

Revised Final Report of the Committee of Initial Inquiry (CII) Concerning Allegations of Research Misconduct

July 21, 2017

A Committee of Initial Inquiry (“Committee”) was formed on September 6, 2016, to review allegations of possible Research Misconduct made against Dr. Mingjun Zhang, Professor, department of Biomedical Engineering, College of Engineering [REDACTED]

[REDACTED] (“Respondents”) by an anonymous complainant. The allegations concern the possible misrepresentation (“falsification”) of the identity of the newly identified gene for an arabinogalactan protein from English Ivy (*IAGP*) in a manuscript published in 2016:

Yujian Huang, Yongzhong Wang, Li Tan, Leming Sun, Jennifer Petrosino, Mei-Zhen Cui, Feng Hao and Mingjun Zhang (2016). Nanospherical arabinogalactan proteins are a key component of the high-strength adhesive secreted by English Ivy. *PNAS* 113 (23): E3193-3202. (Attachment 1)

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In the allegation submitted to the University on June 23, 2016, and subsequently forwarded to Dr. Jennifer Yucel, Director of the Office of Research Compliance and Research Integrity Officer on July 1, 2016 (included in attachment 1), the anonymous complainant asserted:

“The data in Fig 3 claims to show the sequence of an Ivy protein, that is glycosylated to be an AGP. There is an alignment with some Arabidopsis proteins, claiming to show moderate similarity. PNAS paper Figure S4 shows a cladogram on the basis of alignment to Arabidopsis proteins. However, the protein is in fact a fungal cytochrome oxidase subunit. The sequence when aligned to all proteins, not just Arabidopsis, shows up to 90% identity to fungal mitochondrial cytochrome oxidase subunits. ... By showing in this manuscript selective alignment only against Arabidopsis plant proteins, the authors have intentionally concealed this identity...”

The authors have knowingly, intentionally, repeatedly, and substantially misrepresented data in order to publish the manuscript.”

On July 12, 2016, Dr. Yucel, Dr. Richard Hart, Chair, department of Biomedical Engineering, and Dr. Randy Moses, Associate Dean for Research, College of Engineering met to review the allegations against Dr. Zhang and to conduct a Preliminary Assessment as required by the University Policy and Procedures Concerning Research Misconduct (“the Policy” attachment 2). Given the specific domain expertise represented in the allegations, it was determined that a subject matter expert should be consulted to assist in the determination as to whether the allegations might indicate possible Research Misconduct versus simply a difference of scientific opinion or the interpretation of the research results.

On July 13, 2016, Dr. Mike Ibba, Professor and Chair, department of Microbiology, College of Arts and Sciences, was enlisted to act as a consultant on this matter. Dr. Ibba

has extensive experience related to the identification and characterization of new genes. In addition, Dr. Ibba has extensive experience with the publishing process given his work as a journal editor. Dr. Ibba was asked to review the allegations and provide his professional opinion as to whether the allegations may indicate possible Research Misconduct or if they represented something else, for instance a difference of scientific opinion or the interpretation of research results.

In a letter to Dr. Yucel, dated July 16, 2016 (attachment 3), Dr. Ibba indicated that "In my opinion, the case as presented does not constitute research misconduct, but does nevertheless raise concerns related to data interpretation by Dr. Zhang." Dr. Ibba concluded that it was likely that either Dr. Zhang: "Is poorly versed in the state of the art and as a result has unintentionally misled both reviewers and readers" or "Deliberately misled reviewers and readers, although it should be emphasized that none of the materials presented suggest there was an intention to mislead." Lastly, Dr. Ibba suggested that "... the most appropriate course of action going forward would be for the journal PNAS to investigate the allegations with respect to their potential impact on the paper in question."

On July 15, 2016, Dr. Etta Kavanagh, Editorial Manager for PNAS, contacted the University regarding a complaint received by the journal (attachment 4). Dr. Yucel determined that the complaint sent to the journal was the same as the complaint received by the University. Dr. Yucel contacted Dr. Kavanagh on July 21, 2016 acknowledging the University's receipt of the complaint and verifying that the university was reviewing the matter (attachment 5). In response to the suggestion by Dr. Ibba, Dr. Yucel also requested that the journal provide any correspondence between the journal and Dr. Zhang related to the manuscript in question. On July 25, 2016, Dr. Kavanagh provided copies of four decision letters sent by PNAS to the authors corresponding to the multiple submissions to that journal (attachment 6). Dr. Yucel then sent an additional request to Dr. Kavanagh for copies of any submissions by the authors in response to reviewer's comments. These were provided to Dr. Yucel on July 26, 2016 by the journal (attachment 7).

On July 26, 2016, Drs. Yucel, Hart and Moses met to review the information provided by the journal, Dr. Ibba's assessment, and some basic sequence and homology analyses conducted by Dr. Yucel. Based on this review, it was determined that the allegation of possible Research Misconduct (falsification) was credible and specific enough to indicate possible Research Misconduct and should be moved forward to an inquiry.

On August 23, 2016, Dr. Yucel, Dr. Moses, and Dr. Hart met with Dr. Zhang to notify him of the allegations made against him (attachment 8), to discuss the allegations and determine who had participated in the generation of the data in question. Also discussed with Dr. Zhang was the location of the original data for the study in question. During this meeting, Dr. Zhang indicated that [REDACTED]

[REDACTED]
Based on the information provided by Dr. Zhang during this meeting, it was determined that the allegations indicating possible Research Misconduct [REDACTED]

[REDACTED] Immediately following the meeting on August 23, 2016, Dr. Yucel and Dr. Zhang went to the laboratory to sequester all relevant research records and Dr. Yucel briefly met with [REDACTED]

[REDACTED]

The Preliminary Assessment letter regarding the allegations of potential Research Misconduct and recommending that this case be moved forward to a Committee of Initial Inquiry was submitted to Dr. Caroline Whitacre, Senior Vice President for Research on August 25, 2016 (attachment 10). On September 6, 2016, Dr. Whitacre concurred with the Preliminary Assessment and indicated a Committee of Initial Inquiry should be initiated (attachment 11).

Meetings and Discussions of the Committee:

The Committee of Initial Inquiry (CII) first met on October 11, 2016. The following documents related to the allegation were provided:

- The University Policy and Procedures Concerning Research Misconduct (attachment 2)
- Initial allegation referred to the Office of Research Compliance on July 1, 2016 along with the manuscript: Yujian Huang, Yongzhong Wang, Li Tan, Leming Sun, Jennifer Petrosino, Mei-Zhen Cui, Feng Hao and Mingjun Zhang (2016). Nanospherical arabinogalactan proteins are a key component of the high-strength adhesive secreted by English Ivy. PNAS 113 (23): E3193-3202 (attachment 1)
- Notification of Allegations letter dated August 23, 2016 (attachment 8)
- Revised Notification of Allegations letter dated August 24, 2016 (attachment 9)
- The Preliminary Assessment letter dated August 25, 2016 and referenced attachments (attachment 10)
- Review performed by Dr. Mike Ibba, dated July 16, 2016 (attachment 3)
- PNAS communications and decision letters (attachments 6 and 7)
- Zhang [REDACTED] "Response to the Allegation against the PNAS paper" dated August 24, 2016 (attachment 12)
- Thumb drive containing copies of all of the case materials collected to date

During their initial meeting on October 11, 2016, the CII discussed the Research Misconduct policy and process and the specific charge of the CII. The CII reviewed the provided case materials related to the allegation, discussed whom the committee should interview and briefly discussed the disposition of the original research records. As not all members of the CII were able to attend the initial meeting, a second meeting took place on October 13, 2016, with the remaining committee members provided the same information as provided during the October 11, 2016 meeting.

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The CII next met on November 29, 2016 to discuss their review of the case materials provided, to determine who they wanted to interview, and discussed what information they wanted to get and what questions they wanted to ask during the interviews. During the discussion of the case materials, the CII members determined that it would be helpful to determine if [REDACTED] included any of the research presented in the manuscript under investigation. Following discussions with [REDACTED], it was determined that none of the data relating to the manuscript in question was going to be included in [REDACTED].

[REDACTED] Dr. Zhang's lab environment, the training provided to members of the Zhang lab, and any specific manuscript preparation practices in the lab.

Regarding the PNAS manuscript in question, the CII asked specific questions relating to how the experimental studies were conducted, who generated the data and who reviewed the data, who [REDACTED] consulted with as subject matter experts, and who wrote, reviewed, and revised the manuscripts and corresponded with the journals during the review and publication process. Specifically, [REDACTED]

The committee next met on January 11, 2017, to interview Dr. Zhang, and the meeting was recorded and transcribed (attachment 15). [REDACTED], Dr. Zhang was asked to describe the general lab environment, provide details on how graduate students are trained, and speak to any specific manuscript preparation practices for the lab. Dr. Zhang provided the committee members with a document entitled, "Key Points to Interpret Potential Sequence Similarity" (attachment 16). Dr. Zhang was also asked to explain why he believed the protein identified was not a fungal contaminant and to describe the specific experimental evidence that supports the manuscript conclusion that the protein identified is not a fungal cytochrome c oxidase. Dr. Zhang was also asked about [REDACTED]

On January 11, and January 12, 2017, Dr. Zhang provided additional information and a draft erratum to the CII (attachment 17) and then again on February 27, 2017, Dr. Zhang sent additional statements and the co-author's CVs to the committee for their review (attachment 18). The CII met again on February 28, 2017, to discuss the additional materials provided by Dr. Zhang [REDACTED] and to make their final determination as detailed below.

On March 21, 2017, the Preliminary Report was provided to Dr. Zhang [REDACTED] [REDACTED] for their comments. On April 5, 2017 and April 6, 2017, Dr. Zhang (through his attorney Emily Haynes) provided in hard copy and by email comments to the report along with fifteen (15) attachments that included letters of support and /or email correspondence from Dr. Zhang's colleagues and associates (attachment 27). [REDACTED]

As some of the information from Dr. Zhang was sent after the stated deadline and seemed to indicate that more would be coming, the CII agreed to extend the window until April 12, 2017, to allow for the receipt of comments for an additional week. On April 7, 2017, both Dr. Zhang (through Ms. Haynes) [REDACTED] informed Dr. Yucel that they would not be submitting any additional materials and requested that the window be closed (attachment 28). The CII agreed and closed the window for comments as of 6pm, Friday April 7, 2017.

All information provided by Dr. Zhang was immediately forwarded to the CII for their review. The CII met on Friday, April 14, 2017 to discuss the materials and again on April 18, 2017.

Due to the voluminous nature of the comments provided to the CII by Dr. Zhang and the impact those comments had on the CII, on April 20, 2017, the CII requested a five (5) day extension for their response deadline (attachment 29). Dr. Whitacre approved the extension request setting the new date for response to Friday, April 28, 2017 (attachment 30). The CII's reconsideration of their findings are detailed in a letter to the Respondents dated April 28, 2017 (attachment 34) and are summarized below.

The Committee's Concerns about the Published Research

The CII independently reviewed the published paper, manuscript drafts, data and other materials, and like the complainant is concerned about the identification of the identity of the newly identified gene for an arabinogalactan protein from English Ivy (*IAGP*). These concerns include the following:

1. The sequence identified in Figure 3 of [REDACTED] is identified in the text as a full length cDNA ("...the nucleotide sequence for the full-length cDNA encoding the core protein was then determined by 5' and 3' RACE cloning (Fig. 3B)."), yet appears to retain an intron (or at least a mid-sequence in-frame stop codon). This argues that the sequence is not cDNA.

2. In the document "technical communications with the vendor" (attachment 19, pgs. 12 and 26) one 5' end and five 3' end RACE sequencing results are provided by the vendor. Only one of the sequenced clones (designated F3) corresponds to the published sequence while the others, when run through blast analysis, clearly correspond to other gene sequences (attachment 20). When asked why F3 was selected, [REDACTED]

[REDACTED] The committee identifies this as an example of inappropriate data selection without scientific justification.

3. In response to multiple reviewer concerns about the identity of the sequence included in the manuscript, the authors included a comment in the revised manuscript about a blastp analysis, and included supplemental figure S4a (a phylogram) that included comparison only to proteins from the plant *Arabidopsis thaliana*. In the manuscript, the authors state:

“Moreover, the identified full protein sequence, designated as IVY ARABINOGALACTAN PROTEIN (IAGP), demonstrated a moderate similarity to four other HRGPs derived from Arabidopsis in a sequence alignment (Fig. 3C). Notably, in a BLASTp search in the genome of the A. thaliana, the IAGP identified from H. helix also exhibited a moderate extent of similarity to several cytochrome c oxidase subunits, implying potential homology between these two types of proteins.”

While, this is technically a true statement that IAGP does demonstrate only a moderate similarity to *A. thaliana* cytochrome c oxidase subunits (approximately 30%), it fails to accurately reflect that when an unrestricted blastp analysis is done, it identifies the protein most similar (over 90% identical) to IAGP is a fungal cytochrome oxidase, raising significant concerns regarding the source of the sequence, and whether assigning the gene to Ivy (*H. helix*) is appropriate (see attachment 21). The committee identifies this comparison and reporting of the selected sequence only to Arabidopsis sequences an additional example of data selection without scientific justification.

4. In the response to the Preliminary Report provided by the Respondents, the mass spectrometry data (Figure S4b) were offered as support for the sequence of Figure 3 (see attachment 27, page 26 of letter from Haynes, dated April 5, 2017). It is the CII’s opinion that first, only three of the peaks are sufficiently close to argue identity, and second, there are a large number of unaccounted for peaks, possibly owing to the complexity of the mixture that was subject to analysis. However, the rationale for selecting certain peaks, and not others, is not provided. For example, a peak at 1021.37 is identified as being a good match to the expected size, although an adjacent peak of slightly larger size is more abundant, but is not selected as important. The committee identifies this as an additional example of data selection without scientific justification.

5. In the response to the Preliminary Report provided by the Respondents, evidence that the intron is marked in genbank is provided (see attachment 27, page 25 of letter from Haynes, dated April 5, 2017). Evidence that there is actual cDNA sequence supporting the intron is not provided. While computational methods can be used to predict splice sites, none of these methods is completely accurate, and none can demonstrate that particular mRNAs are spliced in a particular way in a particular cell type or RNA sample. cDNA sequence implies that cDNA, prepared by reverse transcription of RNA to DNA, demonstrated that the intron was removed in an RNA harvested from the sample.

6. Here we restate the CII’s concerns, to address several points raised in the response to the Preliminary Report provided by the Respondents that are not relevant to the case. The CII has not raised concerns regarding the evidence that there is detection of AGP in the enriched sample of nanoparticles. The CII has not raised concerns about the evidence for glycosylation of the material in the enriched sample of nanoparticles. The CII has not raised concerns regarding whether or not the reported sequence is or is not an AGP, and the CII agrees that there is much yet to learn about this class of molecules. The issue at hand is whether the sequence of IAGP published in figure 3

has been properly attributed with respect to source (species), accurately represents the relevant molecule(s) in the enriched sample of nanoparticles, and whether data were knowingly presented in a way to intentionally mislead others and misrepresent the sequence.

Reconsideration of the Conclusions by the CII

On April 28, 2017, this report and the CII's reconsideration letter (attachment 34) was provided to Dr. Whitacre for her review, in accordance with the Policy. On May 19, 2017, Dr. Whitacre provided her review to the CII (attachment 36). Dr. Whitacre requested that the CII review the evidence and reconsider its findings (attachment 36). Dr. Whitacre granted the CII an additional two (2) month period in order to accomplish their review and reconsideration (attachment 37).

The CII notified Dr. Zhang [REDACTED] that they would be contacting Dr. Stewart and Dr. Lenaghan, two former collaborators of Dr. Zhang's located at the University of Tennessee, Knoxville and that Dr. Whitacre had granted a two month extension in order to allow the CII time to complete their reconsideration (attachment 38).

During the course of their reconsideration, the CII reviewed additional evidence taken from Dr. Zhang's computer, information provided [REDACTED], and the CII interviewed two former collaborators of Dr. Zhang's located at the University of Tennessee, Knoxville. The CII communicated numerous times with [REDACTED] Dr. Zhang (attachment 39) and communicated with the OSU CCIC facility regarding the mass spec data (attachment 40). During the course of the CII's review and reconsideration, a number of new findings were made that significantly influenced the CII's final decision. In the interest of clarity, the Committee's final reconsideration, the evidence reviewed, their conclusions and findings are provided as a separate section at the end of the report, starting on page 17.

Conclusions of the Committee regarding Dr. Zhang

Regarding the allegations of possible Research Misconduct involving the intentional misrepresentation ("falsification") of the identity of the newly identified gene for an arabinogalactan protein from English Ivy (*IAGP*) brought against Dr. Mingjun Zhang, the Committee of Initial Inquiry originally determined, under the preponderance of evidence standard, by a vote of 3 in favor and 1 against, that the allegations **did not have** sufficient substance to indicate possible Research Misconduct and therefore should be dismissed.

Following consideration of the comments provided by the Respondents on April 5, 2017, the Committee determined, under the preponderance of the evidence standard, by a vote of 3 in favor and 1 against, that the allegations **did** have sufficient substance to indicate possible Research Misconduct and warrant investigation under the Policy.

Following the CII's reconsideration of the evidence, including additional new findings of the CII, the Committee has determined, under the preponderance of the evidence standard, by a vote of 3 in favor, and 1 against, that the allegations against Dr. Zhang **do** have sufficient substance to indicate possible Research Misconduct and therefore warrant investigation under the Policy. The Committee's Reconsideration is detailed starting on page 17 of this report.

The original conclusions were based on the following facts and observations:

By his own testimony, [REDACTED] Dr. Zhang did not do the experiments or prepare the manuscript, or prepare or submit the response to reviews: "I never maintain a draft" (Zhang transcript, attachment 15, pg. 23, line 17); "I don't load these things ... I always ask them to load these things" (Zhang transcript, attachment 15, pg. 26, line 20).

[REDACTED]. The CII found no evidence to indicate that Dr. Zhang provided any specific oversight or had any knowledge that the data might be mischaracterized or misrepresented relating to identification of the IAGP gene.

With respect to general oversight, Dr. Zhang indicated that he requests weekly reports from his lab members (Zhang transcript, attachment 15, pg. 7, line 19), but that

[REDACTED]. The CII is very concerned by the lack of involvement and oversight provided to [REDACTED] by Dr. Zhang during the conduct of the research in question. However, in order for Dr. Zhang's lack of oversight in this matter to be considered "Reckless" and therefore meet the criteria of Research Misconduct it would require that Dr. Zhang be aware that his failure to act or provide oversight could cause Research Misconduct to occur. That is, for example, that there was a past track record of misconduct [REDACTED] that would signal a requirement for closer scrutiny. This committee did not uncover any such evidence, or past track record, so while the CII believes that Dr. Zhang did not fulfill his responsibilities as faculty advisor and Principal Investigator regarding this work, nor exercise the scientific rigor considered to be the accepted practice of the relevant research community due to his lack of involvement, his actions did not rise to the level of 'Reckless.' One CII member felt that if falsification of data did occur, Dr. Zhang should be held responsible even if he was not directly involved in, or aware of, the data misrepresentation because greater oversight might have prevented the opportunity for the misrepresentation to occur and because he is the senior and corresponding author of the paper and therefore assumes responsibility for all aspects of the work. Nevertheless, there was not a preponderance of evidence of knowing, willing, or reckless falsification of data presented.

As noted in our report, there appears to be misrepresentation of data and disregard for at least two different reviews that questioned the kingdom and phylogeny of the DNA sequence identified, as the authors refused to acknowledge or take guidance from the appearance of the same concern in multiple submissions of the manuscript in question. The CII finds that each of the different manuscript reviews was offered in the spirit of education; however, this is not how Dr. Zhang [REDACTED] received the comments. In fact, Dr. Zhang frequently expressed concerns to the CII that feedback is not intended to improve the work, but is rather a threat (e.g., "My trouble is in terms of the scientific community accepting these things. People always coming from their perspective and trying to kill it, particularly plant society."); (Zhang transcript, attachment

15 pg. 39, line 13). The committee is concerned with the attitude and actions taken by both Dr. Zhang [REDACTED] in responding to reviewer comments, especially when the issue was raised by more than one reviewer, and in more than one submission of the manuscript. The committee feels that an important principle of the scientific enterprise is to use reviewer comments as a source of feedback and opportunity to improve research, and both the spirit and letter of this principle was not followed in this case.

The CII unanimously agreed that data regarding the sequence identity was misrepresented in the manuscript when the authors failed to respond properly to the concerns raised by reviewers prior to publication. That said, prior to submission of the response from the Respondents and additional materials by Dr. Zhang on April 5, 2017, the majority of the CII believed there was insufficient evidence to support a finding of possible Research Misconduct (falsification) as there was no clear evidence that the Dr. Zhang's [REDACTED] actions were committed knowingly, willingly, or recklessly to falsify their results. The dissenting CII member does believe that ignoring the reviewers' concerns does constitute intent of possible Research Misconduct.

The committee then carefully reviewed the response to the Preliminary Report provided by Dr. Zhang on April 5, 2017 (attachment 27), and based on the information provided by Dr. Zhang, have reconsidered their findings, leading to a new vote that there IS sufficient substance to warrant investigation under the university's disciplinary processes. The CII's basis for their new finding is provided below:

1. New evidence regarding oversight of the project and the decision-making regarding the figures, manuscript, and response to reviewer comments.
 - a. Dr. Zhang provided letters from several past and current mentees arguing that he was closely involved in oversight of their projects. (See attachment 27, referenced attachments 4-9 with excerpts in the response document, section B, starting pg. 6). For example, The Appeal, in Section B. (pg. 6) now states that Dr. Zhang's "...mentorship and oversight in his lab is rigorous and extensive, he concedes that his interview with the CII has not resulted in the necessary clarity of his roles."
 - b. Dr. Zhang provided letters from colleagues and his departmental chair arguing that he is closely involved in mentoring and oversight of the research (See attachment 27, referenced attachments 1-3, with excerpts in the response document, section B, starting pg. 6).
 - c. Documents from Dr. Zhang's computer (attachments 32 and 33, identified on Mingjun Zhang 15" MacBook Pro in the Downloads folder) that represent drafts of the response to reviewer's comments include annotations by Dr. Zhang (attachment 33, Response letter 1-2.doc). Importantly, text regarding figure 3 is noted by Dr. Zhang as: *"this is not a good response. Must straight forward to response "Are you sure we have cloned the right cDNA". Answer: YES, and provide the evidences"*. The text of the response is changed (compare attachment 32, Response letter 12-29.doc to attachment 33, Response letter 1-2.doc). Contrary to previous statements by Dr. Zhang, these documents and changes argue that Dr. Zhang was involved in the response to reviewer's comments for

this particular manuscript, and the specific response regarding the research in question.

2. New evidence regarding Dr. Zhang's credibility with respect to oversight.
 - a. Throughout the initial review and inquiry process, Dr. Zhang consistently asserted that the decisions in the research were made [REDACTED] and that Dr. Zhang did not have close involvement. For example, Dr. Zhang from the interview with the CII (attachment 15, pg. 44, line 16) communicated that as the paper was continually resubmitted to journals, he became less passionate about this manuscript as other matters were becoming more pressing. Dr. Zhang states that at this point, he did not even read the paper. Dr. Zhang further states that [REDACTED] [REDACTED] to have the ADP [*sic*] idea coming in." (attachment 15, pg. 45, line 3). The documents provided in the Respondent's response to the Preliminary Report and as evidenced by comments on the response to reviewer's comments contradict this assertion (as outlined above, 1.c), compromising the credibility of Dr. Zhang.
 - b. With the submission of the Respondent's response to the Preliminary Report, the CII identifies two conflicting narratives that are argued by Dr. Zhang.
 1. Dr. Zhang has tried to present himself to Dr. Yucel and this committee as a detached PI, who does not have the expertise with respect to the specific allegation. Or;
 2. Dr. Zhang is engaged in all aspects of the process, and fully understands the implication/questions of DNA sequence homology.

Evidence for narrative 1:

- A. Letter to Dr. Yucel et al., "Response to Allegation against the PNAS Paper", dated August 24, 2016 (attachment 12, pg. 1):

"The claim regarding the identity of the IAGP is wrong

The complaint claimed that the identity of the core protein we reported was a fungal cytochrome c oxidase subunits based on the result of sequence alignment alone. Sequence alignment is a tool to assess the homology and/or similarities of multiple selected proteins, but not a precise and determined approach to identify an unknown protein. *Identification of a protein based on sequence alignment alone is non-scientific and peculiar.* Our conclusion was established based on multiple sources of scientific evidences." [italics added]

The italicized text is a surprising statement from a scientist doing biological research. The idea that sequence conservation is not meaningful contradicts over 40 years of protein, gene, and genomic sequence analysis. The CII refers back to point #6, page 6, about what is and is not a concern of the CII. The concern is not that there are data for AGP in the nanoparticles, but rather that the concerns regarding the sequence data are disregarded out of hand.

- B. Many examples in the personal testimony of Dr. Zhang to the committee. See text 2a, page 7, above for specific examples.

- C. An e-mail sent by Dr. Zhang to Dr. Yucel and Courtney Mankowski, dated February 27, 2017 (attachment 18/file “20170227 – Email Zhang to RIO #2.pdf”):

“All I am trying to say during the interview was that with the approval for publication of this co-authorship, I cannot take the blame for any potential research misconduct, although I do feel very very sad for the allegation. After being told that there was 99% similarities in the sequence during the recent interview, this changed my feeling [REDACTED] never admitted me so high and I did ask multiple times. The feeling I got was that the reviewer was wrong. Even in last interview as you might recall, I still thought the 99% needs to be verified.”

This presents a narrative of a detached Principal Investigator who does not understand the importance of how close the DNA sequence in question matched other organisms present in the national database.

Evidence for narrative 2:

- A. Documents from Dr. Zhang’s computer (attachments 32 and 33, identified on Mingjun Zhang 15” MacBook Pro in the Downloads folder) that represent drafts of the response to reviewer’s comments (see 1c, pg. 9 above).

- B. In publications prior to the PNAS paper in question, which discussed the process of obtaining and characterizing the protein in question, (see attachment 35, Lenaghan et al., 2013 publication on which [REDACTED] Dr. Zhang [REDACTED]), includes the following statement:

“Since the root hairs are the only known structures involved in the generation of the nanocomposite adhesive [1], the first step in the development of a procedure for nanoparticle production was to maximize the production of root hairs, while preventing any external contamination. As a result, a tissue culture method was developed for growing the adventitious roots from cut shoots in sterile Magenta GA-7 (MAG) plant culture boxes”

It is important to note, that in the other publications [REDACTED], the concept of “sterile” is not discussed, it is only in the Lenaghan 2013 publication. This is a fundamental question in plant cell culture; do you have a pure culture, or are there contaminants, or symbiotic organisms coming along for the ride? This indicates that Dr. Zhang does understand this concept and that there is a chance that the DNA in question did not come from the Ivy. It also raises the question as why this concept was not discussed in other references.

- C. The detailed response in the Respondent's response to the Preliminary Report by Dr. Zhang about potential for symbiosis suggests that he is much more aware of possible issues regarding origin of the sequence than was apparent from earlier information provided to the CII. If he is aware of this complexity, then it raises questions about the motivation to select and represent only a single species for comparison in the PNAS paper.

- D. In the reviews of the original (first) PNAS manuscript, reviewers sought to draw the authors’ attention to the extremely high similarity between the reported sequence

from Ivy and publically available sequences for several fungal proteins, yet the authors only noted “a moderate extent of similarity to several cytochrome c oxidase subunits”. The likelihood that the authors’ approach to data analysis would mislead the reader was exacerbated by the exclusion of fungal sequences from Fig. S4a, which, contrary to the statement text, does not include the “closest relatives”. This action with respect to the response to the reviewer’s comments, combined with points above, demonstrates a greater understanding of the significance of a potential fungal contaminant, and raises the question of whether they are purposefully omitting the similarity to the fungal DNA in order to mislead the readers.

As outlined in this section, there is evidence that two different narratives exist, and upon reconsideration, the CII questions whether Dr. Zhang has purposefully attempted to present narrative 1 to mislead the CII. At least one committee member identifies these contrasting narratives as intent to commit scientific misconduct.

3. New evidence regarding the credibility of Dr. Zhang’s plans and efforts to correct the scientific record regarding the plant genetics/molecular biology community.

a. Communication from Dr. Zhang to Dr. Yucel after the CII interview with Dr. Zhang indicates “I am consulting carefully with experts in the field [sic] now.” (attachment 18/file “20170227 – Email Zhang to RIO #2.pdf”).

b. While the Respondent's response to the Preliminary Report by Dr. Zhang included letters of scientific support, letters from plant protein biochemists and genomics experts seem lacking. Researchers identified by Dr. Zhang in his interview as important consultants on the biology (Dr. Lenaghan and Dr. Stewart; pg. 30 attachment 15, Zhang interview) did not provide support, nor did the co-author identified in the letter from Dr. Wang (Dr. Mei-Zhen Cui) as an expert in sequencing. Questions were raised about apparent lack of ongoing attempts to reach out to experts in the field of plant molecular biology or genetics (or plant microbe interactions, which Dr. Zhang argues is important in this case, pg. 32 attachment 15, Zhang interview). Scientific support letters from Dr. Lamport and Dr. Kieliszewski are provided, which support the research, but both address issues that are not relevant to the concerns at hand (see point #6 above in “The Committee’s Concerns about the Published Research”). It is also noted that these two scientific letters of support are identically worded.

c. Additional evidence in the letter from Dr. Wang (attachment 27/letter #8) supported the information provided in the Dr. Zhang interview about past conflict with Dr. Stewart, who is a co-Investigator on one of the NSF grants listed as support in the PNAS paper (0965877). Questions were raised about the importance of this collaboration to early phases of this work, and the presence of these collaborators in past publications [redacted] Lenaghan et al., 2013) but absent in a related publication from 2015 [redacted] and the PNAS paper, which is the subject of this inquiry.

4. New evidence supporting intention to mislead rather than ignorance

a. The Respondent's response to the Preliminary Report by Dr. Zhang includes an argument that the other sequences provided by McLab are not valid because they don’t have adequate proline residues (a feature that defines AGPs; see

attachment 27, pg. 25). This raises questions about whether only data consistent with the AGP hypothesis were accepted or were considered, and whether data were selected based on their consistency with the hypothesis.

b. Dr. Zhang asserts in the Respondent's response to the Preliminary Report that the mass spectrometry data argues that the proline residues in the peptides are modified to hydroxyprolines (attachment 27, pg. 29). The CII notes that the mass spectrometry analytical method provides peaks, and then the researcher makes predictions about what the expected peptide lengths are, based on what they anticipate is in the sample. The researchers made the assumption that the prolines are modified in their predictions. Thus, it is an assumption of the experimental prediction, not a conclusion from the data. This also raises the question as to whether only data consistent with the sequence reported in Figure 3 were accepted or were considered.

5. The Respondent's response to the Preliminary Report includes an argument that they did not conceal the identity of the protein and their methods by restricting the comparison to proteins from Arabidopsis (attachment 27, pg. 32). The detailed response by Dr. Zhang about potential for symbiosis suggests that he is much more aware of possible issues regarding origin of the sequence than was apparent from earlier information provided to the CII. If Dr. Zhang is aware of this complexity, then it raises questions about the motivation to select a single species for sequence comparison in the paper.

Based on the Respondent's response to the Preliminary Report, Dr. Zhang seems to have changed his role in the design of research and publication of [REDACTED] PNAS 2016; E3193–E3202. From the Respondent's response to the Preliminary Report, the CII is being asked to understand that Dr. Zhang was fully involved with oversight of the work, the submissions of the versions of the paper during the publication process, and in the submission of the DNA sequence to Genbank, an international consortium of data exchange. The Respondent's response to the Preliminary Report, Section B (pg. 6), states that Dr. Zhang's "...mentorship and oversight in his lab is rigorous and extensive, he concedes that his interview with the CII has not resulted in the necessary clarity of his roles." The Respondent's response to the Preliminary Report provides evidence that indeed, Dr. Zhang is extensively involved with all aspects of mentoring students. The information provided by Dr. Zhang in the Respondent's response to the Preliminary Report is in direct opposition to his earlier statements recorded during our interview on January 11 2017 (attachment 15) and in many other communications with Dr. Yucel's office during this process. The conflict in Dr. Zhang's statements raises the issue of credibility of Dr. Zhang for the CII. Are all of Dr. Zhang's [REDACTED] previous statements and testimony correct, or is the view put forth in the Respondent's response to the Preliminary Report correct? The new evidence provided in the Respondent's response to the Preliminary Report in the letters from Hansford (#1), Hart (#2), Hamel (#3) [REDACTED] if taken as fact, would appear to support a conclusion by the CII of willful direction by Dr. Zhang relevant to falsification of evidence in Figure 3 of the PNAS publication. The committee now believes that from Dr. Zhang's words, references and documents from Dr. Zhang's computer (attachment 33, Response letter 1-2.doc), Dr. Zhang was extensively involved with the submission of the paper and the response/new submissions.

With this understanding/knowledge, the CII's determined that their rationale for the vote of 3 to 1 (No-yes) that Research Misconduct may have occurred was no longer valid. Therefore, following reconsideration of the Respondent's response to the Preliminary Report, the CII re-voted and the vote was 1 NO and 3 YES, under the preponderance of evidence standard, that there was sufficient evidence that Research Misconduct may have occurred by Dr. Zhang.

Recommendations relating to Dr. Zhang:

While originally the CII did not find sufficient evidence of possible Research Misconduct, following their review and final reconsideration, the CII believes that there is sufficient evidence of possible Research Misconduct by Dr. Zhang to warrant an investigation. Further, given the issues with the published work, including the significant new findings related to the publication, the CII strongly recommends that Dr. Zhang be required to complete the following actions within thirty (30) days of the date of the Revised Final Report:

1. Contact PNAS and work with the journal to retract the published paper as an appropriate action under the current circumstances and as required under section V.G of the Policy, 'Correction of Erroneous Research'.
2. Contact NCBI to correct or remove the entry for IAGP in the national databases as required under section V.G of the Policy, 'Correction of Erroneous Research'.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

As noted earlier in this report, [REDACTED] Dr. Zhang acknowledged that Dr. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

FINAL RECONSIDERATION OF EVIDENCE AND FINDINGS

As requested by Dr. Whitacre in her letter to the CII on May 19, 2017, the CII re-reviewed a number of pieces of previously reviewed evidence; conducted additional reviews of new evidence obtained from Dr. Zhang's computer, reviewed additional information provided [REDACTED], and conducted additional interviews.

The CII met on the following days to discuss the following topics:

- May 24, 2017 – Meeting of the committee to discuss the reconsideration request from Dr. Whitacre
- June 12, 2017 – Meeting to develop questions for interview with Drs. Stewart and Lenaghan
- June 16, 2017 – Interview of Drs. Stewart and Lenaghan
- June 21, 2017 – Meeting to discuss information obtained from interview of Drs. Stewart and Lenaghan and to discuss additional evidence from Dr. Zhang's computer
- July 11, 2017 – Meeting to review all new evidence and vote on final determination

In addition to the email communications with Dr. Zhang [REDACTED] (attachment 39) and the communications with the OSU Campus Chemical Instrument Mass Spec &

Proteomics facility (CCIC) (attachment 40), evidence reviewed by the CII include the following files provided [REDACTED] or taken from Dr. Zhang's computer:

- First round of sequence.docx (attachment 41)
- 31214 IVP NP.pdf (attachment 42)
- Huang mass spec trace printout titled "Ivy NPs #1" (attachment 43)
- "Supplemental Fig_092012.pptx (attachment 44)
- "Supplemental Table S1 (A, B and C).xlsx" (attachment 45)
- "Supplemental Table S2 (A, B and C).xlsx" (attachment 46)
- "Supplemental Table S3.xlsx" (attachment 47)

As noted above, the CII interviewed Dr. Zhang's former collaborators at the University of Tennessee, Knoxville, Drs. Stewart and Lenaghan, and the interview was recorded and transcribed (attachment 48 (folder)). Following the interview, Dr. Stewart sent the CII a clarifying email (attachment 49) regarding comments made in the interview about the culturing methods and sterility of the cultures. From this interview, the CII learned that the former collaborators were not aware of the experiments and results published in the PNAS paper until they discovered the published paper (attachment 48, see pg. 11, line 13). However, the interviewees were surprised by the reported results since the method used was an older one with which the collaboration had obtained peptide sequences that represented a very large number of proteins (attachment 48, see pg. 19, line 6; pg. 20, line 3). These data had been prepared to be included in the Lenaghan et al., 2013 paper (attachment 50) on which Dr. Zhang [REDACTED] [REDACTED] but ultimately were not added to that manuscript. A member of Dr. Stewart's research group (Jason Burris) had subsequently developed an improved purification method that reduced the number of included proteins, but still yielded a complex mixture (attachment 48, see pg. 16, line 23; pg. 26, line 11). Neither the earlier mass spectrometry data (from the collaboration) nor their newer data included the protein reported in the PNAS paper (attachment 48, see pg. 43, line 18). From the interview, the CII also learned that additional, unpublished results had been obtained and discussed prior to the experiments published in the PNAS paper as part of the collaboration. Consequently, there is evidence that Dr. Zhang [REDACTED] [REDACTED] had previous knowledge highlighting the need for caution and rigor in the identification of their candidate gene as the background and presence of potential contaminants or non-specific proteins was very high. Yet, they disregarded that information.

In addition to speaking with Drs. Stewart and Lenaghan, the CII focused on three data areas during their reconsideration: the generation and identification of the IAGP DNA sequence, the reported mass spectrometry data, and the complexity of the nanoparticle preparation as it related to the likelihood of identifying an authentic IAGP versus a possible contaminant or non-specific protein. During the CII's reconsideration, a number of new findings were made that influenced the CII's decision. The new findings are summarized below.

1) A contradiction between published sequence methods, and data and documents from the vendor, Molecular Cloning Laboratories (“MCLAB”).

The CII reviewed a document present on Dr. Zhang’s computer entitled “First round of sequence.docx” (attachment 41 of Final Report), attached to an email from Steven Li at MCLAB, dated Sept 4, 2013. This email appears to be a reply to an email sent from [REDACTED] to MCLAB dated Aug 30, 2013. The file “First round of sequence.docx” (attachment 41 of Final Report) includes an entry labeled “original sequence” - a DNA sequence of 108 nucleotides that includes two primer sequences used to amplify different cDNAs (also provided in the document). The CII requested information [REDACTED] as to the identity of the sequence and asked [REDACTED] to clarify what information had been provided to MCLAB to initiate the project. To date, no clarifying or specific information has been provided to the CII [REDACTED] as to what sequences or other information was provided to MCLAB [REDACTED]. Of note, a BLAST search using the “original sequence” fails to bring back any entries in the NCBI databases with significant similarity.

While the generation of, and the source of the “original sequence” is still not clear, the annotation in the document indicates that the cDNA products were generated from distinct, but determinate (i.e., non-degenerate) primers, contrary to the methods as reported in the PNAS paper. The methods described in the PNAS paper are: “According to the obtained N-terminal sequence, a pair of primers comprising an oligo (dT) and a degenerate fragment F1a, 5'-GCICCCICCCICCIACIGAT/CGCI-3' (I = inositol), was used for a PCR amplification.”

The reverse primer is also annotated in the “First round of sequence.docx” document (by the vendor) to include not only the reverse complement of the poly-A tail, but a determinate sequence (which is the same for all cDNAs). The “First round of sequence.docx” document, which identifies a determinate sequence that extends beyond (5') from the degenerate primer as a starting point, and also reports cDNA sequences generated with determinate sequences rather than degenerate and poly-dT, suggests the reported sequence was obtained using methods other than those reported in the PNAS paper. The failure to accurately, or correctly, describe the methods used when reporting research is a significant departure from accepted scientific practices. The CII finds this an additional allegation of possible Research Misconduct by the falsification of the reported research by the intentional misrepresentation of research methods.

2) A contradiction between published mass spectrometry MALDI-TOF methods, data and documentation, and publication.

Following information provided by the Respondents in their responses to the Preliminary Report and the Final Report, dated April 28, 2017, the CII looked in more detail at the reported mass spectrometry data published in Figure S4b of the PNAS paper.

The text of the PNAS paper indicates: “MALDI-TOF MS analyses were carried out at the Mass Spectrometry and Proteomics Facility of The Ohio State University, using a ultrafleXtreme mass spectrometer (Bruker) equipped with 355-nm nitrogen lasers (20 Hz), according to the procedure described previously (91). Reflectron ion mode was used for positive ion detection, with ion source voltage of 25 kV and a 90-ns delay.” Dr. Yucel contacted the OSU CCIC Mass Spec & Proteomics facility to try to obtain records

corresponding to the published data. In communications with Dr. Yucel, the OSU CCIC Mass Spec & Proteomics facility indicated that they did not appear to have records for the data reported in the PNAS paper (attachment 40). Dr. Yucel contacted [REDACTED] to assist the OSU CCIC facility in locating the records. [REDACTED] acknowledging that the published experiment was not actually done at the OSU CCIC facility (as reported) but instead the published data were generated in 2013, in the lab of Dr. Liguo Song, at the University of Tennessee, Knoxville. [REDACTED]

[REDACTED]

(See attachment 39 for communications [REDACTED])

The CII reviewed a file present on Dr. Zhang's computer entitled "31214 IVY-NP.pdf" dated Sept 9, 2015 (attachment 42). The CII believes that this file represents the data generated at the OSU CCIC facility [REDACTED]. This file includes mass spectrometry (mass spec) data that appear to differ from the mass spec data published in the PNAS paper. Therefore, it appears that the reported method for collection of mass spec data was not accurately presented in the published paper. Neither Dr. Zhang [REDACTED] have been able to provide any of the original published mass spec data other than a single mass spec trace (attachment 43) provided from [REDACTED] identified as representing the data that was published in PNAS, but no other supporting documentation or data has been provided. Due to the low resolution of the mass spec trace, the committee is not able to verify if this trace does correspond to the published figure S4b. Further, as there are no other records for this work, the specific methods, information on any consultation or interpretation provided by the researcher who did the experiment, and any related supporting documentation are not available so there is no way to verify any of the reported information.

The CII identifies this as an additional instance of data selection without scientific justification, and a misrepresentation of data presented in the PNAS paper. The failure to accurately, or correctly, describe the methods used to conduct the reported research is a significant departure from accepted scientific practices. The CII has identified this potential falsification of the reported research by intentional misrepresentation of research methods as an additional allegation of possible Research Misconduct.

3) A disregard for previous, contradictory mass spectrometry data carried out in collaboration with Drs. Stewart and Lenaghan at the University of Tennessee, which failed to identify the protein identified in the PNAS paper as Ivy AGP.

The committee reviewed documents present on Dr. Zhang's computer entitled:

- "Supplemental Fig_092012.pptx (attachment 44)
- "Supplemental Table S1 (A, B and C).xlsx" (attachment 45)

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- “Supplemental Table S2 (A, B and C).xlsx” (attachment 46)
- “Supplemental Table S3.xlsx” (attachment 47)

Attachments 44 - 47 summarize mass spec protein sequence data and appear to have been originally prepared for another publication, Lenaghan et al., 2013 (attachment 50), a paper on which [REDACTED] Dr. Zhang [REDACTED] (Zhang is the corresponding author). However, the data present in these attachments generated by Drs. Stewart and Lenaghan were ultimately not included in the Lenaghan et al., 2013 paper nor the PNAS manuscript. These summarized results and the testimony from Drs. Stewart and Lenaghan (see attachment 48, pg. 41, line 8+) fail to identify any proteins with similarity to the protein reported as Ivy AGP in the PNAS paper though there are a lot of proteins identified, highlighting the complexity of the protein mixture in the nanoparticle preps. Attachments 44-47 thus support the points made in the interview with Drs. Stewart and Lenaghan that the groups had collaborative data demonstrating the complexity of the protein mixture in the nanoparticles, and that there was no evidence in these earlier samples for the IAGP molecule reported in the PNAS paper.

The CII believes that taken together, this information should have alerted Dr. Zhang [REDACTED] to the need for caution and rigor in the identification of their candidate gene given that the background and presence of potential contaminants and/or non-specific proteins was very high. The CII identifies this as an additional instance of data selection without scientific justification or appropriate rigor, and represents a departure from accepted scientific practices and norms.

The CII finds the presence of the new files on Dr. Zhang’s computer as informative and particularly compelling as the presence of the files on his computer would appear to support the narrative put forth by Dr. Zhang in his response to comments that he was closely overseeing [REDACTED]. That is, consistent with the Committee’s earlier findings regarding Dr. Zhang, given the new additional evidence that appears to substantiate his claim of providing oversight and involvement of [REDACTED] research, the Committee reaffirms its earlier decision that there is sufficient evidence to support a conclusion of willful direction or possibly the reckless oversight of [REDACTED] by Dr. Zhang leading to falsification of Figure 3 as well the publication of falsified materials and methods related the acquisition of DNA sequence, and mass spectrometry data presented in Fig S4b in the PNAS publication.

The CII is very troubled by the inability and/or unwillingness of [REDACTED] to provide specific, credible answers to the questions asked of him. By both [REDACTED] and Dr. Zhang’s testimony, [REDACTED]; however [REDACTED] is unable to provide scientifically valid answers to most if not all the questions asked by the CII of the data under review. [REDACTED]

[REDACTED] the Committee now believes that there is sufficient evidence to support a conclusion of intentional or knowing falsification of reported research in the PNAS paper and the allegations warrant further investigation.

In summary, based on all of the evidence reviewed and the testimony of Dr. Zhang [REDACTED] the CII affirms its earlier determination that the data regarding the sequence identity in the PNAS paper was misrepresented and that accepted scientific practices were ignored or intentionally not followed in the generation, interpretation, and reporting of the identity of the Ivy AGP. With the addition of the new findings, as outlined above, the CII has determined that there is sufficient evidence at the preponderance of evidence standard to move both Dr. Zhang [REDACTED] forward to investigations. Especially compelling for the CII during their reconsideration was 1) the presence of all of the new identified documents on Dr. Zhang's computer, supporting the claim that he was very closely overseeing [REDACTED]; and 2) given [REDACTED]

[REDACTED]

Appendix

Complainant:

Anonymous

Respondents:

Dr. Mingjun Zhang, Professor, Department of Biomedical Engineering, College of Engineering

[REDACTED]

Members of the Committee of Initial Inquiry:

- Dr. Helen Chamberlin (Chair), Professor, Molecular Genetics, College of Arts and Sciences;
- Dr. Martha Belury, Professor, Human Nutrition, College of Education and Human Ecology;
- Dr. Jeff Chalmers, Professor, Chemical and Biomolecular Engineering, College of Engineering; and
- Dr. Ann Salimbene, Assistant Dean for Administration, Graduate School

Consultant

- Dr. Mike Ibba, Professor and Chair, Department of Microbiology, College of Arts and Sciences

Ex Officio Members:

Jennifer K. Yucel, Ph.D., Research Integrity Officer
Courtney D. Mankowski, Research Integrity and Compliance Manager

Known Federal Research Support:

Army Research Office (ARO) W911NF-10-1-0114 and ARO W911NF-12-1-0294;

National Science Foundation (NSF) Civil, Mechanical, and Manufacturing Innovation #1029953,

NSF Chemical Bioengineering, Environmental and Transport Systems # 0965877;

Department of Energy (DOE) Bioenergy Science Center #DE-AC05-00OR22725.

Correspondence and Documentary Evidence

Initial allegation from anonymous complainant, forwarded to Dr. Jennifer Yucel, Research Integrity Officer, July 1, 2016 including manuscript PNAS 113(23):E3193-3202 (attachment 1)

Letter from Dr. Mike Ibba, to Dr. Yucel with assessment of allegations, dated July 16, 2016 (attachment 3)

Email from Dr. Etta Kavanagh, Editorial Manager, PNAS to Dr. Yucel regarding a complaint received by the journal, dated July 15, 2016 (attachment 4)

Email from Dr. Yucel to Dr. Kavanagh, confirming receipt of allegation and requesting information from the journal, dated July 21, 2016 (attachment 5)

Email from Dr. Kavanagh to Dr. Yucel providing four decision letters regarding the manuscript in question, dated July 25, 2016 (attachment 6 (folder))

Email from Dr. Kavanagh to Dr. Yucel providing responses to review by Dr. Zhang [REDACTED], dated July 26, 2016 (attachment 7, (folder))

Memo from Dr. Yucel to Dr. Zhang, summarizing the allegations and indicating the outcome of the Preliminary Assessment (attachment 8)

Revised memo from Dr. Yucel to Dr. Zhang [REDACTED], summarizing the allegations and indicating the outcome of the Preliminary Assessment and including [REDACTED] as a formal respondent (attachment 9)

Letter from Dr. Randolph Moses, Associate Dean for Research, College of Engineering, to Dr. Caroline Whitacre, Senior Vice President for Research, notifying her of the allegation and informing her of the results of the Preliminary Assessment, dated August 25, 2016 (attachment 10)

Letter from Dr. Whitacre to Dr. Yucel, Research Integrity Officer, requesting that Dr. Yucel move forward with forming a Committee of Initial Inquiry, dated September 6, 2016 (attachment 11)

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Email and document 'Response to the Allegation against the PNAS paper' provided by Dr. Zhang [REDACTED] to Dr. Yucel, August 24, 2016 and again on September 9, 2016 (attachment 12 (folder))

Document 'Response to the allegation, provided to CII by [REDACTED] on August 30, 2016 (attachment 26)

Letters to the designated Committee of Initial Inquiry members from Dr. Whitacre, dated September 14, September 22, and September 26, 2016 (attachment 22)

Letter from Dr. Helen Chamberlin, Chair of the Committee of Initial Inquiry, to Dr. Zhang [REDACTED] of the composition of the CII, dated October 17, 2016 (attachment 23)

Additional materials provided to CII by [REDACTED] on October 18, 2016 (attachment 24 (folder))

Transcript, exhibits and associated errata for CII interview with [REDACTED], December 22, 2016 (attachment 13 (folder))

Additional materials provided to CII from [REDACTED], December 22, 2016 (attachment 25, (folder))

Documents related to Nature Plants manuscript submission provided by [REDACTED] to Dr. Yucel, January 16, 2017 (attachment 14, (folder))

Transcripts, exhibits, and associated errata for CII interview with Dr. Zhang, January 11, 2017 (attachment 15, (folder))

Document 'Key Points to Interpret Potential Sequence Similarity' provide to CII by Dr. Zhang during CII interview January 11, 2017 (attachment 16)

Additional materials provided by Dr. Zhang to Dr. Yucel on January 12, 2017 (attachment 17, (folder))

Additional materials provided by Dr. Zhang to Dr. Yucel on February 27, 2017 (attachment 18 (folder))

Email communications between [REDACTED] McLab provided in a document called "technical communications with the vendor" provided by [REDACTED] to Dr. Yucel on October 18, 2016 (attachment 19, this document is also present as a file in attachment 24)

Basic sequence analysis of McLab sequences performed by Dr. Yucel (attachment 20 (folder))

Basic sequence analysis and homology alignments performed by Dr. Yucel (attachment 21 (folder))

Comments to Preliminary Report from Respondents, dated April 5, 2017 and all referenced attachments (attachment 27 (folder))

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Communications from Dr. Zhang [REDACTED] to RIO requesting that comment period be closed and response by Dr. Yucel that comment period closed as of April 7, 2016 (attachment 28)

Letter from Dr. Yucel to Dr. Whitacre requesting extension for CII reconsideration dated April 19, 2017 (attachment 29)

Letter from Dr. Whitacre to Dr. Yucel granting extension request to CII, dated April 20, 2017 (attachment 30)

Email from Dr. Yucel to Respondents notifying them of deadline extension, dated April 20, 2017 (attachment 31)

Document containing draft responses to reviewer's comments named "Response letter 12-29.doc", authored by [REDACTED], date created 12/28/2015, taken from Dr. Zhang's computer (attachment 32)

Document containing draft responses to reviewer's comments named "Response letter 1-2.doc", authored by [REDACTED], dated 1/2/2016, taken from Dr. Zhang's computer (attachment 33)

Letter from Dr. Helen Chamberlin to Respondents with CII reconsideration of Respondent's comments, dated April 28, 2017 (attachment 34)

Additional manuscripts for comparison, [REDACTED] Lenaghan et al., 2013 (attachment 35 (folder))

Letter from Dr. Whitacre to CII with her review and request that CII reconsider its findings, dated May 19, 2017 (attachment 36)

Email from Dr. Yucel to Dr. Whitacre requesting approval for external notification and extension request. Email response from Dr. Whitacre approving both requests (attachment 37)

Email notification from Dr. Yucel to Dr. Zhang [REDACTED] of the CII's intention to interview former collaborators at University of Tennessee, Knoxville and the extension of the CII's deadline, dated June 2, 2017 (attachment 38)

Email communications between Dr. Yucel and the CII with Dr. Zhang [REDACTED] during reconsideration period (attachment 39)

Email communications between Dr. Yucel and the OSU CCIC Mass Spec & Proteomics facility (attachment 40)

Document with DNA sequence entries from Dr. Zhang's computer entitled "First round of sequence.docx" (attachment 41)

PDF document with mass spec trace from Dr. Zhang's computer entitled "31214 Ivy.NP.pdf" (attachment 42)

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Scan of hard copy document provided by [REDACTED] entitled UTK IVY NP #1 (attachment 43)

Powerpoint file with summary of various sequences of identified proteins from Dr. Zhang's computer entitled "Supplemental Fig_092012 (attachment 44)

Excel file with various database search results from mass spec experiments entitled "Supplemental Table S1(A, B, and C) (attachment 45)

Excel file with various database search results from mass spec experiments entitled "Supplemental Table S2 (A, B, and C) (attachment 46)

Excel file with search settings entitled "Supplemental Table S3 (attachment 47)

Transcript, exhibits and associated errata for CII interview with Drs. Stewart and Lenaghan, June 16, 2017 (attachment 48)

Email from Dr. Neal Stewart to Dr. Yucel with correction regarding discussions during interview, dated June 27, 2017 (attachment 49)

Manuscript, Lenaghan et al., (2013). "Isolation and chemical analysis of nanoparticles from English Ivy (*Hedera helix* L.)". J. R. Soc. Interface 10:20130392 (attachment 50)

Time for Completion:

Due to the scope, complexity, and technical nature of the specific Research Misconduct allegations and the difficulty in scheduling meetings over the holidays, the Committee required more than sixty (60) days to complete its review; however, every attempt was made to ensure that the process moved as quickly as possible. Additional time was required due to the volume and complexity of the Respondent's comments to the Preliminary Report and the significant impact those comments had on the committee's findings. Following the referral back to the CII, an additional two months were required to complete the reconsideration. As noted above, every effort was made to move as quickly as possible and all required deadline extension were requested and obtained.