ode: 4150-31

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Office of the Secretary

Findings of Research Misconduct

AGENCY: Office of the Secretary, HHS.

ACTION: Notice.

SUMMARY: Findings of research misconduct have been made against Sarah Elizabeth Martin (Respondent), who was formerly a Graduate Teaching Assistant, Department of Biological Sciences, Auburn University (AU). Respondent engaged in research misconduct in research included in a grant application submitted for U.S. Public Health Service (PHS) funds, specifically R21 AI159361-01 submitted to the National Institute of Allergy and Infectious Disease (NIAID), National Institutes of Health (NIH), and in research supported by NIAID, NIH, grant R21 AI159361-01. The administrative actions, including debarment for a period of three (3) years followed by supervision for a period of two (2) years, were implemented beginning on November 3, 2023, and are detailed below.

FOR FURTHER INFORMATION CONTACT:

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Office of Research Integrity
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SUPPLEMENTARY INFORMATION: Notice is hereby given that the Office of Research Integrity (ORI) has taken final action in the following case:

Sarah Elizabeth Martin, Auburn University: Based on the report of an investigation conducted by AU and additional analysis conducted by ORI in its oversight review, ORI found that Sarah Elizabeth Martin, who was formerly a Graduate Teaching Assistant, Department of Biological Sciences, AU, engaged in research misconduct in research included in a grant application submitted for PHS funds, specifically R21 AI159361-01 submitted to NIAID, NIH, and in research

supported by NIAID, NIH, grant R21 AI159361-01.

ORI found that Respondent engaged in research misconduct by intentionally or knowingly falsifying and/or fabricating experimental data and results obtained under different experimental conditions that were included in one (1) grant application, one (1) published paper, one (1) submitted manuscript, and six (6) presentations as follows:

- R21 AI159361-01, "The interplay between m^6A and viral lncRNA during KSHV replication," submitted to NIAID, NIH, on July 15, 2020, Funded Period: March 4, 2021-February 28, 2023
- The m^6A landscape of polyadenylated nuclear (PAN) RNA and its related methylome in the context of KSHV replication. *RNA*. 2021 Sep;27(9):1102-1125. doi: 10.1261/rna.078777.121 (hereafter referred to as "*RNA* 2021"). Retraction in *RNA.* 2022 Feb;28(2):274. doi: 10.1261/rna.079042.121.
- Determination of m^6A frequency utilizing 4SedTTP-RT Ligation Assisted PCR (SLAP) in viral and cellular long non-coding RNAs. Manuscript submitted to *RNA* in 2021 (hereafter referred to as "*RNA* ms").
- The dynamic status of N6-methyladenosine modifications of polyadenylated nuclear (PAN) RNA lncRNA and its methylome throughout KSHV replication. Presented at The RNA Institute Mini Symposium, Albany, NY, March 3, 2021 (hereafter referred to as "RNA Mini 2021").
- Elucidating the N6-Methyladenosine Landscape of Viral LncRNA in the Context of Kaposi's Sarcoma-Associated Herpesvirus Replication. Poster presented at the NIH/NCI 2021 RNA Biology Symposium, Frederick, MD, April 14, 2021 (hereafter referred to as "NCI Poster 2021").
- The m^6A epitranscriptomic landscape of polyadenylated nuclear (PAN) RNA." Presented at The KSHV 2021 Virtual Meeting, June 21, 2021 (hereafter referred to as "KSHV Virtual 2021").

- The epitranscriptomic landscape of viral long non-coding RNA. Presented at the Noncoding RNA World: From Mechanism to Therapy, Virtual, July 21, 2021 (hereafter referred to as "RNA World 2021").
- The m^{6}A landscape of polyadenylated nuclear RNA and its related methylome in the context of KSHV replication. Presented at the American Society for Virology Annual Meeting, Virtual, July 19, 2021 (hereafter referred to as "Virology Virtual 2021").
- The Dynamics of N6-methladenosine Landscape of PAN RNA during the KSHV Replication. Presented at the 45th Annual International Herpesviruses Workshop, Virtual, August 2, 2021 (hereafter referred to as "IHW Virtual 2021").

Additionally, data falsification and/or fabrication were identified in four (4) research records sequestered from Respondent's laboratory files, specifically:

- A_response.pptx
- B_response.pptx
- Response_B_clarified.pptx
- Intermediate.pptx

Specifically, ORI finds that Respondent intentionally or knowingly falsified and/or fabricated:

- Native PAGE blots representing 4SedTTP-RT Ligation Assisted PCR (SLAP) analysis for m^{6}A detection on PAN RNA and MALAT1 RNA standards in Figure 2a and 2d, respectively, of *RNA* ms by relabeling and reusing the Native PAGE blot representing SLAP analysis for m^{6}A detection limit on PAN RNA standard in Figure 3A of *RNA* 2021
- calibration curve for detection of m^{6}A modification at nt position 54 on PAN RNA by SLAP analysis in Figure 2b of *RNA* ms by relabeling and reusing the calibration curve for detection of m^{6}A modification at nt position 63 on PAN RNA by SLAP analysis in Figure 3B of *RNA* 2021

- Native PAGE blot representing SLAP analysis of PAN RNA at unmodified adenosine position 366nt in Figure 3a of *RNA* ms by relabeling the amplicon size from 103nt in Figure 3C of *RNA* 2021 to 106nt in Figure 3a of *RNA* ms
- Figure 3a and Figure 4a of *RNA* ms and Figure 3C of *RNA* 2021 by relabeling and reusing the bands and Native PAGE blots to represent SLAP analysis at unmodified adenosine on RNA molecule, specifically:
  - in Figure 3a of *RNA* ms and Figure 3C of *RNA* 2021, the same band is used in lanes 1 and 5, from the left, of 410nt sample Native PAGE blot to represent SLAP analysis of PAN RNA at unmodified adenosine position under different experimental conditions. Relabeling and reuse of the same band also occurred in lanes 3 and 7, from the left, of Figure 4a of *RNA* ms to represent SLAP analysis of MALAT1 RNA under different experimental conditions.
  - Native PAGE blot representing SLAP analysis of PAN RNA at nt position 410 in Figure 3a of *RNA* ms and Figure 3C of *RNA* 2021 is identical to lanes 3-9 portion of the Native PAGE blot representing SLAP analysis of MALAT1 RNA at nt position 2674 in Figure 4a of *RNA* ms.
- Native PAGE panels in Figure 3b of *RNA* ms by relabeling and reusing lanes 1, 4, 6 and 9 of 18nt panel in Figure 3C of *RNA* 2021 representing amplicon sizes of 183nt for m^6A and 106nt for A as lanes 1-4, respectively, for 18nt Replicate 1 panel in Figure 3b of *RNA* ms representing amplification sizes 202nt for m6A and 160nt for A
- Native PAGE panels in Figure 3b of *RNA* ms by relabeling and reusing bands under different experimental conditions, specifically:
  - Replicate 1 18nt 48 hpi +4SedTTP group "202nt, m^6A" band is identical to Replicate 2 18nt 48 hpi +4SedTTP group "202nt, m6A" band
  - Replicate 2 18nt 0 hpi -4SedTTP group "160nt, A" band is identical to Replicate 2 203nt 0 hpi -4SedTTP group "103nt, A" band

  - Replicate 2 203nt 0 hpi +4SedTTP group “103nt, A” band is identical to Replicate 2 1041nt 48 hpi +4SedTTP group “75nt, m6A” band

- Figure 4a of *RNA* m*s* by using identical bands in lanes 3 and 7, from the left, of the Native PAGE blot representing two different experimental conditions
- Figure 4b of *RNA* ms by using identical bands to represent the m^6A modifications on different samples, specifically:
  - lanes presented for replicate 1 of nt position 2515 are identical to lanes for replicate 1 at nt position 2698
  - lanes presented in 0-, 48- and 48+ samples in replicate 2 of nt position 2515 are identical to lanes for 0-, 48- and 48+ samples, respectively, in replicate 2 of nt position 2698
  - lane for 0- sample in replicate 3 of nt position 2515 is identical to lane for 0- sample in replicate 3 of nt position 2698
  - lane for 0- sample in replicate 1 of nt position 2515 is identical to lane for 48- sample in replicate 3 of nt position 2698
  - lanes for 0+ sample in replicate 1 of nt position 2515, 48+ sample in replicate 3 of nt position 2515, and 0+ samples in replicate 1 of nt position 2698 are identical
  - lanes for 48+ sample in replicate 1 of nt position 2515, 0+ sample in replicate 2 of nt position 2515, 48+ sample in replicate 1 of nt position 2698, and 0+ and 48+ samples in replicate 3 of nt position 2698 are identical
  - lanes for 0- sample in replicate 2 of nt position 2515, 48- sample in replicate 3 of nt position 2515, and 0- sample in replicate 2 of nt position 2698 are identical
  - lanes for 48- sample in replicate 2 of nt position 2515, 0- sample in replicate 3 of nt position 2515, 48- sample in replicate 2 of nt position 2698, and 0- samples in replicate 3 of nt position 2698 are identical
  - lane for 0+ sample in replicate 3 of nt position 2515 is identical to lane for 0+ sample in replicate 2 of nt position 2698

- two original gel images on slides 7-8 of A_response.pptx provided in support of nt position 2515 panels in Figure 4b of *RNA* ms
- two original gel images on slides 9-10 of A_response.pptx provided in support of nt position 2698 panels in Figure 4b of *RNA* ms
- Native PAGE panels in Figure 3C of *RNA* 2021 by relabeling and reusing bands under different experimental conditions, specifically:
  - 18nt 48-72 hpi +4SedTTP "183nt m^6A" bands share a same source image with 203nt 48-72 hpi +4SedTTP "61nt m^6A" bands, respectively
  - 672nt "98nt A" sample share a same source bands panel with 1048nt "95nt A" sample, except for bands in two lanes corresponding to 8-24 hpi -4SedTTP samples
  - In 1041nt panel, "101nt A" 72 hpi -4SedTTP and 0 hpi +4SedTTP bands share a same source image with +4SedTTP 8 hpi and +4SedTTP 24 hpi bands, respectively
- Western blot panels for Total Lysate group in Figure 5A of R21 AI159361-01, Figure 4D in *RNA* 2021, Figure [B] on slide 2 in *RNA* Mini 2021, Figure 4D in NCI Poster 2021, Figure d on slide 10 in KSHV Virtual 2021, Figure d on slide 10 in RNA World 2021, and Figure 4D in IHW Virtual 2021, specifically:
  - bands for METTL3 0hr, FTO 0hr, and HNRNPC 0hr share a same source image
  - bands for METTL3 8hr, FTO 8hr and 72hr, HNRNPC 8hr, 48hr and 72hr, and β-actin 72hr share a same source image
  - 24hr time point bands for METTL3, FTO, SND1, and HNRNPC share a same source image
  - bands for METTL3 48hr, FTO 48hr, SND1 48hr, β-actin 8hr and 48hr share a same source image
  - bands for METTL3 72hr, SND1 72hr, and β-actin 0 and 24hr share a same source image
- Western blot panels for PAN Proteins (FA) (also named as RAP-FA Crosslink) group in Figure 5A in R21 AI159361-01, Figure 4D in *RNA* 2021, Figure [B] on slide 2 in *RNA* Mini

2021, Figure 4D in NCI Poster 2021, Figure d on slide 10 in KSHV Virtual 2021, Figure d on slide 10 in RNA World 2021, and Figure 4D in IHW Virtual 2021, specifically:

  - bands for 8-72hr time points in SND1 and FTO panels share a same source image
  - 0-24hr panel areas for HNRNPC and YTHDF2 share a same source image
  - blank panel for METTL3 and β-actin panels share a same source image

- original Western blot images provided in B_response.pptx to support the Western blot panels presented in Figure 4D in *RNA* 2021, Figure 5A in R21 AI159361-01, Figure [B] on slide 2 in RNA Mini 2021, Figure 4D in NCI Poster 2021, Figure d on slide 10 in KSHV Virtual 2021, Figure d on slide 10 in RNA World 2021, and Figure 4D in IHW Virtual 2021, specifically:
  - RMB15 Western blot images for bio reps 1 and 2 share a same source image, with areas pasted over to make the two images appear different from each other. RBM15 bands for Total Lysate and RAP-FA Crosslink sample groups have been pasted over the base image on both the gels. The Total Lysate group bands between the two gel images share a same source image.
  - The two METTL3 Western blot images share a same source image, with areas pasted over to make the two images appear different from one another. METTL3 bands for the Total Lysate and empty areas corresponding to RAP-FA crosslink sample groups have been pasted over the base image. The Total Lysate group bands in two Western blot images share a same source image, although vertical positioning of T2 and T3 with respect to T0 and T1 is changed to make the panels appear different from one another. T0 and T1 bands share same source image with T2 and T3 bands, respectively, on the two Western blot images.
  - SND1 Western blot images for bio reps 1 and 2 share a same source image, with areas pasted over to make the two images appear different from one another. RAP-FA Crosslink T1-T4 bands share a same source image between the two gels. Bands are

shifted vertically to give the impression that the two gels are different from each other. The Total Lysate T0-T3 main darker bands share a same source image between the two Western blot images. The bands are merged with background and additional band patterns to make the two images appear different from one another.

- HNRNPC Western blot images for bio reps 1 and 2 share a same source image, with areas pasted over to make the two images appear different from one another. The Total Lysate bands on the two images share the same source image. Further, Total Lysate T0 and T1 bands share same source image with T2 and T3 bands, respectively. The HNPNRC bio rep 2 Western blot share a same source image with RMB15 bio rep 2 Western blot. In the HNPNRC bio rep 2 image, the 26 kDa bands have been pasted over to make the gel image appear different from the RMB15 bio rep 2 image. Further, the same ladder image has been modified to appear different between the two gels.
- YTHDF2 Western blot images for all the three replicate gels share the same background image, with areas pasted over to make the three images appear different from one another. The Total Lysate group bands on the Western blot 1 and 3 share a same source image. The Total Lysate bands on Western blot 2 share a same source image with METTL3 Total Lysate bio rep 1 (~53kDa) bands, HNRNPC Total Lysate bio rep 2 (26kDa) bands, and SND1 bio rep 2 RAP-FA crosslink (between 125 and 82 kDa) bands.
- FTO Western blot images for all the three replicate gels share the same background image, with areas pasted over to make the three images appear different from one another. On the FTO bio rep 3 Western blot image, RFA-FA Crosslink T3-T4 bands, Total Lysate T0-T1 bands, and Total Lysate T2-T3 band, respectively, are identical.
- β-actin Western blot image for the two replicate gels share the same source image, with areas pasted over to make the blot images appear different from one another. On the second replicate blot image, the Total Lysate T0-T1 bands are identical to Total Lysate T2-T3 bands, respectively. The Total Lysate T0-T3 bands on β-Actin Western blot

replicate 2 image are identical to FTO Western blot replicate 3 Total Lysate T0-T3 bands, respectively.

  - all the original unedited Western blot images for RMB15, METTL3, SND1, HNRNPC, YTHDF2, FTO and β-actin share the same source background image that have been modified to appear different from one another

- Native PAGE data by relabeling and reusing several identical bands to represent m^6A modifications at different nt positions on the PAN RNA samples in Figure 5E in *RNA* 2021, Figure [D] in RNA Mini 2021, Figure 5B in NCI Poster 2021, slide 12 in KSHV Virtual 2021, slide 6 in Virology Virtual 2021, slide 12 in RNA World 2021, and Figure 5B in IHW Virtual 2021, specifically:
  - band in lane 1 corresponding to 0 hpi -4Sed sample of RBM15 KD 18nt panel, after flipping horizontally, share a same source image with band in lane 1 of METTL3 KD 1041nt, RBM15KD 1041nt and FTO KD 18nt samples
  - bands for 0 hpi -4Sed, 48 hpi -4Sed, 0 hpi +4Sed and 48 hpi +4Sed samples in RBM15 KD 1041nt, METTL3 KD 1041nt and FTO KD 18nt blots are identical
  - RBM15 KD 18nt 0 hpi +4Sed and 48 hpi +4Sed bands are identical to METTL3 KD 1048nt 0 hpi -4Sed and 48 hpi -4Sed bands, respectively, and to horizontally flipped FTO KD 203nt 48 hpi -4Sed and 0 hpi +4Sed bands, respectively
  - FTO KD 1041nt 0 hpi -4Sed and 48 hpi -4Sed bands share a same source image with RBM15 KD 203nt 0 hpi -4Sed and 48 hpi -4Sed bands, respectively
  - RBM15 KD 1048nt 0 hpi -4Sed and 48 hpi -4Sed bands are identical to RMB15 0 hpi +4Sed and 48 hpi +4Sed bands, respectively, and to the copy pasted bands on the lanes 10-11 (from the left) and 5-6 (from the left) of gel images on slides 11 and 12 of the intermediate.pptx
- confocal micrographs by using identical images either with or without modifications to present PAN RNA colocalization experiments in Figure 7 of *RNA* 2021, slide 11 of KSHV

Virtual 2021, slide 6 of Virology Virtual 2021, and slide 11 of RNA World 2021, specifically:

  - Replicate 2 and Enlarged-2 of RBM15 at 72 hpi are identical to Replicate 2 and Enlarged-2 of METTL3 72 hpi, respectively
  - Replicate 1 of RBM15 48 hpi is rotated 90 degrees clockwise to present Replicate 2 of RBM15 24 hpi
  - RBM15 24 hpi Enlarged 2 image is a further zoomed area of RBM15 48 hpi Enlarged 1 image

- confocal micrographs by using identical images to present PAN RNA colocalization experiments under different experimental conditions in Supplementary Figures 10a-b of *RNA* 2021, specifically:
  - T3 panel representing staining for RBM15, DAPI, PAN and Combined samples in Supplementary Figure10a is identical to T2 panel representing staining for METTL3, DAPI, PAN, and Combined samples, respectively. The same images also appear in 48 hpi panel in Figure 7A of *RNA* 2021, slide 11 of KSHV Virtual 2021, slide 6 of Virology Virtual 2021, and slide 11 of RNA World 2021, representing staining for RBM15, DAPI, PAN and Combined samples, respectively
  - T4 replicate 2 (Rep 2) in RMB15 staining composite in Supplementary Figure 10a is identical to T4 replicate 2 (Rep 2) in METTL3 staining composite in Supplementary Figure 10b. The same image appeared as RMB15 T4(2) image in Figure 9B of R21 AI159361-01
- images of Native PAGE gel images in intermediate.pptx by adding transparency adjusted images of individual bands, empty areas, and/or ladders, to make the gel images appear different from the baseline images. Additionally:
  - baseline gel image on slide 6 of intermediate.pptx was used to falsify and/or fabricate original gel-2 image for 2698nt sample on slides 9-10 of A-response.pptx

  - baseline gel image on slide 7 of intermediate.pptx was used to falsify and/or fabricate one of the two original gel images on slide 7 of A-response.pptx
  - part of falsified and/or fabricated bands on slide 12 of intermediate.pptx were incorporated in RBM15 KD original bottom gel image on slide 15 of B-response.pptx
- original gel images and Western blot images in A_response.pptx, B_response.pptx and Response_B_clarified.pptx provided to the *RNA* journal, specifically:
  - the right-side gel image for SLAP analysis at nt position 2698 on slide 9 of A-response.pptx is a fabricated and/or falsified gel image that shares an identical baseline image with the gel image on slide 1 of intermediate.pptx
  - bands in lanes 6-8 of the bottom METTL3 KD gel image on slide 14 of B_response.pptx and bands in lanes 9-7 of the bottom RBM15 KD gel image on slide 15 of B_response.pptx are, respectively, identical
  - bands in lanes 9-11 of the bottom METTL3 KD gel image on slide 14 of B_response.pptx and bands in lanes 5-3 of the bottom RBM15 KD gel image on slide 15 of B_response.pptx are, respectively, identical
  - bands in lanes 7-9 of the left-side FTO KD gel image on slide 13 of B_response.pptx and bands in lanes 9-7 of the bottom RBM15 KD gel image on slide 15 of B_response.pptx are, respectively, identical
  - bands in lanes 10-13 of the left-side FTO KD gel image on slide 13 of B_response.pptx and bands in lanes 5-2 of the bottom RBM15 KD original gel image on slide 15 of B_response.pptx are, respectively, identical
  - overall, one replicate gel for each of the three experimental groups (FTO KD, RBM15 KD, and METTL3 KD) provided as original unaltered image in support of Figure 5E of *RNA* 2021 share two panels containing a total of 7 bands from a same source image.

Respondent entered into a Voluntary Exclusion Agreement (Agreement) and voluntarily agreed to the following:

(1) Respondent will exclude herself voluntarily for a period of three (3) years, beginning on November 3, 2023 (the "Exclusion Period"), from any contracting or subcontracting with any agency of the United States Government and from eligibility for or involvement in nonprocurement or procurement transactions referred to as "covered transactions" in 2 CFR parts 180 and 376 (collectively the "Debarment Regulations"). At the conclusion of the Exclusion Period, Respondent agrees to have her research supervised for a period of two (2) years (the "Supervision Period"). During the Supervision Period, prior to the submission of an application for PHS support for a research project on which Respondent's participation is proposed and prior to Respondent's participation in any capacity in PHS-supported research, Respondent will submit a plan for supervision of Respondent's duties to ORI for approval. The supervision plan must be designed to ensure the integrity of Respondent's research. Respondent will not participate in any PHS-supported research until such a supervision plan is approved by ORI. Respondent will comply with the agreed-upon supervision plan.

(2) During the Exclusion Period, Respondent will not apply for, permit her name to be used on an application for, receive, or be supported by funds of the United States Government and its agencies made available through contracts, subcontracts, or covered transactions.

(3) During the Supervision Period, the requirements for Respondent's supervision plan are as follows:

   i. A committee of 2-3 senior faculty members at the institution including Respondent's supervisor or collaborators will provide oversight and guidance. The committee will review primary data from Respondent's laboratory on a quarterly basis and submit a report to ORI at six (6) month intervals setting forth the committee meeting dates and Respondent's compliance with appropriate research standards and confirming the integrity of Respondent's research.

ii. The committee will conduct an advance review of each application for PHS funds, or report, manuscript, or abstract involving PHS-supported research in which Respondent is involved. The review will include a discussion with Respondent of the primary data represented in those documents and will include a certification to ORI that the data presented in the proposed application, report, manuscript, or abstract are supported by the research record.

(4) During the Supervision Period, Respondent will ensure that any institution employing her submits, in conjunction with each application for PHS funds, or report, manuscript, or abstract involving PHS-supported research in which Respondent is involved, a certification to ORI that the data provided by Respondent are based on actual experiments or are otherwise legitimately derived and that the data, procedures, and methodology are accurately reported and not plagiarized in the application, report, manuscript, or abstract.

(5) If no supervision plan is provided to ORI, Respondent will provide certification to ORI at the conclusion of the Supervision Period that her participation was not proposed on a research project for which an application for PHS support was submitted and that she has not participated in any capacity in PHS-supported research.

(6) During the Exclusion and Supervision Periods, Respondent will exclude herself voluntarily from serving in any advisory or consultant capacity to PHS including, but not limited to, service on any PHS advisory committee, board, and/or peer review committee.

Dated: November 15, 2023.

Sheila Garrity,

Director, Office of Research Integrity,

Office of the Assistant Secretary for Health.

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