Authorship is at the centre stage of science because it establishes the credit and responsibility for scientific discovery. It used to be more common that an author of a scientific work was a single person, and authorship did not present as much of a problem as it does today: at the time of writing this chapter the record number of authors on an article indexed in Medline/PubMed is 3040! All those researchers took credit for results from a particle physics experiment at the Large Hadron Collider at CERN – European Organization for Nuclear Research (Medline article record is available at www.ncbi.nlm.nih.gov/pubmed/23006356).

The story of how we moved from single author/inventor to hundreds and thousands of authors on a single article is a long one, and goes beyond this chapter (we recommend two review articles on the origin of authorship problems in biomedicine). We will here address only the issues of authorship relevant for editors and the integrity of the published record in scientific journals.

**There is no single authorship definition**

Unfortunately, there is no single definition of authorship to help editors in solving authorship disputes that frequently arise in journals. We performed a systematic review of research in authorship to gain insight into the differences among research disciplines. Although most of the studies came from health sciences (66 out of 118 studies), authorship research was also present in social sciences (33 studies) but was less frequent in natural sciences (9 studies). Across all scientific fields (and geographical regions and over time), it seems that ‘conception of research/research design’ and ‘writing the manuscript’ were research contributions that were considered most deserving for authorship. These contributions were not reserved for scientists but for all members of the research team.

The order of authors on the by-line was also common topic of research articles. For most sciences, the most important factor determining the order of authors on a manuscript was the amount of work contributed to the article, and not the prestige or academic or research position. There are few rules or guidelines on authorship order, but there is clear community agreement about two places on the byline: the first place is reserved for the researcher who made the major contribution to the work, most often including writing of the first manuscript draft (e.g., doctoral fellow writing a paper from his or her PhD thesis); the last position is held by the senior researcher, such as principal investigator or head of the research group. Other authors on a multi-authored article are usually ordered according to the amount or importance of their contribution to the published work. The complication of these rules has recently emerged in the form of ‘equal’ authorship, where two or more first (or last) authors are given equal authorship weight and thus equal research or academic evaluation advantage. The exceptions to the rules and conventions in authorship order are the fields of physics, economy and management research, where alphabetical order has remained the norm over time (the 3040 authors mentioned above are alphabetically ordered).

Group authorship has also emerged as common practice in large collaborations, such as multicentric clinical trials in health research. Individual authors from such large studies may be all listed on the by-line (such as in the previous example of 3040 authors on a physics paper) or as a single group, in which all members get authorship credit. In cases where a group is listed as an author, there is usually one person that takes on the responsibility of communication with the journal, as well as the role of the guarantor for the content of the manuscript.

All those who contributed to the study but do not deserve full authorship should be thanked in the Acknowledgement section of the manuscript. The examples include language editing, technical laboratory assistance or critical reading of the manuscript. Many journals require a signed agreement from named persons to confirm that they agree to listing their names in the acknowledgement.

**Misuses of authorship**

Authorship disputes are common in journals – up to 30% according to a study in journals from a major publisher. In our systematic review we identified 14 survey studies for which we could perform a meta-analysis to calculate a weighted average of almost 30% researchers reporting their own or others’ experience with misuse of authorship. Authorship misuse was reported more often by researchers outside of the USA and UK, i.e. in France, South Africa, India and Bangladesh (weighted average of 55%) in comparison with that reported in USA/UK or international
3.6: Scientific authorship

Identifying authors and other contributors is the responsibility of the people who did the work (the researchers) not the individuals who contributed to the work but whose contributions were not of sufficient magnitude to warrant authorship. Individual authors should review and approve the manuscript before publication. Editors should require authors and those acknowledged to identify their contributions to the work and make this information available to readers.

What guidance on authorship is available?

With the lack of universal definition of authorship or common rules for all scientific disciplines, editors cannot rely on an international editorial standard in dealing with authorship issues. The increasing number of non-listed authors, editors in some disciplines may find it technically difficult to fit hundreds or perhaps thousands of names on a printed page in their journal.

The best advice on authorship definition we can offer editors is that they should seek guidance in their professional communities. Editors of scholarly journals are aware of policies, guidelines and practices in their field, either IMCIE or internationally. The policies of learned societies or specialty journals often include definitions of authorship and guidance on resolving authorship problems. Box 1 provides examples of authorship definitions from different scientific disciplines. The first two are from editorial organizations, Council of Science Editors (CSE) and International Committee of Medical Journal Editors (ICJME). IMCIE’s authorship definition is widely accepted in biomedical and health fields. Table 1 presents differences in scientific fields and identifies common principles.

Two of the largest scientific publishers, Elsevier and Wiley-Blackwell accept the ICJME definition, in which an author should contribute to the idea AND execution AND writing of the study. Elsevier’s definition is more specific about contributions: “significant contribution to the conception, design, execution, OR interpretation of the reported study.” We also listed definitions from two prominent organizations. The first is most relevant for editors in Europe and covers all disciplines – The European Code of Conduct for Research Integrity from the European Science Foundation (ESF) and ALL European Academies (ALLEA). The Code defines that any of the following contributions merit authorship: “design, data collection, data analysis, or reporting.” We also present the definition of the American Psychological Association (APA) because its Publication Manual is widely used in social sciences. APA does not list specific requirements but describes it as “scientific or professional contributions.” What is most important for a journal is that it publishes its authorship policy, including the recommended definition of authorship and the procedures for dealing with authorship disputes when they arise in the journal. We recommend two sets of documents in defining these policies and procedures:

1. Guidance from the Committee on Publication Ethics (COPE) on handling authorship disputes, which describes good authorship practices and gives an excellent glossary of key concepts in authorship.

2. COPE flowcharts to help editors when they are faced with suspected publication misconduct. Six out of 17 flowcharts are dedicated to authorship issues: a) ‘Corresponding author requests addition of extra author before publication’, b) ‘Corresponding author requests removal of author before publication’, c) ‘Request for addition of extra author after publication’, d) ‘Request for removal of author after publication’, e) ‘Suspicious/ghost, guest or gift authorship’, and f) ‘Advice on how to spot authorship problems’ (See Resources at the end of this chapter).

The Council of Science Editors (CSE) also offers good advice for cases where the author is deceased. CSE lists the following key concepts (see Resources). In such cases, co-authors should inform the journal, and in some cases, when the journal asks for copyright transfer, ‘copyright documentation from a legal or legal proxy’ should be provided.

In health and biomedical fields, many journals have introduced contribution disclosure practice in an attempt to increase accountability and reduce the number of authors who are either IMCIE or internationally.

The policies of learned societies or specialty journals often include definitions of authorship and guidance on resolving authorship problems. Box 1 provides examples of authorship definitions from different scientific disciplines. The first two are from editorial organizations, Council of Science Editors (CSE) and International Committee of Medical Journal Editors (ICJME). ICJME’s authorship definition is widely accepted in biomedical and health fields. Table 1 presents differences in scientific fields and identifies common principles.

Two of the largest scientific publishers, Elsevier and Wiley-Blackwell accept the ICJME definition, in which an author should contribute to the idea AND execution AND writing of the study. Elsevier’s definition is more specific about contributions: “significant contribution to the conception, design, execution, OR interpretation of the reported study.” We also listed definitions from two prominent organizations. The first is most relevant for editors in

Box 1. Examples of authorship definitions by editorial organizations, major publishers and professional organizations from different scientific disciplines

All disciplines: Council of Science Editors - CSE’s White Paper on Promoting Integrity in Scientific Journal Publications (available from: www.councilscienceeditors.org/i4a/pages/index.cfm?pageid=3638#221): Authors are generally defined as those who have contributed significantly to a scientific report to be listed on the by-line of the published report. Many journals provide guidelines on authorship in their instructions for authors. Some professional and research funding organizations and academic institutions also provide such guidance. Principles, customs, and practices regarding authorship differ from one scientific discipline to another. This document aims to summarize common principles to guide authorship across scientific disciplines.

Principles related to authorship with general consensus include the following:

Identification of authors and other contributors is the responsibility of the people who did the work (the researchers) not the people who publish the work (editors, publishers). Researchers should determine which individuals have contributed sufficiently to the work to warrant identification as an author.

To be considered as an author, the contributor must have contributed to the work sufficient to fulfill the criteria for authorship as defined by the ICJME (see Resources). If the number of authors is unusually high, one should consider breaking up the manuscript and publishing it in more than one article.

In the case of an open-ended responses of authors in a general medical journal. BMJ Medical Research Methodology 2012, 12: 189. DOI: http://dx.doi.org/10.1186/1740-8440-12-189

Finally, it is important to keep in mind that journal editors cannot police publishing misconduct, including authorship. They can provide guidance on common authorship practices in the scientific field covered by their
Authorship credit should be based on 1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content; and 3) final approval of the version to be published. Authors should meet conditions 1, 2, and 3.

When a large, multicenter group has conducted the work, the group should identify the individuals who accept direct responsibility for the manuscript. These individuals should fully meet the criteria for authorship/contribution defined above, and editors will ask these individuals to complete journal-specific author and conflict-of-interest disclosure forms. When submitting a manuscript authored by a group, the corresponding author should clearly indicate the preferred citation and identify all individual authors as well as the group name. Journals generally list other members of the group in the Acknowledgments.

Acquisition of funding, collection of data, or general supervision of the research group alone does not constitute authorship.

Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content.

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Authorship of the paper
Authorship should be limited to those who have made a significant contribution to the conception, design, execution, or interpretation of the reported study. All those who have made significant contributions should be listed as co-authors. Where there are others who have participated in certain substantive aspects of the research project, they should be acknowledged as contributors.

The corresponding author should ensure that all appropriate co-authors and no inappropriate co-authors are included on the paper, and that all co-authors have seen and approved the final version of the paper and have agreed to its submission for publication.


8.2 Best Practice: Authorship and acknowledgement
The International Committee of Medical Journal Editors (ICMJE) provides a definition of authorship that is applicable beyond the medical sector. Wiley-Blackwell recommends that journal editors consider adopting the ICMJE authorship criteria as part of their editorial policy. The ICMJE authorship criteria state 'authorship credit should be based on 1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content; and 3) final approval of the version to be published. Authors should meet conditions 1, 2, and 3.'

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• Sequence of authors should be agreed by all authors, ideally at the start of the project or the initiation of the article/monograph, and may follow national and/or disciplinary codes. The criteria for deciding the order of authors should be agreed at the start of the project or writing.
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