently ignored valid critique from the reviewers that had not resulted in significant revision of the conclusions. Some responders were reminded of Harvard University president Larry Summers who in 2005 suggested that differences in innate aptitude rather than discrimination were more likely to be to blame for the failure of women to advance in scientific careers. In 2006 in a Commentary in *Nature* (Vol 442|13 July 2006) the (late) brilliant transgender neuroscientist Ben Barres refuted Summers' position and said, "It was only [through] changing sex at the age of 40 and experiencing life from the vantage of a man that I finally came to be fully aware of these barriers." Barres documented with careful data analysis the prejudice that has led to the dearth of women in science. This paper disappointingly demonstrates how much there is still to improve.

That the authors had the hubris to suggest policy changes because of this study is quite astonishing, and that the editors published it without regard to consequences is a grave misstep. It was irresponsible to use this flawed paper to make recommendations about

organizational policy changes without broader consideration of different findings and disciplinary viewpoints and the time context. Following through on policy changes recommended by the authors should be considered harmful to women in science and their advancement.

The paper was retracted by the authors on December 21, 2020 (AlShebli et al., 2020), acknowledging criticisms in relation to the use of co-authorship as a measure of mentorship while stating nevertheless that they "believe that all the key findings of the paper with regards to co-authorship between junior and senior researchers are still valid." We find this response unacceptable: the reasons for authorship positions on papers are also extremely complex and often disadvantage women who are not prepared or not able to dispute the decision of the senior author. Moreover, their retraction did not acknowledge their unjustified conclusions relating female gender to career success and policy suggestions.

Given our leadership roles in the International Society for Stem Cell Research, we are speaking out about the importance of eliminating inequities that young scientists face throughout their careers. Valuing and recognizing the unique career paths of a diverse talent pool combined with an institutional culture that supports and rewards inclusive excellence in mentoring practices and career advancement should be the core focus of institutional policies. This paper should be a call to arms to redress bias against women in science that has been systemic for decades, not used to insinuate that women mentors are detrimental to scientific progress and career advancement. We need to stop blaming the victim and

do all we can to make significant changes for gender equality.

CONSORTIA

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