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Authorship: an Engine for Research, and a Guarantee of Quality of Publication and Currency for Career Development

Yue Zhang*

Osteoarthritis Research Unit, University of Montreal Hospital Research Centre (CRCHUM), Notre-Dame Hospital, Montreal, Quebec H2L 4M1, Canada

Introduction

Authorship is academic currency for individual scientists [1-3] as well as being the engine for research in biology, medicine and related fields. Different fields might have different traditions, but the fair authorship guidelines and policies in labs and in institutions are always some of the most important guarantees of the quality of publications. A fair crediting system could relate credit to the responsibilities of the author and co-authors. On the contrary, an unfair crediting system will cause severe confusion, dampen enthusiasm for research, and reduce productivity and creativity in lab; the students, post-docs, research scientists, and technicians would lose their motivation to ensure the highest quality. In particular, they do not like to take a share of the responsibility after they have left one lab. Universities need to familiarize students with an institution's or journal's authorship guidelines, or those of the International Committee of Medical Journal Editors (ICMJE, www.icmje.org) and help students have a clear, authentic career vision. At minimum, what is published should be accredited according to ICMJE guidelines. ICMJE has added a fourth criterion for authorship as part of the new ICMJE Recommendations , which includes four criteria: (1) substantial contributions to the conception or design of the work; or the acquisition, analysis or interpretation of data for the work; and (2) drafting the work or revising it critically for important intellectual content; and (3) final approval of the version to be published; and (4) agreement to be accountable for all aspects of the work, thereby ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved, which **OMICS Group** journals may follow.

Authorship and proper credit: currency for career development

Your success is my success. The mentor–student relationship is critical for students' career development [4]. Let us assume that no support from a mentor is the "normal" state in the society. We will borrow from the analogy of the capacitator Hsp90 in development [5] and consider a simple model for a threshold trait (in this case, student career success) requiring at least six (genetic) determinants (i.e. decisive career success requirements/factors). In a population (i.e. an academic community) containing ten independent and additive determinants (i.e. decisive career success factors) affecting the trait (i.e. student career success), each present at a frequency of 0.1. The probability of an individual having at least six of these determinants and thus the trait (i.e. student career success) is about 1 in 7000. However, if the Hsp90 function is compromised (i.e. exceptional support is given by a mentor) to lower the trait's threshold (i.e. career challenge level) by just one or two determinants (e.g. by a fair credit as the author of a publication and/or introducing students to an academic network), the probability of the appearance of the trait (i.e. student career success) increases to 1 in 600 or 1 in 78, i.e. by a factor of about 10- to 100-fold (in reality, one professorship in comparison with hundreds of "academic drop-outs"). Once the frequency of the trait is increased in this manner, given a moderate fitness advantage, selection could increase the frequency of genetic polymorphisms (i.e. career development decision factors) affecting the trait to the point at which it no longer relies on reduced Hsp90 function (i.e. support from a mentor) to be expressed in the population (i.e. the academic community). This student would become independent and successful.

Firstly, to be supportive to students, correct credit, including authorship, which is not always difficult to assign, may leave us with beautiful memories. Twenty years ago, the supervisor of my bachelor thesis told his guest, a famous academic from China, that "It is he who designed and proved it." I felt very flattered indeed. 2ndly, to be kind to abounds. Previously, once, one of my post-doc supervisors kindly offered me the honor of first authorship to continue one of his half-finished projects. Taking into account that there was newly graduated bachelor college student in the lab acting as a technician, I advised that it would be better to credit her with first authorship if she took the burden of doing most of the remaining work. In my experience in Europe, where there is a unique technician-apprenticeship system, I knew at least two people who successfully converted their career tracks from technicians to graduate students; during their PhD programs, they had exceptional publications in top journals including *Cell* and *Science*. For a post-doc, certainly, the more first-authored publications, and the better; on other hand, it is great that being given first authorship of a publication may motivate a technician to be dedicated to science. Indeed, I am very happy that one technician in my previous lab has an excellent first-authored publication in a great journal.

Electronic "Digital Object Identifiers" for each key element in an article and a post-graduate tracking system for career development

Possibly, the by-products of having effective Digital Object Identifiers (DOIs) on every key element in publications may indirectly reflect who generated the data, along this person's lineage for some contexts [4]. Similarly, Linkedin and/or Facebook networking and a post-graduate tracking system may be helpful in doing another kind of job for PhD-holders (i.e. the university's unique "publications") as well. Interestingly, universities across Europe try to improve how they track graduates' career progress, according to the European University

***Corresponding author:** Yue Zhang, Osteoarthritis Research Unit, University of Montreal Hospital Research Centre (CRCHUM), Notre-Dame Hospital, Montreal, Quebec H2L 4M1, Canada, Tel; 1-514-890-8000 ext 23875; Fax: 1-514-412-7583; E-mail: zhanglee2006@gmail.com

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Association (EUA) report. The EUA concluded that if institutions follow career outcomes, they may take steps to improve them, such as to better their communication. On average, around 1 out of 4 institutions systematically track PhD holders' careers. The institutions suggest creating a student database and teaming up to standardize data collection (http://www.eua.be). The internet may empower such efforts. At the same time, the by-product of a graduate tracking system may reveal how and what an institution's academic descendants are doing after departing from one lab; it will also tell us whether a principal investigator (PI) is supportive of the career success of his/her students. In the area of student career development, notably, their help might be a lifelong.

Disputes among students and guidelines for solutions

Importantly, one crucial element for authorship is creativity [1,2]. In fact, current authorship requirements emphasize not only the tangibles (i.e. technical matters, data collection, running experiments, etc.) but also the intangible (conception and design, coming up with the ideas, insightful discussions and analysis, etc.). To be awarded authorship, a researcher must make an intellectual contribution: the article features with his /her work to reshape the experiment/ project progression [1,2], otherwise it would look different. On other hand, a summer student who comes to the lab to learn some techniques may just follow a protocol, so it would be optional to give him/her co-authorship, as anybody could have run the experiments. When a contributor's authorship is in question [1], people may check out lab-journals for the conception or design of the work and so on during the project's progression [1,2]. Similarly, perhaps, only a few physical parts of iPhone 5 are produced in the USA, but nobody has doubted that the iPhone5 is largely an American product.

Ideally, we need argue for crediting authorship if deserved and that no co-author would want to take credit that does not belong to her/him. Different opinions will exist, but it is great to obtain internal concurrence so as to make outside discussion unnecessary. As aforementioned, DOIs for individual elements in publications will be helpful.

A. Rough rank for authorship

1st author contributes(with around ½ arbitrary unit of contribution) > 2nd co-author (¼ of total) > 3rd (around 1/8 of total)> 4th (around 1/16 of total) >5th (around 1/32 of total)>6th (around 1/64 of total) >7th (around 1/128 of contribution) ….(To be the corresponding author, triangle hereby, > 1 unit /more unit)

B. Types of list of authorship.

The author list is clearly ranked in some disciplines such as life sciences and medicine. For example, alongside an invitation to work on collaboration, one of the invited students or post-docs who actually did the work might be listed in the first three co-authors so that not only the result but also new directions or new techniques introduced as mutual comparative advantages from collaboration can be acknowledged. People who initially discover a key phenotype could be the first, second or third co-author; the researchers who came up with the key ideas for the whole project could generally be considered as the first or second author or the co-first author [6]. The corresponding author (PI) is responsible for providing ideal conditions for scientific activitiesi such as securing funding and assembling the group of lab members. Logically and likely in reality, he/she is the first to recognize the significance of the research direction and emphasize observations. It is now common that the PIs will get the credit for the handwork of his/her post-docs and students, but the difference is that some PIs credit the people who did the actual work, while some others shift the credit to those who were not actual workers, so as to acknowledge a scientifically "joint effort", but emphasizes that he/she was the leader and designer.

In general, the authorship of >10% papers is inappropriately assigned [1,2], but sharing credit should be avoided too broadly. Without a key contribution, accepting courtesy authorship is sometimes painful [1,2], particularly everyone may get a share of the blame because of infamous papers [1]. For any co-authors, the corresponding author should ensure that the late addition gets to know and approve (as responsibility) the manuscript via active email addresses. It often happen that the first author registers with his/her co-authors' rarely-used emails. Even some famous journals even from Nature Publication groups (e.g. Scientific Report) do not email each co-author individually. In fact, in our opinion, the **OMICS group** journals could take the responsibility for doing so, particularly today with the ease of the internet era, so that the recipient of this courtesy may have the chance to think it over and avoid many problems. This can be repeatedly performed under revision until final proof so that every author can have a thorough knowledge of its name's exposure on one new manuscript; most importantly, this promotes him/her to improve the quality of manuscript. Besides, it could be better for the journal to assign not only one reviewer and/or one editor to evaluate one manuscript, although it is unnecessary to see biased comments definitively but logically risky. It is unclear why some journals just ask the sole corresponding author to take the responsibility for this in such email era. Sometimes, a researcher might be upset to see their name when the paper is printed if they indeed disagree with the conclusions. In most cases they eventually may have to accept the fact because of politeness and academic networking considerations (1). Logically, as aforementioned, corresponding authors may have the approval of their co-authors; in reality, because of business or ignorance, some do not realize it [1,2] .Furthermore, most PIs do not read or pay attention to the publication agreement as they might have assume that there is no problem or no change from what they did last time. The institution may have to emphasize on familiarizing their PIs and students with the guidelines. Thus one better system, *e.g.* co-email all individual authors, may prevent in part such errors. Otherwise, if misconduct accidentally or intentionally happens, a share of the blame will unexpectedly come to the institution.

Other aspects for such better systems may include: 1).Increasingly, journals are attempting to keep authors in line by asking for details on who did what [1]. In labs and in institutions, it could be better to have at least one electronic database for this. In cases of misconduct, these records should blame the right person [1]. 2). One suggestion is optional to delineate each person's contribution and a DOI for each element in the manuscript should help, as these descriptions need to go into more detail (rather than the brief) in-lab database, though the relevant details will probably vary by discipline [1,2]. 3). Each PI certainly needs a scheme to make authorship requirements explicit for students. Referring to Dr. Kosslyn's 1000-point system [1], a PI may develop his/her own point system [1,2]. The researchers who come up with the idea get 200–250 points, split between them according to their contribution during the project's progression; writing the paper is worth the same [1,2]. A further 500–600 points are available for designing and running the experiment and analyzing the data [1,2]. In general, researchers need score at least 100 points (10%) to

enter the author list [1,2]. If the project is large enough to require international collaboration, sometimes the threshold goes down to 10 points (1%) and less, with each person's point total determining their rank. However, the order is generally obvious. In a few disputes, the PI can easily referee them. Therefore, the evidence should include project progress reports, lab journals and historical data – a production lineage proven by DOIs, for example. 4). Prevention of things'going-awry. First of all, no work, no writing. Merely doing the write-up or doing the editing work does not justify a person being named as key author. This will take place if the PI defaults to allowing favourite students or the one native English speaker in the lab to do so without permission from who actually did the work, and thus compromise the reputation and fair crediting system in lab for a long time. Non-English speakers will need to practice English writing to improve their career development. 2ndly, we also need to avoid the "Lab Drone and the Lab Presenter" syndrome. The Lab Drone might be required to do all the work and takes all the initial project risk. Once a project proves to be of signiifcance, the project could be taken over by the Lab Presenter who may be good at PowerPoint presentations. He/she may even do more experiments (just copying/replicating the Drone's work but on different subjects) to further polish the work. For example, the Drone may genetically test a single mutant and find something interesting but, for some reasons, the Drone has to stop the experiment for a while. The Presenter could catch up with a double mutant based on what the Drone has done and publishes the later work at the same time or even ahead of the Drone's manuscript. It is not recommened but not rare in some labs. In the *Caenorhabditis elegans* community, different labs even avoid investigating the same gene if the content overlaps too much; occasionally if a labs does something unintentionally, some complaints from PIs may work well to stop problems (please see "First, in our friendly *C. elegans* culture, it was not polite to study someone else's gene, and age-1 belonged to Tom…" by Dr. Kenyon [7]).

However, when many scientists work together, determining authorship is not always easy. For PIs, keep in mind that the hard work includes screening the literature, careful design with the right background knowledge, taking pains to explore initial project and so on. Replicating prior success from the same lab is much easier than the establishment of new protocols. The same process applies for the creation of non-published constructs, ideas and so on as well as for unpublished works. If a PI ignores this difference, it is impossible for him/her to misbehave unintentionally. If the one who did the original one disagrees about publishing their work in another manuscript, in principle, this should be respected, although hijacking a manuscript from the same lab is not recommended. In general, further efforts to reach new agreements are obligatory rather than simply taking over by (mis)using authority dominance, which the students clearly cannot challenge.

In general, as summarized in Dance 's article, at the beginning, researchers carefully choose collaborators with whom they can get along with well [1,2]. Second, to discuss and write down authorship at the beginning and decide the type of authorship for the publication (Figure 1). Third, to write down whenever a novel idea is first proposed and keep doing so frequently during evolution of the project. Fourth, if one or two people drop out, to make an agreed final decision regarding authorship. This situation will make the authorship complex, so the researchers must be prepared to compromise or share credit. Fifth, when there are disputes, first try to talk it out amicably (and do it!) and understand the other person's point of view. Since students lack of experience and easy to have confusion with an authorship decision,

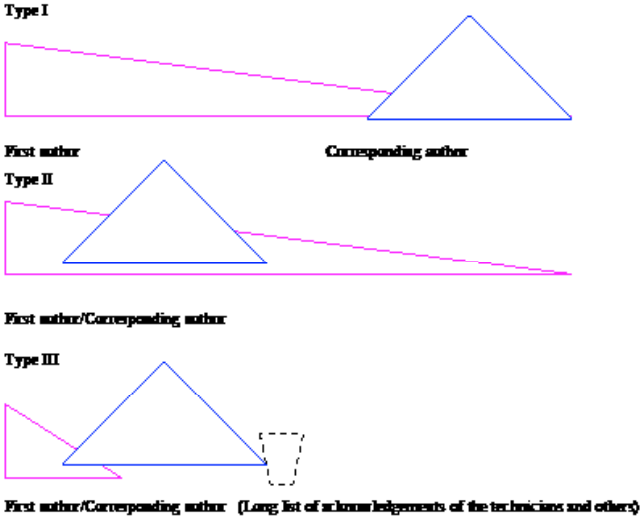

Figure 1: Three type of list of authorship.

they may enquiry it but not to accuse anyone [1,2] until their PIs explain how authorship was decided [1]. Sixth, if issues remain and students can't agree among themselves and even between him/her and PI, then move up to institution for investigation and recommendation [1].

Misuse of authorship connected to the industry

The misuse of authorship will happen when there is a hidden conflict of interest (COI) and money is involved [1,2]. Some medical journals publish a mixture of primary research findings and veiled advertisements for drugs with(out) reports on a medicine's true merits [4]. This type of article related to pharmaceutical companies is out of the scope of this discussion. However, guest and ghost publications represented around 20% of papers published in leading medical journals in 2008 [1]. A tracking system may likely reveal some hidden COIs and is easy to set up with the internet. The industry and medicine should work together intimately [1], but journals may take responsibility for removing the confusion, *e.g.* by marking such articles as "commercial articles", "industry-funded articles" and so on [1].

Conflict between students and PIs for key authorship

Once upon a time, scientific curiosity combined with minimal living standards encouraged students to explore, and articles were often of with type III (Figure 1). Now a big team is involved in a single research project. The disputes on key authorship are not surprising. In reality, most labs are often run as follows: A PI selects and recognizes smart and talented people and leaves them to pursue their own ideas. He/she enquires frequently for feedback and then leads them to move the scientific process forward. Currently, most PIs are busy for grant applications and /or admisntration but even lose their direct contact for actual bench work. While junior scientists each purse their own focus, they may not need to expect the PI to be committed to their individual work too much. However, bright PIs may recognize breakthrough ideas and then act on an initial experimetally-supported hypothesis. Students and post-docs are the initial driving force, Pis should become key subsequent supportive and contribution factors. However, some debates for credits will happen. At this point, students and PI might have often different appreciation on an initial success of pilot projects

in that students often feel lonely during their intial efforts whereby we donot actually have a standard. Otherwise, in some countries, after a period ranging from 6 months to 2 years, the students/workers have the legal rights to deal with their data themselves if their supervisors have no real reasons to hold them up for publication. In other countries, this may never happen. In a few cases, the supervisor assumes that he/she paid the student or post-doc so that the student was merely a contracted worker. In fact, in this society, graduate students and post-docs could officially and legally be considered as contracted workers, for example, no or few benefits for them. What we should never expect is a situation where a young scientist believes that he/she has made a groundbreaking discovery, but they are afraid that their boss would claim the credit solely and do everything to minimize this student's contribution. This student would then either choose to move to a different lab or to keep it hidden until they get their own lab before continuing that groundbreaking research, it will thus lead to delay of its establishment for several years or even decades.

Disclosure

This might be important for fair authorship, the quality of publication and the reproducibility of research. I suggest hereby the **OMICS Group Journals** to do so (and possibly free of certain legal issues as well). For example, as I usually have written in many review reports for manuscripts, the following statement could be added at the end of a paper: "This manuscript has been read and approved by all authors. The raw data will be well kept for at least 5 years for academic reference. The contribution list regarding details of authorship has been included in the lab database and/or the institution's database. This paper is unique and is not under consideration by any other publication and has not been published elsewhere in any manner other than indicated. The authors and peer reviewers of this paper report no conflicts of interest other than those indicated. The authors confirm that they have permission to reproduce any copyrighted material." In summary, the authors have their compliance with their ethical and legal obligations including, but not limited to, compliance with ICMJE authorship and competing interests guidelines, and so on.

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