RSC 9: AUTHORSHIP: HOW TO DETERMINE WHO IS NAMED AS AUTHOR OR NOT?

Authorship is much fought and fraught about. Authorship is about taking credit for research; publications are a key performance indicator and inevitably an ego matter. Traditionally it is the bad old professor who demands to be named without doing anything, while those in the lab do all the work, without getting due credit. There is plenty of abuse such as honorary authorship, unjustified authorship, publications submitted without contributors, as well as submissions without knowledge of the authors. It does not help, that perceptions and customs differ greatly with discipline and geographic location. Collaboration across disciplines and geographic regions can cause a lot of misunderstanding if one does not understand 'local' customs and fails to set clear boundaries. Naturally, this is written for water process engineering. Adding everyone might unduly inflate the authorship lists and dilute the contribution of the main researchers. The situation has triggered the creation of guidelines for good scientific conduct, such as the DFG Kodex, have been created, where the authorship topic covered. However, even the best-intended guidelines allow room for interpretation and hence decisions are rarely black and white. Individual contributions may be queried, especially when appointing or promoting professors. Quantifying the contribution is challenging and who verifies what a candidate claims? As usual, at IAMT open debate and early discussion are part of the process, which cannot prevent some feel ill-treated. While at times the decisions may appear inconsistent, the approach I take is that, overall, the decisions are fair, consistent and reflect, in some reasonable manner, the contribution. Generally, the longer authorship discussions are delayed, the greater the risk of conflicts. Looking at the guideline relevant to IAMT, the DFG KODEX, authorship is defined as follows.

Guideline 14: Authorship

► An author is an individual who has made a genuine, identifiable contribution to the content of a research publication of text, data or software. All authors agree on the final version of the work to be published. Unless explicitly stated otherwise, they share responsibility for the publication. Authors seek to ensure that, as far as possible, their contributions are identified by publishers or infrastructure providers such that they can be correctly cited by users.

Explanations:

The contribution must add to the research content of the publication. What constitutes a genuine and identifiable contribution must be evaluated on a case-by-case basis and depends on the subject area in question. An identifiable, genuine contribution is deemed to exist particularly in instances in which a researcher – in a research-relevant way – takes part in

- the development and conceptual design of the research project, or
- the gathering, collection, acquisition or provision of data, software or sources, or
- the analysis/evaluation or interpretation of data, sources and conclusions drawn from them, or
- the drafting of the manuscript.

If a contribution is not sufficient to justify authorship, the individual's support may be properly acknowledged in footnotes, a foreword or an acknowledgement. Honorary authorship where no such contribution was made is not permissible. A leadership or supervisory function does not itself constitute co-authorship.

Collaborating researchers agree on authorship of a publication. The decision as to the order in which authors are named is made in good time, normally no later than when the manuscript is drafted, and in accordance with clear criteria that reflect the practices within the relevant subject areas. Researchers may not refuse to give their consent to publication of the results without sufficient grounds. Refusal of consent must be justified with verifiable criticism of data, methods or results.

What constitutes a 'genuine, identifiable, contribution? Concept, data, interpretation, writing. Yet it is open to case-by-case evaluation and thus provides room for interpretation and potential conflict. A more thorough definition and clarification of practices is needed that can then be applied to make decisions. No matter what the position of the author is, a clear and identifiable academic contribution is required, which would be linked to the expertise of the person, beyond reading over and giving some comments. Giving comments and discussing is common in a scientific community and this is what peer reviewers do without becoming authors.

- **FIRST AUTHOR:** At IAMT, the first author is the person who writes the full-text manuscript, which is the final stage after many revisions in bullet point form (the writing process will be described in detail in a future RSC). The first author leads polishing and revisions, a huge effort and responsibility. From my experience, the last 10% of the effort may well take 90% of the time. We do not i) share first authorship, as one person needs to be responsible, ii) write publications for, say, PhDs, who struggle to write and still make them first author, without doing the work and learning. The person doing the work gets the credit.
- **LAST AUTHOR:** The last author is typically the project leader. At IAMT, this is usually myself, in collaborations it depends on where the work was based, who's idea it was and who led the effort. When young scientists get their own funding and build their team then they would often (but not by default) move to the last position. Most contributors are in the middle role, which raises the question of order.

- **ORDER OF AUTHORSHIP**: While in some disciplines the authorship is in alphabetical order, we try and order by contribution and effort, which can be difficult to quantify. A postdoc who supervised the PhD on a day-to-day basis and probably brought a lot of the methods and ideas would be second (or second last), followed by all other major contributors.
- **CORRESPONDING AUTHOR (CA)**: The CA status is important in some countries. In collaborations where this is really important, this can be negotiated between the senior authors. At IAMT there are two CA types and these may be different persons; i) the CA for submission for online platforms and ii) the CA on the manuscript. The CA submitting the manuscript may do so on behalf of the CA indicated in the manuscript and forwards all correspondence with editors and publishers to the other authors, making sure all the submissions and revisions are approved, and all authors are informed. This role is more administrative, and requires good communication skills and trust, while sometimes this is simply the person who was invited to send a particular manuscript by the editor. The CA indicated in the manuscript is responsible for handling queries after publication, bears the overall responsibility and consults with co-authors on specific issues. While any author could be CA, this makes little sense for very mobile junior authors.
- **AUTHOR CONTRIBUTION**: At IAMT we take authorship (or not) very seriously, while in other places a more 'inclusive' approach is taken to support the careers of junior researchers. While supporting careers is an important motivation, this has, at times, taken absurd proportions in that researchers with long publication lists are unable to do independent research or write. While we have usually included master students in the author list when results of 'their project' were published, in recent years the scientific contribution of master students has diminished. Contribution remains very welcome, but authorship is not granted automatically. This means that authorship will be evaluated (and invited) if a contribution through new literature, ideas, methods and data analysis is made. Anyone interested in authorship is more than welcome to express this and open the dialogue as to what is required. Merely doing a lot of experiments as prescribed, is not deemed sufficient. The main argument here is that anyone can do these experiments that are very repetitive, even though a master's student will inevitably learn a lot when engaging in such research. What contributes to authorship or not can be a grey zone. Someone who makes minor contributions (characterization tasks, contribution of methods, experiments, etc.) often, may be named on occasion to reflect the overall contribution in a balanced manner. It is much better to rather publish a separate methods paper. To invite and deal with authorship discussions early, our 'concept notes' have a header that specifies contributions (this is the planning phase) and names potential authors. The extent of contribution ought to be specific (who did which experiments and with what contribution?). The purpose is to discuss who will be an author, on what grounds and who will not be an author, but be acknowledged instead. At the later – manuscript stage, this is converted to an author statement (which is also required by publishers, but often in very different formats). There, the author list is agreed and the contributions are specified mostly with the purpose of responsibility. Each author bears responsibility for their data integrity and validity, for example, and hence this is an important matter. This authorship process at IAMT was initiated when senior colleagues demanded authorship on publications where they

1. **Contributions** (authors with confirmed contribution)

Name	Affiliation	Contribution	Comments
Researcher 1		-write actual contributions	
Researcher 2		-communicate with co-authors	
Andrea I. Schäfer	IAMT		

Authors without confirmed contribution (potential authors who may contribute in the upcoming versions)

Name	Affiliation	Expected contribution	Comments
Researcher 3			

Author Contributions

[this will be used as the author contribution in submission as required by many journals, please write detailed academic contributions 'supervision' is not an academic contribution]

Name	Affiliation	Contribution	Comments	Revised by [revision comments please send to corresponding author also]
Author 1				☐
Author 2				☐
Author 3				☐
Andrea I. Schäfer	IAMT			☐

Corresponding Author: [name, email, phone]

[the corresponding author is responsible to forward all correspondence with publisher to co-authors and is delegated with overall manuscript responsibility]

had not made a contribution. While such lists do not protect from political fallouts or other conflicts, they create transparency and a process to adjust or at least discuss expectations. This teaches junior researchers to handle such matters. Clearly, authorship is not a simple topic.

- **ACKNOWLEDGEMENT**: The alternative to authorship is being thanked in the acknowledgements; but, again who gets acknowledged and who does not? Generally, the acknowledgements are very inclusive and encompass funding, instrument access, scientific discussions, material provision (e.g. membranes, adsorbers, ion exchange resins), and routine characterization results (e.g. electron microscopy, water analysis). Proofreading, language editing or morale support are not usually stated.
- **COLLABORATIONS**: At IAMT we collaborate a lot and we publish a lot with collaborators. This requires a very early conversation about authorship and what is expected for this to be the case. Just reading over a nearly finished manuscript once is not sufficient, as common as this practice may be. A collaborator ideally brings a unique skill that is required to do the work. This may be the supply of a very specific membrane or material, which the collaborators may have published before. If that same material is supplied repeatedly, then the authorship moves to acknowledgement at some point, while further development of that material would maintain authorship. A characterization tool may be a standard tool, but our samples tend to be challenging, and method development may be required before it becomes routine. For instruments it is often a question if we pay for characterization or materials or collaborate, even in collaboration some papers will result in acknowledgements to balance the effort better.
- **QUANTIFICATION OF CONTRIBUTION**: Perceptions of contributions differ. Two main factors contribute to this quantification i) effort (in our lab time spent in the lab and time analysing data and writing) and ii) conceptualization and idea. One would not be possible without the other, yet rarely the Nobel Prize winner has done the lab work. To put a contribution (usually in %) next to authors in a publication strikes me as nearly impossible. The decision that the person who made everything possible, yet was never seen in the lab where the actual work was done would not warrant authorship, was one of my biggest career mistakes. This was born out of a supervisor (the researcher who supervised my project and left the decision to me) and young naivety on my behalf that left me unqualified to make such a decision (which is very normal) based on my clueless perception. In this case, it was wrong to leave that person off, in other cases it may well be justified. There are colleagues who demand authorship, while never even reading the work. It is very difficult to intercept such abuse of power and position and quantification may be useful for such cases.

In summary, if authorship is warranted is often clear and, at other times debatable. Just doing work and collecting or analysing data does not suffice. The perception of the big bad professor can be turned around when one asks the question of why the student should be named and the lab technician not. '*Because the technician is paid for the job*' is usually the swift answer. Most PhD students are paid too, while master's and PhDs attain a personal academic degree. The point is that authorship is not about status or rank, but about creativity and scientific contribution. Merely doing work as instructed does not warrant authorship, as little as providing money or materials will – all of which are inherently necessary to get the work done. In experimental research, a few things happen regularly that require discussion of authorship. Some common examples are provided below to describe how we deal with this at IAMT. I wish I could say we were very consistent, decisions always very clear, often we are not and this has a number of reasons.

- **EXTERNAL ANALYSIS**: Everyone likes nice pictures and good sample characterization in their research, the complexity of such tools usually requires expert operators and a lot of resources (such facilities cannot usually be financed by users and their third-party funders alone). Often such facilities charge a relatively small fee to operate and good facilities provide expert operators. The common question is payment, authorship, or both. Many facilities have rules in place and are happy with being acknowledged, but for the highly trained scientists who provide this 'service' this is a career dead-end. At IAMT we discuss this, normally we do not grant authorship when we pay (collaborators do not pay for our expensive research either!). Authorship is warranted when methods require a lot of effort. If not, then we prefer to pay. It is a case-by-case discussion and we have established a process of 'sample analysis request (SAR)' to stop the random requests for analysis from wasting the time of colleagues and to ask the authorship question upfront (most junior researchers are uncomfortable with bringing this up). Agreeing to not proceed, if consensus cannot be reached is a lot better (in the long term) than a massive conflict later.

- **PROVISION OF MATERIALS**: Some of our most valued collaborators give us novel membrane materials with the most amazing properties. This is always a joint publication, even though they have long published, or patented their development. We often add significant application data or fundamental understanding. Sometimes we use the same material for many projects without material modification. At this point, a conversation will take place about where/what we acknowledge. As a general rule, when we ask for modification of a material then this warrants authorship, subsequent publications with the same material are not as grateful as we are to receiving these. A factor to consider is how difficult and expensive it is to prepare materials, this is where, again, a conversation needs to take place.
- **MASTER PROJECTS**: Traditionally, being Australian trained, in my team, master students are mostly left with co-authorship in hand. Master students always had 'first right of refusal' for first authorship (and thus writing the work), although this was rarely of interest unless a PhD was planned and the student was aware of the importance of publications to secure scholarships. Most others were heading for industry and happy that the study phase was over, not prepared to put in the required extra effort or maybe not confident of their ability. In consequence they were usually second author. The lack of interest combined with the lack of intellectual input during the master's has resulted in the IAMT approach changing. Taking part in a publication is very much encouraged, but if interest is not communicated with active involvement and ideas (finding important publications that no one else has found and contributing creative ideas is not so difficult) then authorship is no longer granted. Yes, at IAMT experimental effort is always significant, but experiments can be done by anyone and masters who contribute to other groups do not normally receive authorship either.
- **ORPHANED PROJECTS**: A common challenge in academia is PhD students or postdocs leaving without the desire to finish writing up the research[1]. This leaves a lot of 'orphaned projects' on the desks of overwhelmed professors with little time to write. This is easy to handle when a handover takes place where the continuation is discussed, after all those staying in academic careers need the publications and may wish to complete their projects, even while in a new position. If a demanding new industry position looms this is likely unrealistic and a solution can be discussed. Less pleasant are the abrupt departures, that are becoming increasingly common, where PhD students quit without graduating, or postdocs leave with short, or no, notice. This prevents a discussion as to the continuation or completion of the work. Ultimately, this requires someone else to finish the work, which is very challenging and it raises authorship questions. As described above, the person inheriting the work will be the first author. The previous researcher may or may not be in contact, and may or may not be willing to contribute or agree to being named. On some occasions, first authorship may be demanded. This requires careful judgment. How do we handle this? An author tries to make contact, which is difficult if no forwarding contract is provided. Ultimately, the contribution is decided when requirements to complete the work are established; sometimes many experiments need to be repeated and analysis redone, especially when a PhD candidate quit because things were not going well. This may mean that authorship is lost. A risk to be considered is that an unpleasant departure creates bias. Such decisions require objectivity, which is extremely difficult and hence it is important to be mindful and transparent.
- **TRAINING EXPERIMENTS**: When new team members arrive at IAMT, it has become a helpful practice to train these new team members with relevant projects, where for example a number of experiments are required to finish off a project. This can be a favour to a busy team member, a project where someone left and repeats are required or an 'orphaned' project. The question arises if this would warrant authorship. The answer is usually not, while there are exceptions to the rule. The reason for the lack of authorship contribution is that experiments to finish a project are typically well defined (by someone else) and the methods established. The benefit for the person carrying out the work is training, which at IAMT covers operating equipment, learning about experimental protocols, running analytical equipment, and making graphs. Doing so while searching for literature on the own project tends to be a win-win as it helps to focus what to look for. At times the finishing off turns into a – for training purposes - unjustified effort, albeit this should be rewarded financially (if the student is unpaid), rather than with authorship. If the work falls into the 'favour' category then one would expect a return in one form or another and in a team such opportunities are abundant, ranging from help with scholarship/fellowship applications to operating complicated analytical tools.

[1] *Note that at IAMT a PhD can only be submitted once the 4th publication is submitted, solutions will need to be discussed about inclusion of unpublished work in a PhD.*

- **FIELD WORK**: Fieldwork takes many forms and has usually a multitude of purposes from plain exploratory sampling, training logistics and organizational skills, to actual scientific research. Fieldwork tends to encompass repetitive tasks, and long hours, unless the team plans very diligently – which is one of the very skills to be gained – and involves many helpers that are not directly involved in the research. This can generate heated debates about who should be an author and who should not, for every participant has by nature put in long hours. If a field trip is perceived as fun (as a field trip enthusiast field trips are holidays for me and I have used holidays for field work or labelled field trips as holidays!) while for others they may be unpleasant and labour-intensive chores. People are different, yet a university is a training institution and fieldwork is an expensive and very privileged training opportunity. Who will be the author when the results are published? Ideally, those who drive the research scientifically with curiosity and enthusiasm. One needs to evaluate who has to develop the idea and contribute novel methods or approaches. Similar things to what was done before with no novelty in actual science do not qualify, and in fieldwork, this can be difficult. When managing a fieldwork team, I usually examine carefully how a particular trip contributes to someone's profile. This may mean that participation is the training ground for a future field trip where the science is better aligned for a particular person.
- **FRIENDLY HELPERS**: Helpers are people in the team who I draw on when someone is well and truly stuck and more 'encouragement' from the professor is not useful, as this tends to put even more pressure. Depending on the person and the situation I may ask a peer, whom I know has a good connection with the stuck person, to help. This may involve i) sitting next to someone for days to overcome procrastination, ii) explaining the science that cannot be digested, and iii) all sorts of motivational strategies, both out or in the lab. Now should our helper become an author? I find this difficult, as it has a taste of 'the PhD student could not do it alone' or feel like being used to do the professor's job. I observe and deal with individual cases. Usually, trusted team members are asked to help and with trust everything is easy. While we may decide that on a particular work, the helper is not named, another opportunity where the effort can be compensated appropriately is created. Grey? Very! Helpers are much appreciated, but one needs to watch that 'helper syndrome' does not develop and become an 'everyone needs me' career sacrifice. Discussion of boundaries is warranted (note helper syndrome is often ego-driven!). Being able to 'unstick' someone is WIN-WIN-WIN, by itself a great reward and we all get stuck sometimes.
- **HONORARY/STRATEGIC AUTHORSHIP**: In this scenario, a collaborator whom we want to apply for a grant together (and know that a joint paper would help a lot) or a friendly collaborator who wants to be generous offers authorship as a gift. This is kind, saying 'no' may be offensive and clearly, saying 'yes' is out of the question for lack of academic contribution. So how do we handle this? Typically, I will have a look at the work and see how we could contribute with additional experiments that add to the science. Often this is too much effort to the person offering the gift and the problem is solved. If this is accepted, then the hard work starts, which usually requires making methods compatible and adding to an existing story, which is never easy. Collaborations that withstand this process are bound to be strong and there are nice examples at IAMT. Reading over and commenting to become an author is not an option. Obviously, this is a temptation that many may engage in (who wouldn't like to shortcut the many revisions most papers require?!), and in some countries, authorship is even traded after acceptance of manuscripts. This topic has the potential of corruption and my strong advice would be to stay clear.
- **DEVELOPMENT AID/FUNDING-RELATED AUTHORSHIP**: When working in international collaborations, in particular developing countries, a new form of damaging 'developing aid' is taking hold. Giving money without requesting a return can cause a lot of damage in the form of learned helplessness and dependency. In the context of authorship, it is much more important to teach to publish, than to grant unwarranted authorship, that may be required to demonstrate 'successful' collaboration and look good. If a collaborator has not contributed, then authorship has to be refused. Yes, this ends apparent friendships and I find it extremely unpleasant when authorship is demanded outright, even though every offer to contribute was left unanswered. The better funding agencies are aware of the problem and do not judge the success of a collaboration on publications when there was no contribution, but rather reflect what is required such that contributions are made. This is becoming more and more difficult the more accustomed colleagues become to 'free' authorship. It is about teaching someone how to fish, rather than giving someone a fish while understanding why it is harder in some environments can be very enriching and usually a meaningful way to contribute can be found.

- **RESCUE AUTHORSHIP**: At times I receive emails like '*my supervisor does not have time to revise my work, will you please help me by becoming an author*'. I tend to find this supervisor (who is usually not copied) and send them the email such that they can stop this very damaging interaction. If they re-affirm, that they do not have the time, I may encourage them to do their job (clearly on a path of 'how to win friends and influence people…'). No established professor has more time or a need to babysit the students of others. Yet others may claim '*we are from a developing country and our work does not get published unless your name gets added to it*'. Again, who is the supervisor here? Yes, there is bias in the system and it is probably easier to publish when the institution and/or the senior author enjoys a good reputation. But every time when I care enough to have a look at the work that is being sent, I see very quickly that the quality of the work prohibits publication. I do not engage, beyond sharing my inevitably unpleasant views, but this situation is one of my motivations for this research skill coaching. One can do brilliant work in the most underprivileged situations, it just takes a lot more determination, and if the work is good and novel, has a meanigful structure and is well written, it will be published.
- **THESIS AUTHORSHIP**: The inevitably sole author of a thesis is required to sign a statement that the work was carried out without assistance (the phrasing differs). The statement required in many theses (Master's or PhD) is – in my opinion - outdated. In our research environment and discipline, this is a false statement and should be adjusted, rather than demanding students to sign this. A thesis ought to be written by the sole author alone. This is achievable when it comes to literature and text. The graphs and schematics may be plotted by the author, while this may build on existing templates. In reality, a lot of feedback is received in the process from various supervisors – even though at some organizations such feedback is forbidden as a master thesis is an academic exam. AT IAMT it is collaborative research, where the candidate learns by doing prescribed exams. The idea of the research is very rarely (in my career so far never) the exclusive idea of a master or PhD student and no one is able to carry out a project without the help of others. The situation exhibits in my opinion a conflict between academic (teaching) requirements and the reality of research, in fact where research interfaces with teaching. Research has become collaborative and in this environment, all participants learn a lot, provided they engage. Some academic institutions claim that results obtained as part of a master's thesis are the sole property of the master's student and the institution where this student is enrolled (rather than the lab where the research was carried out). Clearly, this clashes with third-party funding and well-accepted agreements on intellectual property and data ownership. This needs to be resolved, ideally by academics rather than legal departments that may not understand scientific reality. In the interim, clear contribution statements and acknowledgements must give due credit to contributors. In a PhD, this may mean spelling out in every chapter who did what – and not copying and pasting jointly written text.

All this said, IAMT we are very publication focused. IAMT welcomes active contributions to writing and encourages joint authorship very much. Of course, it is great when students, and collaborators (from all geographic regions) publish with us – we do this a lot – but it is essential to stick with the ground rules and in the inevitable cases of 'shades of grey' agree on acceptable compromises. If mutually agreeable compromises cannot be reached then a leader does what he/she must do: listen and make a decision. This may, in some cases, then lead to scientific misconduct queries that are investigated – hopefully – independently and fairly.

References

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3. KIT, Statutes for Safeguarding Good Research Practice at Karlsruhe Institute of Technology (KIT) https://www.gwp.kit.edu/english/statutes.php#Anker18, Article 14 (accessed 11/12/2024)