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## Elucidating authorship issues as an element of research quality at Thailand's National Science and Technology Development Agency

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### ABSTRACT

Authorship in a scientific publication is an indicator of significant intellectual contribution in scientific work. Regardless of the discipline, it is important for research-related personnel to receive credit and take responsibility for their publications. There are currently several systems of listing authorship that arise from many factors such as research complexity, pressure to obtain funding, hierarchical structure, and promotion. Some of these may unfortunately lead to authorship abuse. Raising awareness and understanding of authorship guidelines can help prevent abuses and disputes. National Science and Technology Development Agency (NSTDA) is a national research agency of Thailand with about 2 000 research staff members. The research emphasis of the agency is mainly technology development for application in broad areas, ranging from engineering to medicine, including forensic science. We conducted a survey to identify the level of awareness of NSTDA research staff and their authorship practices. A questionnaire was designed based on the International Committee of Medical Journal Editors (ICMJE) authorship guidelines and used to survey 15% of randomly selected NSTDA research staff. Nearly 90% of them responded to the interview. Among the respondents, 60% were not sure about authorship criteria. When presented with the ICMJE criteria, more than 90% agreed with the criteria except for the third one, approval of the final manuscript before submission, 33% of respondents thought that authors are only responsible for their particular contribution. However, nearly 80% agreed that every author is responsible for the integrity of the whole manuscript. These results offered an important foundation for forming a strategy to raise awareness about authorship in NSTDA. Following survey analysis, we organized several seminars and developed learning materials and an authorship guideline to increase the level of awareness of authorship for researchers.

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### Introduction

Authorship is a fundamental tool for determining who receives credit for published research work. It can be considered by academic or research institutions and funding agencies as a valued currency paid to researchers for their career advancement, reputation, tenure, and acquisition of funds and awards [1–3]. With these benefits, some may feel the pressure to publish. They may be evaluated by the number of publications rather than the quality and may not have thoroughly considered the appropriateness of their authorship practices, which may lead to ethical issues and inconsistencies between their contributions to and credit from published research [4–6].

There are currently no universally accepted criteria for defining authorship that span all disciplines [7]. Many journals and academic/research institutions have different guidelines for deciding and indicating authorship and the order of authors [2,7–9]. In biomedical disciplines, the most widely used authorship guidelines were developed by the International Committee of Medical Journal Editors (ICMJE), the first group to establish an authorship guideline in 1978 *via* the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. Many disciplines have adopted the ICMJE criteria, which balance credit and accountability. In summary, those who qualify as an author should make a significant intellectual contribution conforming to the criteria and take responsibility for the contents of the entire

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manuscript. Individuals who contribute to a project or manuscript but do not meet the criteria should be named in the acknowledgments [10].

Most advanced research fields, including forensic sciences, have become multidisciplinary, and the number of authors per publication has increased over time, a phenomenon known as “author inflation” [11–15]. Increasing the number of possible authors makes it difficult to decide whose name should appear on the paper and in what order, which can sometimes result in “gift authors”. Therefore, a guideline is needed to prevent conflict and authorship abuse, particularly in this area. A previous survey of French researchers in distinct clinical programmes showed that some researchers still lacked a clear understanding of authorship, and the granting of gift and ghost authorship appeared to be common [6,16].

NSTDA previously did not have an explicit policy or any guidelines for authorship. The authorship agreement depends on the judgment of the team. In this study, we initiated the first survey ever on this topic to determine the level of awareness of authorship criteria among NSTDA’s research-related staff. We explored common practices about authorship and understanding of the author’s responsibility. These results have been critical to designing a strategy to educating and promoting integrity in the high-quality research produced by NSTDA staff. Given the number of diverse disciplines of research conducted by those working at NSTDA, it is likely that our results may reflect the level of awareness and authorship practices of researchers throughout Thailand as well.

## Materials and methods

The survey used ICMJE authorship criteria as a reference to develop a set of questionnaires. The questionnaires consisted of two parts: personal information; and awareness and practice of authorship. To ensure consistency, clarity, and fairness, the first version of the questionnaire was reviewed by senior researchers and improved before obtaining approval from the NSTDA Institutional Review Board (IRB). The study population consisted of 1 224 NSTDA research staff, each of whom had worked at NSTDA for more than 1 year. Staff members included in the study were categorized as follows: researchers, capable of conducting independent projects; research assistants, assigned by researchers to perform various tasks; engineers, performing engineering works; technicians, with specific laboratory skills; and research specialists, working in distinct areas. We randomly selected 15% of the population (184 persons) by a lottery method using the random tool in Microsoft Excel. We asked their permission to conduct a personal interview and record the responses from 167 participants. The answers to the

questionnaire were recorded in such a way to protect anonymity. All data were kept confidential, analyzed, and summarized, with data from personal interviews deidentified. The data in this study were analyzed by using Chi-square statistical test.

## Results

### Respondent characteristics

Totally 167 NSTDA staff members responded to the interview. Nearly 53% were researchers and 38% were research assistants. There were slightly more male (54%) respondents than female (46%). Most were between 36–40 years of age (28%) and 41–45 years of age (26%) and had working experience between 11–15 years (24%). The demographic distribution is shown in Table 1. The diverse research fields of respondents were Engineering (18.6%), Material Science (18.0%), Computer Science (13.2%), Agricultural and Biological Sciences (12.6%), and forensics-related fields such as Biochemistry Genetics and Molecular Biology (12.6%), Medicine (3.0%), Pharmacology, Toxicology and Pharmaceutics (1.8%), as shown in Figure 1.

Among all the responders, 93% had authored at least one paper in 2019. Over 84% of the respondents had published original research articles in journals and 75% had published peer-reviewed proceedings.

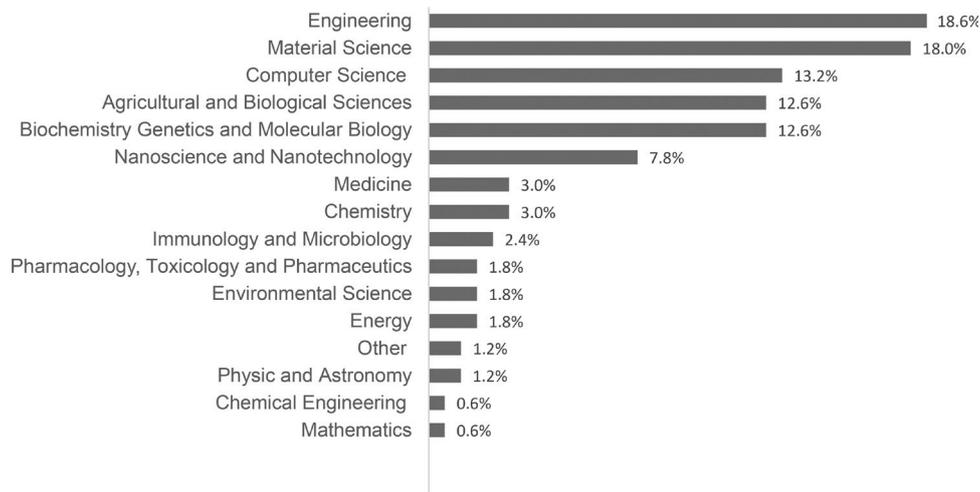
### Awareness of general authorship criteria

We divided the responses into three categories, including “Aware”, “Not sure” and “Not aware” of the authorship criteria. Most of respondents (60%)

**Table 1.** Summary of the profiles of respondents ( $N=167$ ).

Characteristic	Number of respondents	Percentage (%)*
Position		
Researcher	89	53
Research assistant	63	38
Engineer	11	6
Technician	3	2
Research specialist	1	1
Gender		
Male	90	54
Female	77	46
Work experience (years)		
1–5	37	22
6–10	37	22
11–15	40	24
16–20	26	16
21–25	22	13
26–30	5	3
Age (years)		
26–30	10	6
31–35	35	21
36–40	46	28
41–45	43	26
46–50	18	11
51–55	12	7
55–60	3	2

\*Numbers are rounded so the percentages may not add up to 100%.



**Figure 1.** Distribution of the research fields of the respondents ( $N=167$ ). The classification is consistent with Scival database. Numbers are rounded so the percentages may not add up to 100%.

reported “Not sure”. Only 31% were aware of the authorship criteria, and 9% of respondents were not aware at all, including 11% of research assistants, 9% of engineers, and 7% of researchers. Analysis of the correlation between gender, job position, age, and working experience of the respondents and their awareness of general authorship criteria (aware *vs.* not sure or not aware) revealed that only job position ( $P=0.034$ ) and age of respondent ( $P=0.015$ ) had statistically significant correlations. Researchers were generally more aware of authorship criteria as detailed in [Table 2](#).

The respondents thought that those who perform the following functions did not need to be listed as authors: article writing without participating in the research (98%), language editing and proofreading (91%), funders (85%), research material or sample

providers (67%), heads of laboratory (77%), and technicians (66%). On the other hand, half of respondents indicated that those who were responsible for general research-supporting activity (51%), and data collection (46%), should be listed as authors.

### ICMJE criteria for authorship

We sought to understand the respondents’ opinions about the four ICMJE criteria; namely, (1) substantial contributions to the conception or design of the work, (2) drafting the work or revising it critically for important intellectual content, (3) final approval of the version to be published, and (4) agreement to be accountable for all aspects of the work [16]. Most of the respondents agreed with each ICMJE

**Table 2.** Relationship between demographic characteristics and awareness of general authorship criteria ( $N=161$ ).

Characteristic of respondent	Aware of the authorship criteria ( $N=50$ ) $n$ (%)	Not sure of the authorship criteria ( $N=97$ ) $n$ (%)	Not aware of authorship criteria ( $N=14$ ) $n$ (%)	$P$ -value <sup>#</sup>
Gender				
Male	26 (31)	50 (59)	9 (11)	0.892
Female	24 (32)	47 (62)	5 (7)	
Position				
Researcher	35 (41)	45 (52)	6 (7)	0.034
Research assistant	13 (21)	41 (67)	7 (11)	
Engineering	2 (18)	8 (73)	1 (9)	
Technician	–	3 (100)	–	
Age (years)				
26–30	5 (56)	4 (44)	–	0.015
31–35	5 (15)	25 (76)	3 (9)	
36–40	12 (27)	27 (60)	6 (13)	
41–45	18 (42)	23 (52)	3 (7)	
46–50	4 (25)	11 (69)	1 (6)	
51–55	3 (27)	7 (64)	1 (9)	
55–60	3 (100)	–	–	
Work experience (years)				
1–5	12 (35)	21 (62)	1 (3)	0.225
6–10	10 (27)	24 (65)	3 (8)	
11–15	12 (31)	20 (51)	7 (18)	
16–20	6 (23)	18 (69)	2 (8)	
21–25	6 (30)	14 (70)	–	
26–30	4 (80)	–	1 (20)	

<sup>#</sup>Numbers are rounded so the percentages may not add up to 100%.

\*Test statistic is Person Chi-square test comparing between respondent demographic characteristics and general authorship criteria, aware and the other (not sure merges with not aware).

criterion for authorship noted above; the first criterion (99%), the second (98%), the third (98%), and the fourth (97%). Some of the respondents who disagreed expressed the opinion that meeting two to three of the ICMJE criteria should be sufficient to be a named author.

The respondents were also asked about their practice of being listed as an author on a paper according to the ICMJE criteria. Most respondents reported that they complied with the first (98%), the second (93%), and the fourth criterion (80%). Interestingly, only 74% stated that they complied with the third criterion, the final approval of the version to be published. Table 3 provides more detail.

### Sequence of authors listed on the publication

We asked questions about four basic approaches for determining the author sequence for the publication, including Sequence Determines Credit (SDC), Equal Contribution (EC), First-Last-Author-Emphasis (FLAE), and Percent-Contribution-Indicated (PCI) [17]. Most respondents reported using the three most common approaches: 36% used FLAE, 33% SDC; and 27% PCI. Only 1% of the respondents

said they used the EC approach, as shown in Figure 2.

### Author responsibility for the manuscript's contents and integrity

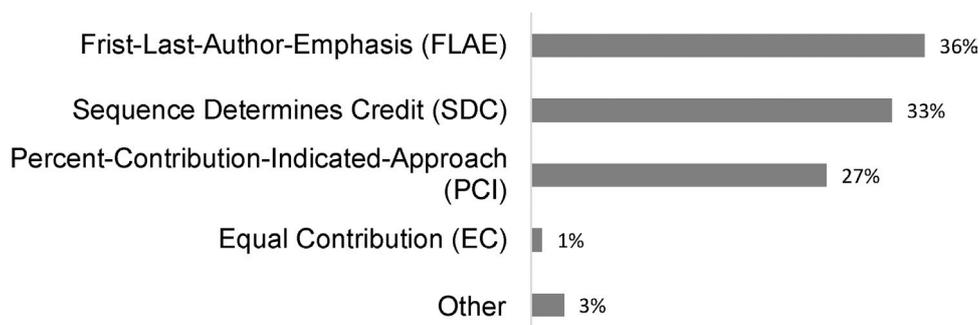
Around 65% of respondents thought that authors should be responsible for all content accuracy, while 33% thought that they were responsible only for the part of the paper relevant to their own contribution. In contrast, in a different question, 80% of the respondents believed that they were fully responsible for the integrity of the entire article while 17% thought that they were responsible only for the part relevant to their own contribution, as illustrated in Figure 3.

### Handling of authorship disputes

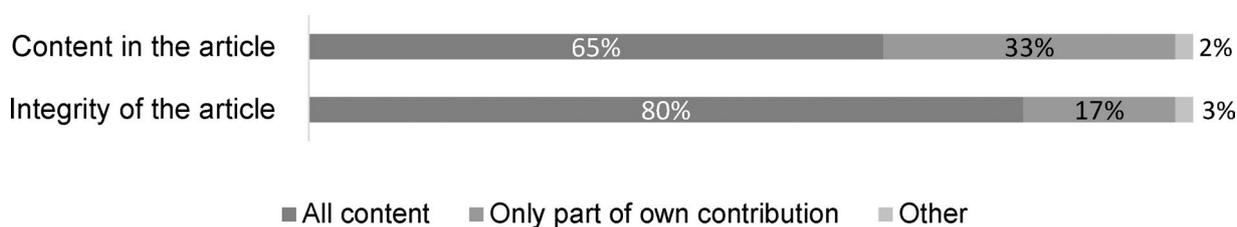
Respondents were asked the following open-ended questions: (1) have you ever been involved in authorship disputes? and (2) what is the cause? Then 27% of respondents had some experiences with authorship disputes, the cause of which can be grouped into six categories: (1) unfair credit distribution; (2) unequal credit distribution; (3) omitted

**Table 3.** Awareness of the International Committee of Medical Journal Editors (ICMJE) criteria for authorship ( $N=162$ ).

ICMJE criteria	Agree with criteria $n$ (%)	Practice in their institution $n$ (%)
Substantial contributions to the conception or design of the work	160 (99)	158 (98)
Drafting the work or revising it critically for important intellectual content	159 (98)	151 (93)
Final approval of the version to be published	159 (98)	120 (74)
Agreement to be accountable for all aspects of the work	157 (97)	129 (80)



**Figure 2.** The frequency of practice of author sequences in publications. (The respondents can have more than one response) ( $N=155$ ). SDC: known as the sequence of authors is descending order follow by their contributions; EC: known as the alphabetical sequences indicated that similar contributions of authors; FLAE: known as the first author who does the most of contribution and should get credit for the entire impact and last is the important position while the credit of other authors is divided between all remaining authors; PCI: known as each author's contribution show in terms of percentage, using various scoring systems [17].



**Figure 3.** Opinions of author responsibilities for their contents and integrity ( $N=161$ ).

credit distribution; (4) inappropriate credit distribution, such as to supervisors; (5) inappropriate division of credit with other institutes; and (6) an inappropriate sequence of authorship. We correlate the causes of authorship disputes to position, age range, and working experience. Only those with a research assistant position reported experience with inappropriate sequence authorship (13%). Respondents older than 45 years had no issue with inappropriate credit distribution, while respondents with less than 5 years of work experience had a high rate of response for omitted credit distribution (60%), as shown in Table 4.

Regardless of whether they reported having experienced an authorship dispute, all respondents were asked how the disputes were resolved or should be resolved. About 40% and 55% of both groups stated that they would inform their colleagues. Interestingly, 27% of respondents experienced with authorship disputes stated that they chose to remain silent and did nothing as a means of preventing damage to their career advancement. Only 16% stated they would inform their supervisor. On the other hand, only 4% of those who reported not having experienced an authorship dispute said they would stay silent, with 47% stating they would inform their supervisor. The differences were statistically significant ( $P < 0.00001$ ), as shown in Table 5.

## Discussion

To our knowledge, this is the first study that explores awareness of authorship criteria and authorship practices in Thailand. The level of awareness of authorship criteria did not increase significantly with respondents' working experience, conforming to the

**Table 4.** Causes of authorship dispute and respondent characteristics.

Characteristic	Causes of authorship dispute (%) <sup>*</sup>						
	1	2	3	4	5	6	7
<b>Position</b>							
Researcher	36	7	21	11	7	–	18
Research assistant	40	7	13	13	7	13	7
Engineer	100	–	–	–	–	–	–
<b>Work experience (years)</b>							
1–5	–	–	60	–	–	40	–
6–10	42	8	8	–	17	17	8
11–15	47	7	13	27	–	–	7
16–20	67	17	–	17	–	–	–
21–25	17	–	33	–	–	17	35
<b>Age (years)</b>							
26–30	33	–	22	–	11	11	22
36–40	37	5	16	21	5	5	11
41–45	56	11	11	11	–	–	11
46–50	–	25	25	–	25	–	25
51–55	67	–	33	–	–	–	–

<sup>\*</sup>1: unfair credit distribution; 2: unequal credit distribution; 3: omitted credit distribution; 4: inappropriate credit distribution such as supervisors; 5: divide the proportion of credit distributions with other agencies such as universities; 6: an inappropriate sequence of authorship; 7: other. The values are rounded to single digit places so the percentages may not add up to 100%.

**Table 5.** The frequency of methods to handle authorship disputes. The respondents can have more than one response ( $N = 165$ ).

Handle authorship dispute	Encountered a conflict ( $N = 45$ ) $n$ (%)	Never experienced a conflict ( $N = 120$ ) $n$ (%)	$P$ -value <sup>*</sup>
Inform co-researcher	18 (40)	66 (55)	<0.00001
Inform project leader	11 (24)	49 (41)	
Silent	12 (27)	5 (4)	
Inform supervisor	7 (16)	56 (47)	
Inform committee/the person who has the authority to make a decision	3 (7)	17 (14)	
Other	7 (16)	13 (11)	

<sup>\*</sup>Test statistic is Person Chi-square test comparing between respondent demographic characteristics and general authorship criteria, aware and the other (not sure merges with not aware). The values are rounded to single digit places.

fact that most institutes do not have a clear system for promoting understanding of authorship. Their practice of determining authorship may follow the practice of their supervisors or research groups. A lack of awareness of authorship criteria can undermine the transparency and accountability of authorship credit, potentially leading to authorship abuse that can undermine integrity and thereby hinder one's career advancement. Nevertheless, our study also revealed that staff members in the researcher group are more aware of the authorship criteria than other groups involved in research (e.g. technicians, engineers). Since a leader or supervisor is likely to be a researcher, this suggested that more communication between leaders and their team members would help raise awareness about appropriate authorship.

While most respondents stated that they already comply with ICMJE criteria, only 74% reported adhering to the third criterion. It is likely that in practice they have only paid attention to their specific contribution, or that they were not assigned to proofread, revise, and approve the final manuscript before submission. The process of obtaining approval of a final manuscript by all authors may not be fully practiced. Consequently, if some people disagree with a certain section, such as interpretation of results, they lose the opportunity to express their disagreement or withdraw their name prior to submission of the manuscript [18].

The accuracy of research output is a key aspect of the integrity of the research. Some respondents reported they should take responsibility for the accuracy and integrity of their particular contribution. It is possible that they thought the responsibility for accuracy and integrity of the entire paper lies with the first or corresponding author or the project leader. This gap may be rectified by having explicit guidelines about taking full responsibility as an author.

Experience with authorship disputes differed among distinct groups of personnel. The "inappropriate

sequence of authorship” response was highest among research assistants, with “omitted credit distribution” most prevalent among personnel with less than 5 years of work experience. This likely resulted from the overwhelming authority and decision-making power of supervisors, mostly researchers.

The different choices of resolution of authorship disputes between personnel who had experienced or had not experienced such disputes may be due to two reasons. The experienced ones may be aware that although their opinion about authorship differed from that of their supervisor, they were unlikely to be able to change their supervisor’s decision as the ultimate authority. It may also be possible that some of them tried unsuccessfully. In this study we did not gather information to assess whether authorship disputes had been resolved fairly. The Committee on Publication Ethics (COPE) and numerous other experts have recommended that if negotiation among persons involved fails to resolve the problem, disputes should be resolved by informing an authority such as institutional administrator, a department chair, or college Dean as an alternative [18–21]. NSTDA has a whistle-blowing system for informing various ethical committees, but dispute-experienced personnel were less likely to seek help from any ethical committees.

The results generated by this study have some limitations. First, the data were collected only from a single research institute, NSTDA. It remains to be validated whether our findings would resonate in other similar academic institutions or private institutes. The second limitation is that, due to our sampling method, the respondents who may have been involved in inappropriate authorship practices did not necessarily report such involvement. We did not seek to identify who might have previously been a gift author or ghost author, due to a dominant culture of respect and credit-giving to elders and benefactors in Thailand.

Despite these limitations, our findings have contributed significantly to our strategy and continue to inform our efforts to raise awareness about and improve practices in authorship. Based on the results described, we have achieved the following: (1) developed NSTDA guidelines for responsible authorship practice; (2) offered seminars and workshops to spark discussion and promote the guidelines; (3) developed self-learning materials; and (4) established a consultation mechanism called the “Professional Authorship Center” that provides advice for individuals and groups.

## Conclusion

Authorship in publications clearly constitutes a reward for those involved in scientific research and enhances career advancement. Our exploration

of the level of awareness and prevalence of various authorship practices revealed that we have many opportunities for improvement at NSTDA. We believe that each member of our research staff should possess a clear understanding of authorship criteria and the responsibility that comes with the rewards. Our personnel at all levels and in all disciplines need to realize that assuming authorship means taking credit for work done well, but also taking responsibility if something has gone wrong and the research presented is not trustworthy. We seek to increase awareness of responsible authorship because we believe it is fundamental to ensuring research quality and integrity at NSTDA. We realize that this is an ongoing process. To this end, we commit to offering guidance, assistance, and continued support and evaluation both within NSTDA and, in the near future, with our collaborating institutes in Thailand and around the world.

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## Authors’ contribution

Sudarat Luepongpattana contributed to the research design, data curation and analysis, and article writing. Aviga Soonmongkol carried out the data curation and wrote the article. Supattra Laorrattanasak participated in the research design, data curation, and article writing. Anucha Prucksunand contributed to the conception of the project, and wrote the article. Prasit Palittapongarnpim participated in the conception of the project, supervised the study and edited the article.

## Compliance with ethical standards

Our institution provides a template form for recording each researcher’s contribution to the research team, which follows the standard. The study was approved by the Internal Review Board of the National Science and Technology Development Agency, Thailand (No. NIRB-030-251).

## Disclosure statement

No potential conflict of interest was reported by the authors.

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