

## Decision regarding research misconduct

### Decision

The National Board for Assessment of Research Misconduct (“the Board” or “NPOF”) finds [REDACTED] and [REDACTED] guilty of research misconduct in the articles below.

### Background

On 29 January 2020, Linköping University submitted to the Board a case of alleged research misconduct that the University had received on 13 November 2019. The submission took place pursuant to the transitional provisions in the Swedish Act (2019:504) on responsibility for good research practice and the examination of research misconduct (“the Act”). The allegations concern fabrication of X-ray diffractograms in Figures 2 and 13b in Article 1; Figure 4 in Article 2; Figure 2 in Article 3; and Figure 3 in Article 4 (see below). Author names in bold refer to individuals who have stated their affiliation to Linköping University and are affected by the case submitted. The other co-authors’ responsibility has not been investigated.

[REDACTED]  
[REDACTED]  
[REDACTED] (Article 1)

[REDACTED]  
[REDACTED]  
[REDACTED] (Article 2)

[REDACTED]  
[REDACTED]  
[REDACTED] (Article 3)

[REDACTED]  
[REDACTED] (Article 4)

An internal expert<sup>1</sup> at Linköping University analysed the raw data for Article 1. For Articles 2–4, only the graphs were examined, since locating the raw data was not feasible at the time.

The Board has obtained an external expert statement on the matter. The expert<sup>2</sup> was given access to all the case documents, including the raw data for the figures in Articles 1, 3 and 4 (for Article 2, the raw data were still missing) specified in the allegations.

The respondents were given the chance to comment on the matter. [REDACTED], head of the research group, issued a statement to the Board in which he wrote, on behalf of all the authors of the four articles cited in the allegations, that they contested the accusations of research misconduct.

## Grounds for decision

### Legal regulation

Under the Act (2019:504) on responsibility for good research practice and the examination of research misconduct (“the Act”), the Board is tasked to investigate issues of research misconduct. Section 2 of the Act defines research misconduct as a serious breach of good research practice in the form of fabrication, falsification or plagiarism, committed with intent or through gross negligence, in the planning, conduct or reporting of research.

### Fabrication, falsification or plagiarism

The Board’s remit is to investigate three forms of research misconduct: fabrication, falsification and plagiarism. These terms are not defined by law, but are described in research ethics codes (codices) and guidelines, such as *The European Code of Conduct for Research Integrity*.<sup>3</sup> They are also explained in the Swedish Research Council’s publication *Good Research Practice*.<sup>4</sup> Fabrication is often described as making up results and documenting them as if they were real. Falsification refers to manipulation of research materials, equipment or processes, or unjustified alteration, omission or suppression of information or results. Finally, plagiarism is defined as a researcher’s use of other people’s texts, ideas or work without duly acknowledging the original source.

The assessment of the internal expert at Linköping University was that the top five X-ray diffractograms in Figure 2, Article 1 were based on identical raw data, and also that the associated data files had been manipulated. Concerning the remaining figures in Articles 2–4 specified in the allegations, he thought it was highly unlikely that the graphs came from different source data, based on the fact that the noise in X-ray diffraction is always stochastic in nature and never the same in two measurements.

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<sup>1</sup> Jens Birch, Professor at the Department of Physics, Chemistry and Biology, Linköping University.

<sup>2</sup> Magnus Skoglundh, Professor at the Department of Chemistry and Chemical Engineering, Chalmers University of Technology.

<sup>3</sup> *The European Code of Conduct for Research Integrity*, revised edition. Berlin: All European Academies (ALLEA); 2018, section 3.1.

<sup>4</sup> *Good Research Practice*. Stockholm: Swedish Research Council 2017, Chapter 8.

The expert engaged by the Board has analysed the article figures cited in the allegations by comparing the X-ray diffractograms with respect to absolute and relative intensity for the diffraction peaks and, above all, to the noise between the peaks. To draw conclusions, in his view, analysing the graphs in the articles is sufficient. He draws the conclusion that the two figures reported in Article 1 and the respective figures reported in Articles 2–4 contain fabricated X-ray diffractograms. The expert writes that in Article 1, at least four of the uppermost five X-ray diffractograms in Figure 2 are fabricated, as is at least one of the two diffractograms in Figure 13b. In Article 2, at least one of the upper two X-ray diffractograms in Figure 4 must be fabricated because they contain substantial sections that are identical. In Article 3, at least three of the four X-ray diffractograms in Figure 2 are fabricated; and in Article 4, at least one of the two X-ray diffractograms lowest down in Figure 3 is fabricated.

██████████ points out that the expert engaged by the Board did not appear to have examined the raw data for the articles where such data had been provided, and that analysis of the raw data is necessary for a fair assessment. In his statement, however, ██████ admits that the same sample was plotted several times during the preparation of the figures for two of the articles (Articles 3 and 4). He writes that this is due to errors and that the mixing of data does not affect the articles' results or conclusions. For Figures 2 and 13b in Article 1, he says there are technical and scientific explanations for the similarities in the X-ray diffractograms; and for Figure 4 in Article 2, he states that there are two points in the X-ray diffractograms that are not entirely identical.

In a supplementary expert opinion, the expert engaged by the Board has examined the raw data for Figures 2 and 13b in Article 1 that ██████ provided the Board with. The expert notes that the raw data files do not match the plotted graphs. The expert's previous conclusions — that at least four of the five uppermost X-ray diffractograms in Figure 2 are fabricated, and that at least one of the two X-ray diffractograms in Figure 13b is fabricated — remain.

The respondents were given the opportunity to comment on the supplementary expert statement, and ██████ commented on behalf of all the authors. He does not agree with the expert, but states that it is a matter not of research misconduct but, rather, of a misunderstanding that could have been avoided if they had contributed more detailed explanations and/or data in the article.

The Board reaches the same assessment as the experts, and it finds that the four articles clearly contain fabricated X-ray diffractograms. The Board also notes that the original data for Article 2 do not appear to have been managed and archived correctly.

### **Serious breach**

Only serious breaches of good research practice constitute research misconduct and are thus subject to investigation by the Board. Chapter 1, Section 17 of the Swedish Higher Education Ordinance (1993:100) prescribes that other breaches should instead be dealt with by the entities responsible for the research. The preparatory work for the Act states that fabrication and falsification are, in principle, always serious breaches of good research practice. In certain cases, plagiarism should not be considered a serious

breach of good research practice, for example if it is a minor infraction on a single occasion.<sup>5</sup>

The premise for the Board’s investigation here is therefore that, in principle, fabrication is a serious breach of good research practice. No reason to deviate from this premise, stated in the preparatory work, has emerged in this case. Accordingly, the Board’s conclusion is that the breaches are serious.

### **Intent or gross negligence**

Under Section 2 of the Act, for research misconduct to be found, the serious breach of good research practice must have been committed with intent or through gross negligence. “Intent” means, according to the preparatory work, that the researcher understood what (s)he has done, while “negligence” means that the researcher, in any case, should have understood this. “Gross negligence” requires the conduct to appear particularly serious or reprehensible. According to the preparatory work, oversights, carelessness or misunderstandings should not, as a rule, be considered gross negligence.<sup>6</sup>

The Board’s assessment is that –there is a lack of scientifically acceptable explanations for why the respondents fabricated research results in the way that took place in the articles in which research misconduct was alleged. Neither do the raw data support the results reported. Nothing has emerged to indicate that the actions involve oversights, carelessness or misunderstandings. In light of this, the Board therefore considers that, in any case, the respondents acted with gross negligence.

Accordingly, in summary, the Board therefore finds the respondents guilty of research misconduct.

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The Board has made a decision in this matter, following a presentation by caseworker Miriam Matsson.

Thomas Bull  
President

Miriam Matsson  
Caseworker

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<sup>5</sup> Government Bill 2018/19:58, p. 100.

<sup>6</sup> Government Bill. 2018/19:58, pp. 50–51, 100.