RePoSS: Research Publications on Science Studies

RePoSS #30:

Responsible Conduct of Research: Collaboration

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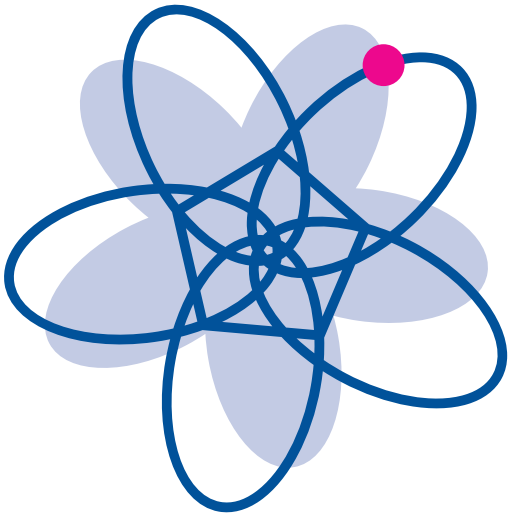

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COLLABORATION

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Collaboration is the basis for most research in the natural, biomedical and engineering sciences today. In this chapter we shall review why collaboration is so important and describe what characterizes a good scientific collaboration. Further, we shall explain how collaboration necessarily builds on trust, but that trust in collaborators at the same time needs to be warranted. On this basis we shall discuss when co-authors are responsible for scientific misconduct or poor science conducted by a collaborator, and we shall give some advice on how to avoid ending in such a situation.

1. COLLABORATION IN SCIENCE

Over the last century, science has developed dramatically. While much science up to the late 19th century was performed by individuals – one need just think of heroic figures from the history of science such as Galileo, Newton, Maxwell, or Darwin – collaborative research has been steadily growing throughout the 20th and into the 21st century, and today most research publications in the natural, biomedical and engineering sciences are published by groups of authors who report the result of their collaborative efforts.

Collaborations in science can have many different forms, and practices vary widely between fields and disciplines and between countries and cultures. Hence, some collaborations are performed in huge groups with hundreds of participants, possibly spread among many institutions, while others are performed in small and tightly knit groups located geographically and institutionally in one place. Some collaborations are interdisciplinary, others are mono-disciplinary. Some collaborations consist of equal peers, others are centered around a principal investigator who directs the others. Some collaborations are highly international, while others are not.

The tendency to collaborate also varies between different disciplines and different fields. In the one end of the spectrum, much work in mathematics is still performed by individuals. In the other end of the spectrum, most research in the biological and biomedical sciences is performed by groups. Special kinds of collaborations can form around big and very expensive equipment, although they may also differ in the way they are structured. Research in experimental high energy physics conducted at the big accelerators is often carried out by groups with hundreds of participants who will not all be participating at the same time, or even all know each other. In contrast, in observational astrophysics conducted at the big telescopes people often work in much smaller groups, but at the same time there is an expectation that researchers using the instruments are sensitive to incoming requests to record data for others if very special events suddenly occur. Other special kinds of collaborations can form around a particular aim or goal, such as the large Manhattan project aimed at producing the world's first atomic bomb, or the HGP aimed at uncovering the total map of the human genome.

With all these divergences, many practices will therefore differ from collaboration to collaboration, yet some general descriptions can still be given of what it to be gained by collaborating (section 2), what it means to cooperate with others (section 3) and trust them in the process (section 4), and finally how

to deal with the interplay between collaboration and competition in the highly competitive world of science (section 5).

2. WHY COLLABORATE

Scientists collaborate for many different reasons. Sometimes research requires so much labor that no individual could carry it out alone. Sometimes it needs to be geographically distributed and requires presence at multiple sites at the same time. Sometimes it requires multiple competences, or access to material or equipment that are possessed by different researchers. In all of these cases, collaboration is required if research is to be carried out at all.

Studies also report that collaboration has some benefits as such. Some studies have found that Nobel laureates have been more engaged in collaborative work early in their career than a comparable sample of non-laurates (Zuckerman, 1967). Other studies have found that co-authored publications receive more citations than comparable single-authored publications (Wuchty, Jones, & Uzzi, 2007), and that collaborating scientists are more productive that scientists working alone (Crane, 1972).

Several factors have been suggested to explain these benefits of collaboration, including that collaboration enables scientists to acquire results more quickly and at more limited costs, that it enables the results to be distributed among many other scientists, and that it increases the reliability of the produced results (Thagard, 1997; Wray, 2002). Collaborators engaged in the same collaboration may at the same time put different weight on these factors. A senior scientist may want to collaborate with a PhD student because this is the most cost-effective way of acquiring a particular result, while the PhD student may want to collaborate with the senior scientist because the expertise of the senior can ensure a higher reliability of the result.

3. WHAT IS A GOOD COLLABORATION

Many 'survival guides' to science emphasize the importance of communication and mutual harmonization of expectations when a new collaboration is initiated and provide check-lists for what it is advisable to agree upon before entering a collaborative relation. However, it is important to remember that collaboration is a process, and that communication and mutual harmonization of expectations is not only important before the collaboration begins, but keeps being important throughout the whole process. In characterizing a good collaboration we shall therefore start by characterizing what a collaborative process is, and then turn to a list of what to remember as a collaborator.

3.1. DOING THINGS *TOGETHER*

When collaborating, scientists perform their research *together* and that implies some important mutual expectations. For example, when doing something together one partner cannot suddenly withdraw unilaterally from the activity without any previous warning. That would take the other partner(s) with surprise, and probably cause anger or disappointment.

When engaging in an activity together with others, you need first of all at some level to have the same aim, for example to conduct a particular experiment or to test a particular hypothesis, and this needs

to be common knowledge among you. This may sound trivial, but unfortunately conflicts are often seen arising because it turns out that the people who thought they were working together were either not working towards the same, or they did not agree on whether they were actually performing the activity together. It is frequently seen that some people thought that they were working on a grant application or a publication together with some others, while the others apparently did not share that view and submitted the application or publication alone.

Although sharing a concrete aim at one level, like performing a particular experiment, aims may differ at other levels. For example, The PI of a group may engage in the activity with the aim of winning a major reward, while the youngest PhD student in the group may engage in it in order to learn a particular technique. These differences can easily lead to conflicts, and it is therefore important in a collaboration always to be aware of where you aims are similar and where they differ.

When engaging an activity together with others, for example conducting an experiment together, you will typically share labor among you. You therefore each need to ensure that your individual plans for how to carry out your part of the activity fit with the plans of the others. You need to make sure that you agree on how to conduct the experiment, including who will perform which parts and when, and on the quality of work that you are aiming for. This usually requires a lot of communication and coordination – and many conflicts arise because collaborators neglect this and have different ideas about the time scale for when to deliver, the quality that they aim for, or about who will deliver what.

Further, because research is a process during which things can change substantially, it is important to continuously track whether the subplans of all collaborators still mesh, and be mutually responsive and supportive if they do not. If you are preparing a sample that a collaborator needs at a very particular stage in a long and complicated process, then you both need to mutually track each other's work to make sure that you finish your preparations at the same time. If the one gets delayed, the other cannot just carry on unimpeded, but needs to adjust to the new situation that the delay prescribes. Similarly, if a collaborator faces problems and is in need of help in order to fulfill his or hers share of the collaborative activity, it is part of a collaboration that others capable of assisting take action and provide the help required. The responsibility for tracking the status of the activity and for being responsive and supportive may be distributed unevenly within a collaborative research group, depending on whether it is a group of equal peers, or a hierarchical group with one or more principal investigators who decide over the work of other, more junior members.

3.2. WHAT TO DISCUSS AND AGREE UPON

It sounds easy to make sure that goals are shared and that individual subplans for carrying out the activity mesh. However, many intricate details go into this and most researchers can report that it is far from trivial. Below is a list of some of the key issues that you should consider and re-consider as the collaboration develops:

- **Goals:** What do you want to achieve jointly in the collaboration, and how does this relate to other goals that you may each have individually?
- **Participants, their roles and responsibilities:** Who are participating in the collaboration, do some have special managerial roles over others, and how is labor distributed?
- **Timing and deadlines:** When does the collaboration begin, how does it progress, and what are the major deadlines to meet?

- **Commitment of time and resources:** How much of their time do the individual collaborators dedicate to the collaboration, and where are resources drawn from?
- **Expectations on quality:** What level of precision or detail are you aiming at? What do you consider 'good enough'?
- **Data sharing, ownership and access:** Who has ownership of the data collected by the collaboration, where will is it stored, and who has access to the data and how?
- **Intellectual property rights:** Who will have the ownership to patens that can be derived from the collaborative work?
- **Publication of results and authorship of publications:** Which publications are produced and who are the authors?
- **Closure:** When and how does the collaboration end?

Additional checklists for what to settle when initiating a new collaboration can be found in the Danish *Guidelines for Good Scientific Practice* as well as in most textbooks on responsible conduct of research (e.g. Macrina, 2005; Shamoo & Resnik, 2009).

4. TRUST IN SCIENCE

As described above, scientists often collaborate in order to obtain results that neither of the collaborating partners could have obtained alone, for the lack of time, resources, knowledge, or a mixture of these. In order to obtain the results they therefore share labor among them. This may be a massive amount of identical labor that it would take too long to perform for an individual, or it may be labor that requires different kinds of competences and which they therefore divide among them according to their different fields of expertise. But whether they share labor among them for the one or the other reason, it means that they each make different contributions to the collaboration that the others need to trust. If they did not trust each other's contributions, but instead needed to check and control whether there were all correct, there would be no idea in collaborating at all. In this way, trust is a key ingredient in collaborative research.

At the same time, it is important that this trust is not blind. You probably would not collaborate with just anybody, without having some vague idea of their trustworthiness. To trusting another scientist you need to have warrant for believing that the other scientist is both reliable and truthful, that is, that the other scientist a) is competent within the area and is capable of assessing the limits of this expertise, b) has worked conscientiously in producing the result reported, and c) is truthful in the reporting. In this way, collaborating with others rests on having a warranted belief in both the epistemic character (being competent and conscientious) and moral character (being truthful) of the collaborating partners (cf. Hardwig, 1985; 1991).

In the following we shall consider which reasons can warrant belief in the epistemic and moral character of a collaborator, respectively, and we shall then turn to some of the signs that should cause researchers to reconsider their belief in a collaborator (see alsoAndersen, 2014, p. for additional details). Finally, we shall discuss a very important implication of trust among collaborators, namely the responsibility of co-authors for the content of a scientific publication.

4.1. COLLABORATORS' EPISTEMIC CHARACTER

The assessment of a scientist's epistemic character is highly dependent on expertise. To assess whether a person is competent within an area, one may start by assessing directly what the person says within the area and whether it is correct and reasonable. But to know whether it is correct requires that the assessors are themselves at least as knowledgeable within the area as the person assessed. Senior scientists may therefore be in a better position to assess the epistemic character of junior scientists than the other way around. Senior scientists' assessments of junior colleagues' epistemic character can also be seen as an integral part of normal practices as when they write reference letters and similar evaluative descriptions of their junior group members' scientific competence.

However this does not mean that no assessment of epistemic character can be made among interdisciplinary collaborators with expertise within different fields, or that junior scholars have no warrant at all in their belief in the epistemic character of their senior collaborators such as their supervisors. In such cases one has to perform the assessments indirectly, for example by drawing on how other experts in the field assess the person, by looking at how successful his or her previous work has been, and by considering how well the person in question manages to argue, explain and answer questions (Wagenknecht, 2013; Goldman, 2001).

4.2. COLLABORATORS' MORAL CHARACTER

Science is often described as a dedicated search for truth, with the underlying understanding that all scientists are necessarily truthful. However, the many misconduct cases that have kept occurring over the last decades show that this is not the case.

In addition to assessing whether their collaborators are knowledgeable and conscientious, scientists therefore also need to consider whether they can expect their collaborators to be truthful or not. Despite the many misconduct cases, this is rarely something that is addressed in guidelines and 'survival guides'. However, some studies of researchers have been conducted which report that scientists ground their trust in the moral character of other scientists in the evidence of moral virtues such as honesty, loyalty, cooperativeness, fairness, consideration for others, etc. (Frost-Arnold, 2013). We shall return in more detail on when to believe in the truthfulness in a collaborator below in discussing particularly when to re-consider if a collaborator really is truthful.

4.3 WHEN TO RE-CONSIDER YOUR TRUST IN A COLLABORATOR

Equally important to the questions of whom to trust and why is the question when trust should be given up. It is here important to remember that uncritically trusting a collaborator who is known to be sloppy is not any better than relying on an instrument that is known to be imprecise.

Whether you are in a position to calibrate your trust in a collaborator's epistemic character directly and notice statements that you think are wrong, or you have to rely on indirect calibration and wonder at what appears to you to be incoherent explanations, signs of lacking competence or negligence should always prompt you to ask clarifying questions. Vice versa, if your own competence does not match the tasks you are set, it is important to be honest about it. We cannot all know everything; hence, lack of knowledge can well be acceptable as long as it is declared. In contrast, pretending to have knowledge that you do not and hiding your ignorance is never acceptable. Remember that if a poor result gets published that it was in your command to correct, you have failed to conduct your

research responsibly. Although this may not be outright scientific misconduct, it is definitely poor science.

Similarly, any signs of a collaborator being deceitful should prompt you to react, either by asking clarifying questions or by reporting your observations to the PI, the head of department, the local 'named person' or a similar authority. Examples of occurrences that will often call for clarification are if data suddenly change without explanation, if things are kept hidden, if results appear too good to be true, or if a collaborator always manages to be alone when conducting experiments without any witnesses.

It may be difficult to draw the line between an initial hunch which you may want to examine further before contacting others, and direct evidence of misconduct that should always be taken seriously and conveyed immediately to the PI, the head of department, the local 'named person', the local practice committee, or a similar authority. Be aware that if witnessing misconduct without interfering, you may be held equally responsible for the misconduct as the original perpetrator. One can think of it as similar to thieves and handlers of stolen good: although the latter have not committed the original theft, by handling the stolen good they are still supporting the theft and thereby committing a criminal act. Further, it is not necessary to directly know of the theft to become a handler of stolen good; if you buy a commodity at a price that is too good to be true, you will still be seen as a handler of stolen good because you should have realized that something was wrong. Similarly for scientific misconduct. If results seem too good to be true and it later turns out that they have been obtained by falsified data, collaborators can be held responsible for not having questioned that which was obviously questionable.

4.4. TRUST AND RESPONSIBILITY

An important implication of trust in science is the intricate question of when co-authors share responsibility for misconduct or poor science that has been produced by a collaborator. There are so far no clear consensus on this point. Some guidance can be extracted from international and national misconduct cases. International and national recommendations also provide some guidance, but it is important to be aware that their interpretation has been a matter of dispute. Thorough consideration of whom to trust and why, is a good basis for avoiding being responsible for misconduct or poor science.

4.4.1. PRACTICE IN NATIONAL AND INTERNATIONAL MISCONDUCT CASES

In misconduct cases, there seems to been a tendency internationally to let responsibility vary with expertise, such that collaborators who have little expertise within the relevant field, either because they are junior researchers or because as seniors their expertise are in other areas of science, are not held responsible for misconduct perpetrated by a co-author. Conversely, collaborators who do have the necessary expertise are usually expected to detect if results appear 'too good to be true', or react immediately if questionable practices are brought to their attention. However, it still varies between the cases whether failure to do so has been seen as scientific misconduct or, less severely, as questionable practice (see e.g. Andersen, 2013; 2014 for descriptions of some major cases).

4.4.2. THE VANCOUVER RECOMMENDATIONS

The Vancouver Recommendations state that all authors are "accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately

investigated and resolved" (ICMJE, 2013, p. 2), but it has remained an issue of dispute whether this shall be interpreted as if all authors are fully responsible for a publication in its entirety, or if all authors are responsible for ensuring that any questions that may arise regarding the content of a publication will be adequately resolved.

4.4.3. NATIONAL AND LOCAL REGULATIONS AND RECOMMENDATIONS

The Danish *Guidelines to Good Scientific Practice* (2009) published by the DCSD suggests a strict interpretation of co-author responsibility. Here it is recommended that "all authors of an article within the limits of what is possible and fair are co-responsible for it being based on honest research so as for the risk of fraud to be minimised. If irregularities or dishonesty are proven in the research, it will be difficult for the co-authors of such work to disclaim co-responsibility" (p. 32). However, the guidelines also grant that geographical distance may challenge this co-responsibility, while they do not discuss whether expertise within the area is a precondition for co-responsibilty.

4.4.3. FURTHER REFLECTIONS ON CO-AUTHOR RESPONSIBILITY

Very important in relation to the analysis of trust in collaborators and the basis for this trust in a warranted belief in their epistemic and moral character is the note from the ICMJE released together with the latest version of the Vancouver Recommendations. Here the ICMJE group explicate that authors need to "have confidence in co-authors' ability and integrity" and stress their view that "each author remains accountable for the work as a whole by knowing who did what, by refraining from collaborations with co-authors whose integrity or quality of work raises concerns, and by helping to resolve questions or concerns if they arise" (http://www.icmje.org/news-and-editorials/new_rec_aug2013.html, accessed August 20, 2014).

As this note states very clearly, one should always make sure to have warrant for the belief in a collaborator's epistemic and moral character, otherwise there is no basis for confidence in their ability and integrity. If this warrant is challenged, action needs to be taken, either to restore it, or if it cannot be restored to withdraw from the collaboration, and possibly to report what has happened to relevant authorities.

5. COLLABORATION AND COMPETITION

Science is very competitive, and often scientists have to consider how they both collaborate and compete with their peers, sometimes even at the same time. Practices differ enormously between fields and between cultures. Reports exist of laboratories in which new junior scholars are given identical assignments and told that by the end some initial trial period only one of them will have the contract extended, leaving them to compete. Needless to say, this form of competition can create a very harsh working environment in which collaboration as described above can be very difficult.

Competition exists at various levels, directed at various benefits, and conducted by various means. For example, departments may compete on rankings, groups may compete on getting priority on a new discovery, and individuals may compete on getting an open position.

Some researchers find competition stimulating and a driving force for their research, while others find it a continuous pressure that spoils the fun. Studies report that many scientists distinguish between competition that is seen as something positive, 'good' or 'healthy' which they characterize by

descriptions such as working hard and doing your best, and competition that is seen as something negative, 'bad' or 'unhealthy' which they characterize by unfair actions and bad feelings (cf. Poulsen, 2001). These reports fit with the analysis above of a good collaboration as a cooperation in which you pursue the same goal and in doing so are continuously mutually responsive and supportive, while neglect of shared goals or failure to respond to and support the work of collaborators can cause collaborations to break down.

QUESTIONS

- What are the characteristics of a good collaboration
- Give examples on issues that you should consider when initiating and during a collaboration
- What is required to trust a collaborator
- Give examples of some of the warning signs that should cause you to reconsider your trust in a collaborator

CASES FOR DISCUSSION

1. Professor B's group has achieved some preliminary results that have potential for getting published in a very high-ranking journal like *Science* or *Nature.* To get the results published in such a high-ranking journal, they would still need to perform a number of additional experiments. One of the PhD students in the group has been heavily involved in the first set of experiments and is expected to be among the first authors on a publication that will also be included as one of the key achievements in his dissertation. However, his enrollment is about to run out and he will not have time to conduct (or wait for) the additional experiments. What should the group do: perform the extra experiments in working towards a high-ranking publication and leaving the PhD student to wait for the results before finishing his dissertation, or finish the paper in time for the dissertation deadline and submit it to a lower ranking journal? Who should take the decision and how?

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